Cardiovascular disease risk in young Indigenous Australians: a snapshot of current preventive health care

Bethany Crinall,[1,2,3] Jacqueline Boyle,[1,4] Melanie Gibson-Helm,[1] Danielle Esler,[3] Sarah Larkins,[5] Ross Bailie[4]

Abstract

Objective: To examine preventive health attendance and recording of type 2 diabetes and cardiovascular disease risk factors and their management in young Aboriginal peoples and Torres Strait Islanders (Indigenous Australians) at primary health care centres (PHCs).

Methods: This descriptive cross-sectional study audited medical records of 1,986 Indigenous people aged 15–34 years attending 93 Australian PHCs. Measurements included blood pressure (BP), blood glucose level (BGL), smoking status, body mass index (BMI) and lipid profile.

Results: Last attendance was most commonly for acute care (46%); 12% attended for preventive assessment. BP was recorded in 85% (1,686/1,986), BGL 63% (1,244/1,986), smoking status 52% (1,033/1,986), BMI 37% (743/1,986) and lipids 31% (625/1,986). Of those with a recorded assessment, elevated BGL (39%, 479/1,244), smoking (63%, 649/1,033), overweight/obesity (51%, 381/743) and dyslipidaemia (73%, 458/625) were common. Follow-up of abnormal results was documented for elevated BP 28% (34/120), elevated BGL 17% (79/479), smoking 65% (421/649), overweight/obesity 11% (40/381) and abnormal lipids 16% (75/458).

Conclusions: These findings highlight the importance of raising awareness and assessment of chronic disease risk factors in young Indigenous people and implementing preventive health care strategies.

Implications: Strengthening the capacity of PHCs to provide preventive health care may contribute to reducing the chronic disease burden experienced by young Indigenous people.

Key words: Indigenous, primary health care, Australia, quality improvement, cardiovascular disease, diabetes, prevention

Cardiovascular disease (CVD) and type 2 diabetes (T2DM) are major contributors to the gap in life expectancy of Aboriginal peoples and Torres Strait Islanders (referred to as Indigenous for the purpose of this paper) relative to non-Indigenous Australians.[1,2] CVD is the primary cause of death in Indigenous people and the single largest determinant of the Indigenous health gap.[1,2] Among Indigenous people, T2DM occurs at younger ages and with higher prevalence, and leads to mortality at 5.7 times the rate of other Australians.[2-5] There has been no reduction in the mortality gap due to CVD and diabetes over the past decade.[2]

Modifiable metabolic risk factors (overweight and obesity, dyslipidaemia, hyperglycaemia, smoking and hypertension) may precede the onset of CVD by many years.[6-9] Diabetes is a major risk factor for CVD, and frequently co-exists with one or more modifiable metabolic risk factors in the same individual.

Disproportionately high rates of diabetes and CVD are seen in Indigenous Australians by the age of 35 years,[3] highlighting the importance of early detection and treatment of risk factors and targeted preventive strategies in adolescence and early adulthood in Indigenous Australians.[2,3,6] However, there is a paucity of data available on assessment of and follow-up of risk factors for CVD and T2DM in young (15–34 year old) Indigenous people.[3,5,10-12]

An important role of primary health care is to facilitate early detection, diagnosis and appropriate intervention for common and treatable conditions that cause significant and early morbidity and mortality.[13] Tools designed to facilitate this preventive health care assessment of Indigenous Australians are referred to as 'Well Person's Checks' and include the Medicare Benefit Schedule Item 715 Annual Health Assessment for Aboriginal and Torres Strait Islander People[14] and other alternate Adult Health Checks. Information on participation in these preventive health strategies for young Indigenous people is scarce, as is information on assessment of chronic disease risk factors when young people attend health care for other reasons. Continuous Quality Improvement (CQI) in Indigenous primary health care centres (PHCs) is emerging as an effective tool for enhancing the delivery of quality preventive health care.[15-18] Information on current assessment practices regarding chronic disease risk factors can be used in the development of strategies to support PHCs to deliver preventive strategies for this population.

1. Monash Centre for Health Research and Implementation, School of Public Health and Preventive Medicine, Monash University, Victoria
2. Monash Health, Diabetes and Vascular Medicine, Victoria
3. School of Public Health, Tropical Medicine and Rehabilitation Sciences, James Cook University, Queensland
4. Menzies School of Health Research, Charles Darwin University, Queensland
5. Anton Breinl Research Centre for Health Systems Strengthening, College of Medicine and Dentistry, James Cook University, Queensland
Correspondence to: Dr Jacqueline Boyle, School of Public Health and Preventive Medicine, Monash Medical Centre, Locked Bag 29, Clayton, VIC 3168; email: jacqueline.boyle@monash.edu
Submitted: September 2015; Revision requested: November 2015; Accepted: March 2016
The authors have stated they have no conflict of interest.
Aust NZ J Public Health. 2017; 41:460-6; doi: 10.1111/1753-6405.12547

© 2016 Public Health Association of Australia

Objectives

This descriptive quantitative cross-sectional study examined the provision of preventive health care to young Indigenous people in PHCs around Australia, using a snapshot of data from a CQI initiative to determine what preventive health care young Indigenous people are receiving for CVD and T2DM.

Using clinical audit data, our objectives were to determine:

- the proportion of young Indigenous people attending for preventive health assessments
- the frequency of assessment of risk factors for CVD and T2DM when young people present to PHCs
- the proportion of those assessed who have risk factors
- what management is documented for identified risk factors.

A subgroup analysis aimed to determine whether these factors are associated with individual or PHC characteristics.

Methods

The data presented here were collected by the Audit and Best Practice for Chronic Disease (ABCD) National Research Partnership[19] between 2010 and 2012, for which the study design, planning and implementation have been previously described.[19,20] Participating PHCs were distributed in remote (n=79), regional (n=9) and urban (n=5) settings in Queensland (n=47), Northern Territory (n=35), South Australia (n=5), New South Wales (n=4) and Western Australia (n=2). Government PHCs (n=78) and Aboriginal Community-Controlled Health Services (community-controlled PHCs; n=15) participated.

Delivery of preventive health care was assessed by auditing health records from participating PHCs. Both paper-based and electronic clinical records were audited. Trained members of the project team conducted the audits in conjunction with local health care staff supported by a standard protocol, local CQI facilitators and regional CQI coordinators. The Preventive Services Clinical audit tool was generated based on best practice clinical guidelines,[21,22] and developed with stakeholder consultation. A random sample of at least 30 eligible records was selected by the auditor at each PHC using a standard sampling protocol.[19] PHCs with fewer than 30 eligible records audited those of all eligible clients.

Records eligible for auditing included those of adults aged between 15 and 54 years with no known diagnosis of diabetes, hypertension, coronary heart disease, rheumatic heart disease or renal disease. Patients included had been living in the community for at least six months in the past year. Women who were pregnant or up to six weeks postpartum at the time of the audit were excluded.

Data examined included patient and PHC characteristics, (location, governance structure [government or community controlled], state/territory), the date and reason for the last attendance, record of assessment, presence and management of risk factors for CVD and T2DM. Assessment of risk factors was measured as documentation of blood pressure (BP), blood glucose level (BGL), smoking status (current smoker/non-smoker/not-stated), body mass index (BMI), and lipid profile[21] in the medical record. These could be collected either as part of a routine/acute health consultation, or as a part of a preventive health assessment.[23]

The presence of risk factors for CVD and T2DM were defined as overweight/obese as indicated by BMI (≥25 kg/m^2);[24] elevated random or fasting BGL (BGL≥5.5 mmol/L); abnormal lipid profile (low density lipoprotein≥2.5 mmol/L, triglycerides≥1.5 mmol/L, and/or high density lipoprotein<1.0 mmol/L); current smoking; and hypertension (BP≥140/90), as audited from the medical record.[21]

Follow-up was measured as documentation of:

- hypertension: a management plan including repeat BP testing
- elevated BGL: a management plan including repeat glucose testing
- smoking: brief intervention including documentation of intention or interest in quitting
- overweight/obesity: a brief intervention where the client had been asked about their weight and their intentions or interest in reducing weight, and a referral for weight management advice/support
- abnormal lipid profile: a management plan including repeat blood lipids testing.[21,22]

The study was approved by human research ethics committees in the relevant state or territory and by Indigenous sub-committees where required.[25] The analyses presented here were approved by Monash University and James Cook University Human Research Ethics Committees (CF12/3434-2012001670 and CF12/3434 – 2012001670).

Statistical analysis

Categorical variables are presented as count and proportions. Continuous data are reported as mean and standard deviation, or median and interquartile range (IQR) where data is not normally distributed. Subgroup comparative analysis of nominal values was undertaken using chi-squared tests for age, sex, Indigenous status, location and governance structure (government or community controlled) of PHCs. A *p*-value less than 0.05 was considered statistically significant. Statistical analysis used Stata 12.1.

Results

Patient and health centre characteristics

Audit data were obtained from PHCs for 4,536 young people (15 to 34 years). Where PHCs had undergone more than one audit during the study period 2010 to 2012, only data from the most recent audit were included to avoid repeat counting from the same service, resulting in the exclusion of 1,878 records. A further 478 records were excluded if people did not identify as Aboriginal and/or Torres Strait Islander and 192 records were excluded as they were seen more than 24 months prior to the audit. Two were excluded where the date of auditing was documented as earlier than the date last seen.

Audit data were obtained for the remaining 1,986 young Indigenous people from 93 participating PHCs. Patient and PHC characteristics are shown in Table 1. Acute care was the reason for the most recent presentation in 46% of audited patients, while 12% presented for preventive health assessment (a 'Well Person's Check', Figure 1). One patient did not have a reason for last attendance recorded. In 30% of audited records, there was evidence of a standardised comprehensive annual adult health assessment for Aboriginal and Torres Strait Islander People form (Medicare Benefits Schedule 715[14]), or alternative, having been conducted in the past two years (Table 1).

Most subjects were audited in remote (80%, 1,578/1,986) and government-operated (82%, 1,628/1,986) PHCs, although a range of locations and governance structures were represented (Table 1).

© 2016 Public Health Association of Australia

Assessment of CVD and T2DM risk factors

The majority of audited patients had record of BP (85%, 1,686/1,986), BGL (63%,1,244/1,986) and smoking status (52%, 1,033/1,986) (Figure 2). Assessment of BMI and lipids was less frequent (37%, 743/1,986 and 31%, 625/1,986, respectively) (Figure 2). Patients aged 25 to 34 years were significantly more likely to be assessed for risk factors than those aged 15 to 24 years, with the exception of BMI measurement (BP: 87% vs 84%, p=0.04; BGL: 70% vs 58%, p<0.001; smoking: 58% vs 48%, p<0.001; lipids: 39% vs 26%, p<0.001) (Table 2). Women were more likely to have a record of BP, BGL and smoking status than men (BP: 88% vs 82%, p<0.001; BGL: 68% vs 58%, p<0.001; smoking: 55% vs 50%, p=0.03) (Table 2). Smoking status and BMI were more likely to be recorded in community controlled PHCs. Those in remote communities were less likely to have a record of BP, smoking status and BMI assessment, but more likely to have a recorded lipid profile (Table 3). Variations in assessment were noted across jurisdictions (state/territory) but no consistent pattern was observed.

Presence of CVD and T2DM risk factors

The presence of risk factors was high in those who had a record of assessment, with the exception of BP (BP: 7%; BGL: 39%; smoking: 63%; BMI: 51%; lipids: 73%) (Table 2 and Figure 2). Patients aged 25 to 34 years who were assessed had a significantly higher presence of hypertension, overweight/obesity and abnormal lipid profile than those aged 15–24 years (9% vs 6%, p=0.01; 65% vs 41%, p<0.001; 81% vs 66%, p<0.001; respectively) (Table 2). A significantly higher proportion of women were in the overweight/obese category than men (59% vs 44%, p<0.001); however, men were more likely to be hypertensive than women (10% vs 4%, p<0.001) (Table 2).

Follow-up of identified risk factors for CVD and T2DM

Among those with abnormal findings, documented follow-up was infrequent with the exception of current smokers (BP 28%; BGL 17%; smoking 65%; BMI 11%; lipids 16%) (Figure 2 and Table 2). A lipid management plan was more likely in the older group (20% vs 12%, p=0.03) (Table 2). Brief interventions (BI) for smoking and overweight/obesity and follow-up of abnormal lipid profile were more likely in urban than regional or remote

Table 1: Characteristics of young Indigenous people (n=1986) whose records were audited.

Characteristic	Total n (%)	Patient age		Patient gender	
		15-24 n (%)	25-34 n (%)	Male n (%)	Female n (%)
n (%)	1986	1163 (59)	823 (41)	984 (50)	1002 (51)
BMI median (± IQR)	25 (10)	23 (9)	28 (10)	24 (9)	27 (11)
MBS Item 715 or alternate in last two years	599 (30)	344 (30)	255 (31)	321 (33)	278 (28)
Indigenous status					
Aboriginal	1414 (71)	836 (72)	578 (70)	695 (70)	719 (72)
Torres Strait Islander	471 (24)	255 (22)	216 (26)	243 (25)	228 (23)
Both	101 (5)	72 (6)	29 (4)	46 (5)	55 (5)
PHC location					
Urban (>25,000 people)	160 (8)	130 (11)	30 (4)	96 (10)	64 (6)
Regional (<25,000 people)	248 (13)	150 (13)	98 (12)	124 (13)	124 (12)
Remote (>10km from a regional town)	1578 (80)	883 (76)	695 (85)	764 (78)	814 (81)
PHC Governance					
Community Controlled	358 (18)	204 (18)	154 (19)	173 (18)	185 (19)
Government Operated	1628 (82)	959 (83)	669 (81)	811 (82)	817 (82)
PHC State/Territory					
Queensland	951 (48)	577 (50)	374 (45)	464 (47)	487 (49)
Northern Territory	780 (39)	432 (37)	348 (42)	387 (39)	393 (39)
South Australia	125 (6)	78 (7)	47 (6)	76 (8)	49 (5)
New South Wales	91 (5)	53 (5)	38 (5)	41 (4)	50 (5)
Western Australia	39 (2)	23 (2)	16 (2)	16 (2)	23 (2)

Figure 1: Frequency of reason for most recent attendance to PHC stratified by age and gender (n=1986).

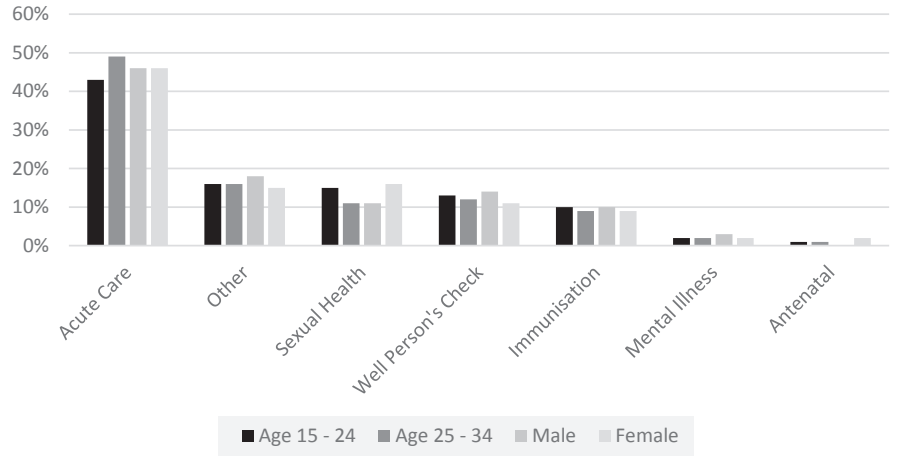
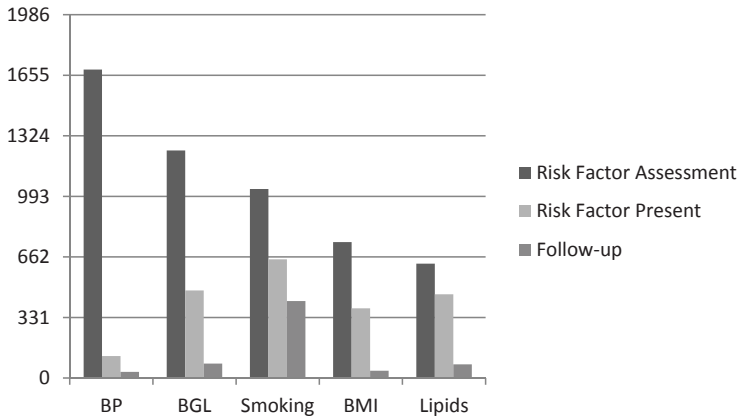


Figure 2: Number of patients with documented risk factor assessment and management.



© 2016 Public Health Association of Australia

settings (smoking BI: 79% vs 59% vs 64%, p=0.01; overweight/obesity BI: 60% vs 26% vs 42%, p=0.001; lipid follow-up: 33% vs 3% vs 17% p=0.02) (see Table 3). Variations across jurisdictions were noted but were not uniform for each risk factor.

Conclusions

This unique, large, national study investigating provision of preventive health care for cardiovascular and diabetes risk in young Indigenous people shows that while risk factors are being assessed, there is opportunity to engage with PHCs to improve their capacity to provide effective preventive care for young people. Although acute care is the most common reason for this population to present to PHCs, the majority receive an assessment of risk factors for CVD and T2DM (BP, BGL, smoking). Despite the young age of the survey population, those who received assessment were commonly found to have important modifiable risk factors for chronic disease. However, follow-up of abnormal results was undertaken less thoroughly. Early assessment is important as it provides an opportunity for prevention, early detection and mitigation of metabolic disease in a group of people at increased risk. The current national guidelines on preventive health assessment recommend screening young Indigenous people for chronic disease risk factors in an annual health assessment and opportunistically.[26] Preventive health care recommendations include measurement of BP and assessment of diabetes risk in all Indigenous people over 15 years of age, with record of smoking status and BMI in all those aged over 12 years.[21,22] Lipid profile should be assessed if an additional cardiovascular risk factor is present.[21,22] Other research assessing cardiovascular risk in Indigenous adults in PHCs has reported that more than half of patients aged over 30 years were not adequately screened.[27] Our study contributes new knowledge to this area by focussing on a younger population and highlights that some areas of risk are assessed relatively well (BP, BGL, smoking status) and other aspects (BMI, lipids, assessing men, people aged 15–24, those in remote locations) are areas where service provision could be strengthened. Almost one-third had a record of attending for a comprehensive annual primary health care review in the previous two years. How this compares to other populations is difficult to gauge, due to a lack of comparable estimates.

Acute care was the primary reason for most recent attendance, while few attended for preventive health care assessment. This is consistent with a case-finding approach, in which people undergoing medical care are assessed for asymptomatic diseases and risk factors, rather than systematic population screening, where an asymptomatic population are assessed to identify a subgroup of people at high risk of a disease or a risk factor for a disease.[28] This suggests a need to support PHCs to strengthen delivery of preventive health care services at a population level through strategies such as strengthening financial and workforce support to PHCs to facilitate screening programs; supporting efforts to enhance documentation and undertake assessment and follow-up of CVD and T2DM risk factors in line with best practice clinical guidelines; using reminder systems to encourage patient attendance and follow-up of abnormal findings; and continuing the implementation of CQI processes.[29]

The potential for selection bias through patterns of attendance and screening practices mean the data presented may not be an accurate reflection of population prevalence. The data indicate that risk factor assessment is being targeted appropriately to patients who are clinically identified as high risk. Despite this, the high prevalence of smoking and obesity are consistent with other recent reports.[30-33] Obesity is a key risk factor for T2DM and CVDs: hypertension, stroke and coronary artery disease.[33] Half of all patients audited were overweight/obese and, while these proportions are similar to the general Australian population,[34] elevated BMI is a stronger risk factor for

Table 2: Documented risk factor assessment, prevalence and follow-up of abnormal findings stratified by gender and age.

Risk Factor	Total n (%)	Gender			Age		
		Males n (%)	Females n (%)	*p*-value	15-24 years n (%)	25-34 years n (%)	*p*-value
BP							
BP Recorded	1686/1986 (85)	805/984 (82)	881/1002 (88)	<0.001	971/1163 (84)	715/823 (87)	0.04
BP Elevated	120/1686 (7)	82/805 (10)	38/881 (4)	<0.001	55/971 (6)	65/715 (9)	0.01
BP Management Plan	34/120 (28)	22/82 (27)	12/38 (32)	0.59	15/55 (27)	19/65 (29)	0.81
BGL							
BGL Recorded	1244/1986 (63)	566/984 (58)	678/1002 (68)	<0.001	670/1163 (58)	574/823 (70)	<0.001
Elevated BGL	479/1244 (39)	205/566 (36)	274/678 (40)	0.13	254/670 (38)	225/574 (39)	0.64
BGL Management Plan	79/479 (17)	37/205 (18)	42/274 (15)	0.43	36/254 (14)	43/225 (19)	0.15
Smoking							
Smoking Status Recorded	1033/1986 (52)	487/984 (50)	546/1002 (55)	0.03	558/1163 (48)	475/823 (58)	<0.001
Current Smoker	649/1033 (63)	320/487 (66)	329/546 (60)	0.07	346/558 (62)	303/475 (64)	0.56
Smoking Brief Intervention	421/649 (65)	216/320 (68)	205/329 (62)	0.17	227/346 (66)	194/303 (64)	0.67
BMI							
BMI Recorded	743/1986 (37)	381/984 (39)	362/1002 (36)	0.23	427/1163 (37)	316/823 (38)	0.45
Overweight/Obese	381/743 (51)	169/381 (44)	212/362 (59)	<0.001	175/427 (41)	206/316 (65)	<0.001
Brief Intervention	157/381 (41)	69/169 (41)	88/212 (42)	0.89	71/175 (41)	86/206 (42)	0.82
Weight Management Referral	40/381 (11)	13/169 (8)	27/212 (13)	0.11	14/175 (8)	26/206 (13)	0.14
Lipids							
Lipid Profile	625/1986 (31)	319/984 (32)	306/1002 (31)	0.37	305/1163 (26)	320/823 (39)	<0.001
Abnormal Lipid Profile	458/625 (73)	242/319 (76)	216/306 (71)	0.14	200/305 (66)	258/320 (81)	<0.001
Lipid Management Plan	75/458 (16)	44/242 (18)	31/216 (14)	0.27	24/200 (12)	51/258 (20)	0.03

© 2016 Public Health Association of Australia

T2DM in Indigenous than non-Indigenous people.[30,33,35] While overweight/obesity was considerably more common in the 25 to 34-year age group, this may not represent a true difference in prevalence, but may instead represent variation in the selection of those for BMI assessment. A potential hypothesis is that patients in the younger age group may be less likely to attend, or may be less likely to be weighed, if they appear obese as they may be considered to be at relatively lower risk of CVD. Despite this, the high levels of overweight/obesity seen in young Indigenous women is of major concern, given that maternal obesity increases pregnancy-related risks for the mother and baby, and increases the child's risk of future obesity, diabetes and CVD.[4,36] Further assessment for T2DM was required in 41% of patients, based on a random or fasting BGL ≥5.5 mmol/L. Given this low glucose cut-off, it is difficult to make comparisons to the prevalence of T2DM risk identified in other studies, where the prevalence of T2DM in Indigenous adults ranges from 3–33% and IGT 4.7–22%, with patterns suggesting higher risks in women and in remote areas.[6]

This study is inherently limited by its retrospective, cross-sectional nature; however, this is the design of CQI projects, which analyse existing data in a cyclical fashion to improve processes.[37] We rely on accurate documentation of health care provision as a measure of preventive health care. Failure to document services may lead to an underestimation of service provision; however, failure of documentation itself is a barrier to quality preventive care.[25] Data around follow-up appeared to be the most affected by such quality issues. Given that acute care was the most frequent reason for last attendance, we consider it possible that BP, BGL or lipid profile measured during those presentations were affected by the acute condition, potentially leading to an over-estimation of the prevalence of abnormal results. Hypertension, overweight/obesity and abnormal lipid profile were categorised by adult values, even in those aged 15–18 years; however, if anything, this is likely to lead to an underestimation of the prevalence in this young population. Chi-squared tests have been used to conduct exploratory analysis of associations between service delivery and potential predictors (age, gender, location, governance structure); however, we acknowledge that these do not take into account the possible contributions of multiple variables. Quantifying the magnitude of associations would be an important future direction for this ongoing CQI initiative, as sample size increases.

This is the largest and most comprehensive study of primary health care provision for risk factors for CVD and T2DM experienced by young Indigenous people, and spans remote, rural and urban populations. This community controlled and directed project was conducted as a part of a research partnership with a commitment to translation of research into effective change. The findings of this study fill gaps in knowledge about preventive health care provision to young Indigenous people, and may be used to enhance Indigenous primary health care.

These findings can be used to inform improvements in public health practices, and highlight the importance of support for the implementation of targeted preventive health care strategies, which may reduce the burden of CVD and T2DM experienced by young Indigenous people and improve long-term health. At completion of the Preventive Health Clinical Audit, CQI facilitators assisted local PHCs with interpretation of the data, feedback to health care providers and management, goal setting and action planning.[19] Individual PHCs then independently implemented their action plan to inform enhancements in health care services, systems and policy.[19] Nationally, the aggregated findings presented in this paper were presented to a broad range of stakeholders at the annual ABCD National Research Partnership meeting. Evidence briefs are also prepared to communicate key findings and messages for action to health

Table 3: Documented screening, prevalence and follow-up of abnormal findings stratified by governance structure and location.

Risk Factor	Community controlled n (%)	Government operated n (%)	*p*-value	Urban n (%)	Regional n (%)	Remote n (%)	p-value
BP							
BP recorded	313/358 (87)	1,373/1,628 (84)	0.14	142/160 (89)	223/248 (90)	1,321/1,578 (84)	0.02
BP elevated	37/313 (12)	83/1,373 (6)	<0.001	7/142 (5)	19/223 (9)	94/1321 (7)	0.43
BP management plan	6/37 (16)	28/83 (34)	0.05	1/7 (14)	3/19 (16)	30/94 (32)	0.33
BGL							
BGL recorded	207/358 (58)	1,037/1,628 (64)	0.04	90/160 (56)	149/248 (60)	1,005/1,578 (64)	0.12
Elevated BGL	98/207 (47)	381/1,037 (37)	0.004	38/90 (42)	74/149 (50)	367/1005 (37)	0.01
BGL management plan	19/98 (19)	60/381 (16)	0.39	10/38 (26)	7/74 (9)	62/367 (17)	0.07
Smoking							
Smoking status recorded	224/358 (63)	809/1628 (50)	<0.001	125/160 (78)	151/248 (61)	757/1578 (48)	<0.001
Current smoker	157/224 (70)	492/809 (61)	0.01	85/125 (68)	95/151 (63)	469/757 (62)	0.43
Smoking brief intervention	97/157 (62)	324/492 (66)	0.35	67/85 (79)	56/95 (59)	298/469 (64)	0.01
BMI							
BMI recorded	180/358 (50)	563/1628 (35)	<0.001	98/160 (61)	124/248 (50)	521/1578 (33)	<0.001
Overweight/obese	89/180 (49)	292/563 (52)	0.10	43/98 (44)	69/124 (56)	269/521 (52)	0.50
Brief intervention	31/89 (35)	126/292 (43)	0.16	26/43 (60)	18/69 (26)	113/269 (42)	0.001
Weight management referral	10/89 (11)	30/292 (10)	0.80	8/43 (19)	7/69 (10)	25/269 (9)	0.19
Lipids							
Lipid profile	114/358 (32)	511/1628 (31)	0.87	16/160 (10)	46/248 (19)	563/1578 (36)	<0.001
Abnormal lipid profile	86/114 (75)	372/511 (73)	0.57	12/16 (75)	35/46 (76)	411/563 (73)	0.94
Lipid management plan	9/86 (10)	66/372 (18)	0.10	4/12 (33)	1/35 (3)	70/411 (17)	0.02

© 2016 Public Health Association of Australia

workers and community health boards. During this feedback process, concerns were raised by health care workers that increased efforts to incorporate screening during acute care consultations may jeopardise the fragile relationship they have with young people and discourage them from returning to the PHC. Another concern among health care workers was that there is a lack of effective evidence-based management programs or guidelines to facilitate follow-up. This may contribute to both reduced screening and provision of follow-up, which is likely to be particularly relevant in remote locations, where assessment was found to be least frequent.

Examining documentation of follow-up identifies areas where PHC systems and processes could be strengthened to support health professionals to provide these aspects of preventive care. Lack of follow-up may relate to the use of case-finding rather than participation in screening programs that ensure systematic follow-up of abnormal findings. Comprehensive cardiovascular risk assessment during a dedicated Adult Health Check has been found to be an effective way to increase early identification of elevated cardiovascular risk and improve provision of preventive care services in Indigenous adults.[38,39] This may offer an opportunity to increase preventive health care provision and improve follow-up without imposing on acute care.

The need for culturally appropriate training for health workers in screening, assessment, treatment and referral is a key finding of the ABCD National Research Partnership project.[29] As discussed above, health care workers request development and promotion of evidence-based management programs or guidelines to facilitate follow-up. Future research directions may include examining barriers to health services attendance for assessment and follow-up through focus groups involving young Indigenous people.

The results from this study were obtained from PHCs participating in a large-scale CQI initiative across a broad range of settings and, as such, the findings are to some extent generalisable to PHCs providing care to the wider young Indigenous population across Australia. We anticipate that the limitations in preventive health care provision identified are system-level issues, on which PHCs may choose to focus their quality improvement activities, to strengthen health care practices and improve delivery of preventive health care.[37,40] System-wide quality improvement is an effective method to strengthen health systems and enhance provision of quality care.[41] Primary health care networks and partnership-based approaches to quality improvement, such as the ABCD National Research Partnership, can be used to strengthen quality of primary health care to address inequitable levels of chronic disease experienced by Indigenous people.[42,43]

The high frequency of risk factors for CVD and T2DM evident by the age of 15 years, the age gradient in overweight/obesity and the lipid profile seen in our study, indicate that primary preventive health care should target Aboriginal and Torres Strait Islander people in early life. Programs aimed at adolescents, children, babies and mothers are required to circumvent development of these risk factors before the age of 15 years.

Implications

An appreciation of the importance of preventive health care provision to young Indigenous people in PHCs is highlighted by the frequency of assessment demonstrated in this study. The high presence of risk factors for CVD and T2DM in young Indigenous people, and the low frequency of documented follow-up when these are identified, have important public health implications for Australia. Improvements in effective management tools to facilitate follow-up may strengthen the capacity of PHCs to provide crucial preventive health care to reduce the burden of chronic disease experienced by young Indigenous people. Such programs need to be driven by health centres and communities, and a CQI framework is a successful strategy that could be employed to facilitate this.

Acknowledgements

This manuscript would not have been possible without the active support, enthusiasm and commitment of members of the ABCD National Research Partnership, especially the participating primary health care centres that have provided de-identified data. The authors gratefully acknowledge the assistance of Veronica Matthews and Cynthia Croft who facilitated data provision.

The ABCD National Research Partnership Project is supported by funding from the National Health and Medical Research Council (545267) and the Lowitja Institute, and by in-kind and financial support from a range of community-controlled and government agencies. Ross Bailie's work is supported by an Australian Research Council Future Fellowship (100100087).

References

1. Vos T, Barker B, Begg S, Stanley L, Lopez AD. Burden of disease and injury in Aboriginal and Torres Strait Islander Peoples: The Indigenous health gap. *Int J Epidemiol*. 2009;38(2):470-7.
2. Australian Institute of Health and Welfare. *Mortality and Life Expectancy of Indigenous Australians: 2008 to 2012*. Catalogue No.: IHW 140. Canberra (AUST): AIHW; 2014.
3. Australian Bureau of Statistics. *Australian Aboriginal and Torres Strait Islander Health Survey: First Results, Australia, 2012-13*. Canberra (AUST): ABS; 2013.
4. Ryan D. Obesity in women: A life cycle of medical risk. *Int J Obes (Lond)*. 2007;31 Suppl 2:3-7; discussion S31-2.
5. Maple-Brown LJ, Sinha AK, Davis EA. Type 2 diabetes in indigenous Australian children and adolescents. *J Paediatr Child Health*. 2010;46(9):487-90.
6. Minges KE, Zimmet P, Magliano DJ, Dunstan DW, Brown A, Shaw JE. Diabetes prevalence and determinants in Indigenous Australian populations: A systematic review. *Diabetes Res Clin Pract*. 2011;93(2):139-49.
7. Brown AD, Morrissey MJ, Sherwood JM. Uncovering the determinants of cardiovascular disease among Indigenous people. *Ethn Health*. 2006;11(2):191-210.
8. O'Dea K. Preventable chronic diseases among Indigenous Australians: The need for a comprehensive national approach. *Heart Lung Circ*. 2005;14(3):167-71.
9. Sayers SM, Mackerras D, Singh G, Bucens I, Flynn K, Reid A. An Australian Aboriginal birth cohort: A unique resource for a life course study of an Indigenous population. A study protocol. *BMC Int Health Hum Rights*. 2003;3(1):1.
10. Azzopardi PS, Kennedy EC, Patton GC, Power R, Roseby RD, Sawyer SM, et al. The quality of health research for young Indigenous Australians: Systematic review. *Med J Aust*. 2013;199(1):57-63.
11. Stone M, Baker A, Maple Brown L. Diabetes in young people in the Top End of the Northern Territory. *J Paediatr Child Health*. 2013;49(11):976-9.
12. Azzopardi P, Brown AD, Zimmet P, Fahy RE, Dent GA, Kelly MJ, et al. Type 2 diabetes in young Indigenous Australians in rural and remote areas: Diagnosis, screening, management and prevention. *Med J Aust*. 2012;197(1):32-6.
13. World Health Organization. Declaration of Alma-Ata. *Proceedings to the International Conference on Primary Health Care*; 1978 September 6-12; Alma-Ata, USSR. Geneva(CHE): WHO; 1978 [cited 2015 Jun 6]. Available from: http://www.who.int/publications/almaata_declaration_en.pdf
14. Department of Health. *Medicare Health Assessment for Aboriginal and Torres Strait Islander People (MBS ITEM 715)* [Internet]. Canberra (AUST): Government of Australia; 2013 [cited 2014 Jul]. Available from: http://www.health.gov.au/internet/main/publishing.nsf/Content/mbsprimarycare_ATSI_MBSitem715
15. Bailie R, Si D, Dowden M, O'Donoghue L, Connors C, Robinson G, et al. Improving organisational systems for diabetes care in Australian Indigenous communities. *BMC Health Services Research*. 2007;7:67.
16. Bailie RS, Si D, O'Donoghue L, Dowden M. Indigenous health: Effective and sustainable health services through continuous quality improvement. *Med J Aust*. 2007;186(10):525-7.
17. Ralph AP, Fittock M, Schultz R, Thompson D, Dowden M, Clemens T, et al. Improvement in rheumatic fever and rheumatic heart disease management and prevention using a health centre-based continuous quality improvement approach. *BMC Health Serv Res*. 2013;13:525.
18. Gibson-Helm M, Teede HJ, Rumbold AR, Ranasinha S, Bailie R, Boyle J. Continuous quality improvement and metabolic screening in pregnancy at primary health centres attended by Aboriginal and Torres Strait Islander women. *Med J Aust*. 2015;203(9):369-70.

© 2016 Public Health Association of Australia

19. Bailie R, Si D, Shannon C, Semmens J, Rowley K, Scrimgeour DJ, et al. Study protocol: National research partnership to improve primary health care performance and outcomes for Indigenous peoples. *BMC Health Serv Res*. 2010;10:129.
20. Si D, Bailie RS, Dowden M, O'Donoghue L, Connors C, Robinson GW, et al. Delivery of preventive health services to Indigenous adults: Response to a systems-oriented primary care quality improvement intervention. *Med J Aust*. 2007;187(8):453-7.
21. Central Australian Rural Practitioners Association. *CARPA Standard Treatment Manual*. 4th ed. Alice Springs (AUST): CARPA; 2003.
22. National Aboriginal Community Controlled Health Organisation. *National Guide to a Preventive Health Assessment for Aboriginal and Torres Strait Islander Peoples*. South Melbourne (AUST): Royal Australian College of General Practitioners; 2012.
23. Bonita R, Beaglehole R, Kjellstrom T. *Basic Epidemiology*. Geneva (CHE): World Health Organisation; 2006.
24. World Health Organization. *Obesity: Preventing and Managing the Global Epidemic of Obesity* [Report]. Geneva (CHE): WHO; 1997.
25. Bailie RS, Si D, Connors CM, Kwedza R, O'Donoghue L, Kennedy C, et al. Variation in quality of preventive care for well adults in Indigenous community health centres in Australia. *BMC Health Serv Res*. 2011;11:139.
26. Aspin C, Brown N, Jowsey T, Yen L, Leeder S. Strategic approaches to enhanced health service delivery for Aboriginal and Torres Strait Islander people with chronic illness: A qualitative study. *BMC Health Serv Res*. 2012;12:143.
27. Peiris DP, Patel AA, Cass A, Howard MP, Tchan ML, Brady JP, et al. Cardiovascular disease risk management for Aboriginal and Torres Strait Islander peoples in primary health care settings: Findings from the Kanyini Audit. *Med J Aust*. 2009;191(6):304-9.
28. Jekel JF, Katz DL, Elmore JG, Wild DMG. *Epidemiology, Biostatistics, and Preventive Medicine*. 3rd ed. Philadelphia (PA): Saunders Elsevier; 2007.
29. Bailie J, Schierhout G, Cunningham F, Yule J, Laycock A, Bailie R. *Quality of Primary health Care for Aboriginal and Torres Strait Islander People in Australia: Key Research Findings and Messages for Action from the ABCD National Research Partnership Project*. Casuarina (AUST): Royal Darwin Hospital Campus, Menzies School of Health Research; 2015.
30. O'Dea K, Cunningham J, Maple-Brown L, Weeramanthri T, Shaw J, Dunbar T, et al. Diabetes and cardiovascular risk factors in urban Indigenous adults: Results from the DRUID study. *Diabetes Res Clin Prac*. 2008;80(3):483-9.
31. Thomas DP, Davey ME, Briggs VL, Borland R. Talking about the smokes: Summary and key findings. *Med J Aust*. 2015;202(10):S3-4.
32. Panaretto KS, Mitchell MR, Anderson L, Gilligan C, Buettner P, Larkins SL, et al. Tobacco use and measuring nicotine dependence among urban Indigenous pregnant women. *Med J Aust*. 2009;191(10):554-7.
33. Guh DP, Zhang W, Bansback N, Amarsi Z, Birmingham CL, Anis AH. The incidence of co-morbidities related to obesity and overweight: A systematic review and meta-analysis. *BMC Public Health*. 2009;9:88.
34. Australian Bureau of Statistics. *Australian Health Survey: First Results, 2011 – 12*. Canberra (AUST): ABS; 2012.
35. Australian Institute of Health and Welfare. *Australia's Health 2014*. Report No.: AUS 178. Canberra (AUST): AIHW; 2014.
36. Shin D, Song WO. Prepregnancy body mass index is an independent risk factor for gestational hypertension, gestational diabetes, preterm labor, and small- and large-for-gestational-age infants. *J Matern Fetal Neonatal Med*. 2014;28(14):1679-86.
37. Bailie RS, Si D, O'Donoghue L, Dowden M. Indigenous health: Effective and sustainable health services through continuous quality improvement. *Med J Aust*. 2007;186(10):525-7.
38. Burgess CP, Bailie RS, Connors CM, Chenhall RD, McDermott RA, O'Dea K, et al. Early identification and preventive care for elevated cardiovascular disease risk within a remote Australian Aboriginal primary health care service. *BMC Health Serv Res*. 2011;11:24.
39. Spurling GK, Hayman NE, Cooney AL. Adult health checks for Indigenous Australians: The first year's experience from the Inala Indigenous Health Service. *Med J Aust*. 2009;190(10):562-4.
40. Gardner KL, Dowden M, Togni S, Bailie R. Understanding uptake of continuous quality improvement in Indigenous primary health care: Lessons from a multi-site case study of the Audit and Best Practice for Chronic Disease project. *Implement Sci*. 2010;5:21.
41. Tricco AC, Ivers NM, Grimshaw JM, Moher D, Turner L, Galipeau J, et al. Effectiveness of quality improvement strategies on the management of diabetes: A systematic review and meta-analysis. *Lancet*. 2012;379(9833):2252-61.
42. Bailie R, Matthews V, Brands J, Schierhout G. A systems-based partnership learning model for strengthening primary healthcare. *Implement Sci*. 2013;8(1):143.
43. Bailie R, Si D, Shannon C, Semmens J, Rowley K, Scrimgeour DJ, et al. Study protocol: National research partnership to improve primary health care performance and outcomes for Indigenous peoples. *BMC Health Serv Res*. 2010;10:129.

© 2016 Public Health Association of Australia