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Aboriginal health workers and diabetes care in remote community health centres: a mixed method analysis

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ABSTRACT

Objective: To assess the effect of employing Aboriginal health workers (AHWs) on delivery of diabetes care in remote community health centres, and to identify barriers related to AHWs' involvement in diabetes and other chronic illness care.

Design, setting and participants: Three-year follow-up study of 137 Aboriginal people with type 2 diabetes in seven remote community health centres in the Northern Territory.

Main outcome measures: Delivery of guideline-scheduled diabetes services; intermediate outcomes (glycated haemoglobin [HbA_{1c}] and blood pressure levels); number and sex of AHWs at health centres over time; barriers to AHWs' involvement in chronic illness care.

Results: There was a positive relationship between the number of AHWs per 1000 residents and delivery of guideline-scheduled diabetes services (but not intermediate health outcomes). Presence of male AHWs was associated with higher adherence to the guidelines. Barriers to AHWs' involvement in chronic illness care included inadequate training, lack of clear role divisions, lack of stable relationships with non-Aboriginal staff, and high demands for acute care.

Conclusions: Employing AHWs is independently associated with improved diabetes care in remote communities. AHWs have potentially important roles to play in chronic illness care, and service managers need to clearly define and support these roles.

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Aboriginal health workers (AHWs) developed as a professional group in Australia from the employment of Aboriginal people, mainly women, as leprosarium workers in the 1950s and as medical assistants in the Northern Territory in the 1960s.[1] They were recognised as cultural brokers and were trained on the job in basic clinical skills to deliver health care to community members. The role of AHWs was further developed with the adoption of primary health care as a policy model for improving the health of Aboriginal people.[2] This led to AHW involvement in a range of health promotion activities and immunisation services and in environmental and mental health.[1] However, the role of AHWs in the Australian health workforce remains poorly documented and inadequately understood.[3] Of all the Australian states and territories, only the Northern Territory has enacted laws to provide professional registration for AHWs.[4] This limited recognition may in part be due to the dearth of evidence on the impact of AHWs on the quality of health care.

The Coordinated Care Trials (CCTs) in the Northern Territory (1997–2002) embraced two main objectives of health system reform: to achieve community control of health services through establishing health boards with purchasing authority, and to implement best practice clinical guidelines in the form of disease- and age-specific care plans maintained on purpose-built electronic information systems.[5]

The CCTs were evaluated by examining changes in the organisation of health services, in clinical practice and in intermediate indicators of health outcomes.[6,7] The impact of the trials on diabetes care has been reported previously.[8] The aim of this article is to report on the relationship between employment of AHWs and delivery of diabetes care, and on barriers to AHWs' involvement in diabetes and other chronic illness care.

METHODS

Setting and sampling

The CCTs took place in two remote areas of the Northern Territory: the Tiwi Islands and the Katherine West region. At trial recruitment, there were 1205 participants from a population of about 2000 for the Tiwi Islands, and 1340 participants from a population of about 3000 for Katherine West. Of these participants, 188 were identified from health centre records as having type 2 diabetes.

For the clinical audits, a stratified sampling strategy was used to ensure the study sample included participants from each of seven communities. Because of small numbers in each of the five smallest communities, all participants with diabetes living in these communities ($n = 57$) were included in the sample. A random sample of participants with diabetes was drawn from each of the two largest communities ($n = 83$). As the records of three people in this original sample of 140 were not available at the time of baseline audit, the sample at baseline consisted of 137 participants. Out-migration and death resulted in four participants being lost to follow-up at Year 1 ($n = 133$), another 10 at Year 2 ($n = 123$), and another 16 at Year 3 ($n = 107$). The sample at the Year 3 audit was supplemented by recruiting an additional 39 participants from six of the communities (total $n = 146$).

Data collection

Measuring delivery of diabetes services and intermediate outcomes. Clinical records of the sample were audited at baseline, 6 months, 1 year, 2 years and 3 years against the locally developed practice guideline for diabetes care.[9] Four categories of services are scheduled in the guideline for people with diabetes: basic measurements and vaccinations, clinical examinations, laboratory investigations and counselling (Box 1).

Both paper and electronic records for each participant were checked to assess whether there was a record of delivery of each specific service within the appropriate period preceding the audit. For example, the guideline recommends that weight be measured every 3 months. If the weight was recorded within the 3 months preceding the audit, the weight check was assessed as delivered, otherwise as undelivered.

The overall adherence to delivery of guideline-scheduled diabetes services was calculated by dividing the sum of services delivered by 29 (the total number of scheduled services), and expressing this as a percentage. For example, if 15 services were delivered to participant A at Year 1 audit, the overall adherence to delivery of scheduled

services for participant A was 52% (15/29). Similarly, adherence to delivery of each category of services was also calculated.

Intermediate outcomes of diabetes care included two measures: the most recent glycated haemoglobin (HbA_{1c}) and blood pressure levels measured within 12 months before each audit.

Measuring AHW profile and covariates. During each audit, the profile of AHWs in community health centres was measured in terms of number of AHWs per 1000 residents and whether any male AHWs were present. Covariates were defined at the participant and community health centre levels (Box 2). All AHW profile variables and covariates were measured at each of five audits, except for population size, for which baseline data were used throughout the study period. As diabetes services delivered were documented in paper-based and computer-based records, the proportion of services recorded on computer was used to denote the level of uptake of computerised information systems at each health centre.

Qualitative data on AHWs' involvement in chronic illness care. Qualitative data were collected throughout the evaluation in order to monitor diabetes guideline implementation processes and barriers to implementation. Sources of qualitative data were observations at health centres at the time of audits; attendance at meetings of health boards and related sub-committees; and semi-structured interviews with health centre managers (4), general practitioners (3), registered nurses (RNs) (3), and AHWs (7). In addition to these interviews, we had many discussions with health centre staff and other health service providers in which we focused on audit outcomes and related issues, roles of the professional classifications (GPs, RNs, and AHWs), effects of staff turnover, training, views on health board management, and strategies for integrating acute and chronic illness care within health centre processes. Interview notes were entered as raw data and analysed manually for emerging themes.

Statistical analysis

We used multilevel regression models to determine the independent effects of employing AHWs on adherence to delivery of diabetes services and patient intermediate outcomes. Three-level models were used to accommodate the inherent dependency structure of the data in the presence of both repeated observations from the same individuals and clusters within the same community health centre.[10] As adherence to delivery of scheduled diabetes services was normally distributed, multilevel linear regression models* were used to assess the effect of employing AHWs on adherence to delivery of services, with adjustment for covariates. (* The command "gllamm" [generalised linear latent and mixed models] was used with the "family" option as "Gaussian" in Stata software version 8.1 [Stata Corporation, College Station, Tex, USA].) The effect of employing AHWs on intermediate outcomes (HbA_{1c} < 7.0% or not; blood pressure < 130/80 mmHg or not) was assessed using multilevel logistic regression models† adjusted for covariates. († The command "gllamm" was used with the "family" option as "binomial".)

1 Contents and frequencies of scheduled services in the diabetes clinical care guideline[9]

	Frequency (months)
Basic measurements and vaccinations	
Weight	3
Waist circumference	3
Body mass index	6
Blood pressure	3
Pneumococcal vaccine	60
Influenza vaccine	12
Clinical examinations	
Heart auscultation	6
Peripheral pulses	6
Visual acuity	6
Cataracts	6
Fundi	6
Ophthalmologist visit	24
Feet: sensation	6
Feet: reflexes	6
Feet: pressure areas	6
Feet: infection	3
Laboratory investigations	
Blood sugar level	3
Urine dipstick	3
Albumin–creatinine ratio	6
Urea	6
Creatinine	6
Glycated haemoglobin (HbA_{1c})	3
Fasting lipids	6
Counselling	
Diet	3
Physical activity	3
Weight loss	3
Smoking	3
Alcohol	3
Medications	6

Ethics approval

Ethics approval for the study was obtained from the Top End Health Research Ethics Committee, including the Indigenous subcommittee.

RESULTS

At the baseline audit, all seven health centres had fewer than 10 AHWs/1000 residents, and four centres employed AHWs of both sexes (Box 2). Over the study period, AHW profile variables changed due to recruitment, resignation or turnover of AHWs at participating health centres.

Overall adherence to delivery of diabetes services rose progressively with increasing numbers of AHWs/1000 residents (Box 3). People in health centres with 10 or more AHWs/1000 residents received more guideline-scheduled services than those in health centres with fewer than five AHWs/1000 residents (adjusted mean difference, 17%; 95% CI, 8%–26%). The employment of male AHWs was associated with delivery of more diabetes guideline-specified services (adjusted mean difference, 6%; 95% CI, 1%–10%).

With regard to covariates, greater adherence to delivery of services was significantly and independently associated with participants having more comorbidities, the centre being served by a visiting (as opposed to a resident) doctor, having more nurses per head of population, the presence of a men's clinic, higher levels of uptake of the computerised information system, and medium-sized (as opposed to smaller or larger) communities (Box 3).

The adherence to delivery of individual categories of services was influenced by the numbers and types of health care professionals present (Box 3). Participants attending health centres with more nurses and AHWs per head of population tended to receive more clinical examinations and laboratory investigations. Participants in health centres served by a resident doctor had less laboratory investigation services delivered than those in health centres served by a visiting doctor (adjusted mean difference, –12%; 95% CI, –20% to –5%). The

2 Aboriginal health worker (AHW) profile and participant and health centre level covariates over five audit periods

Variable	Baseline	Month 6	Year 1	Year 2	Year 3
AHW profile*					
Number of community health centres	7	7	7	7	7
Total number of AHWs (full-time equivalents)	30.5	31.5	33.0	33.5	34.0
Average number of AHWs/1000 residents	5.9	6.0	6.2	6.2	6.3
Number of AHWs/1000 residents					
1–4	3 (43%)	3 (43%)	2 (29%)	2 (29%)	3 (43%)
5–9	4 (57%)	3 (43%)	4 (57%)	4 (57%)	3 (43%)
⩾ 10	0	1 (14%)	1 (14%)	1 (14%)	1 (14%)
Presence of male AHWs	4 (57%)	5 (71%)	5 (71%)	5 (71%)	6 (86%)
Proportion of male AHWs (range)	0–33%	0–50%	0–50%	0–50%	0–43%
Participant level covariates					
Number of participants	137	137	133	123	146
Males	52 (38%)	52 (38%)	49 (37%)	47 (38%)	55 (38%)
Age (years)					
< 35	25 (18%)	24 (18%)	22 (17%)	15 (12%)	17 (11%)
35–49	51 (37%)	50 (36%)	51 (38%)	47 (38%)	58 (39%)
50–64	43 (32%)	43 (31%)	39 (29%)	39 (32%)	45 (31%)
⩾ 65	18 (13%)	20 (15%)	21 (16%)	22 (18%)	26 (18%)
Number of comorbidities†					
0	48 (35%)	46 (33%)	29 (22%)	23 (19%)	30 (21%)
1	51 (37%)	49 (36%)	48 (36%)	42 (34%)	32 (22%)
⩾ 2	38 (28%)	42 (31%)	56 (42%)	58 (47%)	84 (57%)
Health centre level covariates*					
Number of community health centres	7	7	7	7	7
Doctor types — visiting (as opposed to resident)	6 (86%)	6 (86%)	6 (86%)	4 (57%)	3 (43%)
Average number of nurses/1000 residents	2.6	3.9	3.9	3.7	3.6
Number of nurses/1000 residents					
1–4	6 (86%)	4 (57%)	4 (57%)	4 (57%)	4 (57%)
⩾ 5	1 (14%)	3 (43%)	3 (43%)	3 (43%)	3 (43%)
Presence of separate men's clinics	1 (14%)	1 (14%)	3 (43%)	3 (43%)	3 (43%)
Presence of separate women's clinics	3 (43%)	3 (43%)	4 (57%)	3 (43%)	3 (43%)
Proportion of services recorded in computerised information systems					
< 50%	5 (71%)	3 (43%)	1 (14%)	1 (14%)	1 (14%)
50%–70%	1 (14%)	2 (29%)	4 (57%)	3 (43%)	5 (71%)
> 70%	1 (14%)	2 (29%)	2 (29%)	3 (43%)	1 (14%)
Size of population served					
⩽ 500	4 (57%)	4 (57%)	4 (57%)	4 (57%)	4 (57%)
501–999	2 (29%)	2 (29%)	2 (29%)	2 (29%)	2 (29%)
⩾ 1000	1 (14%)	1 (14%)	1 (14%)	1 (14%)	1 (14%)

* Figures are numbers (%) of health centres unless otherwise stated. † Comorbidities were hypertension, renal disease, cardiovascular diseases and chronic respiratory conditions. ◆

adherence to delivery of basic measurements and vaccinations was linked weakly to the number of AHWs, but was not related to type of doctor or number of nurses. Greater adherence to delivery of counselling services was associated with health centres being served by a visiting doctor, but not with the number of nurses or AHWs.

There was no independent association between employment of AHWs and HbA_{1c} levels and blood pressure control (full data are available from the authors on request). With respect to covariates, being ⩾ 65 years of age and having a resident doctor were associated with better HbA_{1c} control, and women were more likely to have better blood pressure control than men.

Interviews with community health centre staff revealed four major barriers to AHWs' involvement in diabetes and other chronic illness care:

- Insufficient and discontinuous training of AHWs on use of clinical guidelines and computerised information systems;
- Lack of a clear division of roles among health care professionals in the area of chronic illness care;
- Lack of stable relationships with non-Aboriginal nursing staff, which influenced retention and performance of AHWs; and
- High demand for acute care, which limited opportunities for AHWs to be involved in chronic illness care.

DISCUSSION

Our findings highlight the importance of AHWs in the health workforce and are consistent with reports of the perceived importance of AHWs in the Indigenous primary care setting.[1,3] Adherence to best practice guidelines for delivery of diabetes care was independently associated with employment of more AHWs per head of population and with employment of male AHWs in addition to female AHWs. The apparent significant role of male AHWs is consistent with the common distinction in Indigenous cultures between the accepted roles of men and women in society and the preference for treatment by health staff of the same sex.[11]

While we included a number of participant and health centre covariates in the statistical model, the associations we found may be subject to unidentified confounders not measured in the original evaluation, including the general process of capacity-building within the CCTs, characteristics of health centre organisations and individual

3 Association of employment of AHWs with adherence to delivery of diabetes services and different categories of diabetes services, adjusted by participant and health centre level covariates

Factors	Mean overall adherence to delivery of services (%)	Adjusted mean difference (%) of adherence to delivery of services* (95% CI†)				
		All diabetes services	Basic measurements and vaccinations	Clinical examinations	Laboratory investigations	Counselling
Number of AHWs/1000 residents						
< 5 (referent)	37					
5–9	44	13 (6, 20)‡	12 (2, 22)§	13 (4, 21)‡	21 (10, 32)‡	7 (–3, 18)
⩾ 10	60	17 (8, 26)‡	3 (–10, 17)	24 (12, 35)‡	26 (11, 40)‡	7 (–7, 20)
Presence of male AHWs						
No (referent)	43					
Yes	47	6 (1, 10)¶	2 (–5, 9)	9 (3, 15)‡	7 (–1, 15)	–1 (–7, 7)
Participant level covariates						
Sex						
Male (referent)	48					
Female	46	–1 (–5, 4)	4 (–2, 9)	–1 (–6, 5)	1 (–5, 8)	–5 (–10, 1)
Age (years)						
< 35 (referent)	34					
35–49	39	1 (–5, 7)	–1 (–9, 6)	6 (–1, 13)	–4 (–13, 5)	–1 (–9, 7)
50–64	46	7 (1, 14)¶	2 (–6, 10)	19 (11, 26)‡	2 (–8, 12)	–2 (–10, 7)
⩾ 65	35	–4 (–11, 4)	–5 (–15, 4)	6 (–3, 15)	–12 (–23, –1)¶	–10 (–20, –1)¶
Number of comorbidities						
0 (referent)	31					
1	43	8 (3, 13)‡	8 (2, 15)§	5 (–1, 11)	12 (5, 19)‡	10 (3, 17)‡
⩾ 2	50	13 (8, 18)‡	16 (9, 22)‡	7 (1, 13)§	19 (11, 27)‡	14 (7, 21)‡
Community health centre level covariates						
Doctor types						
Visiting (referent)	44					
Resident	42	–5 (–10, –1)¶	–3 (–10, 4)	–1 (–7, 5)	–12 (–20, –5)‡	–9 (–17, –2)§
Number of nurses/1000 residents						
< 5 (referent)	39					
⩾ 5	41	15 (3, 26)§	11 (–5, 27)	14 (1, 28)¶	23 (5, 40)§	8 (–8, 25)
Regular and separate men's clinic						
No (referent)	38					
Yes	54	9 (1, 18)¶	–1 (–12, 12)	3 (–7, 13)	13 (–1, 25)	22 (10, 35)‡
Regular and separate women's clinic						
No (referent)	37					
Yes	47	5 (–2, 13)	10 (–1, 20)	5 (–4, 14)	–1 (–13, 10)	9 (–2, 20)
Proportion of services recorded in computerised information systems						
< 50% (referent)	39					
50–70%	42	–6 (–13, 1)	–2 (–11, 8)	–4 (–12, 5)	–11 (–22, 2)	–8 (–18, 3)
> 70%	55	9 (1, 16)§	6 (–4, 17)	19 (10, 28)‡	–1 (–12, 11)	2 (–9, 13)
Served populations						
⩽ 500 (referent)	35					
501–999	41	19 (11, 28)‡	15 (5, 26)‡	18 (8, 27)‡	29 (17, 40)‡	14 (3, 24)§
⩾ 1000	47	1 (–11, 13)	9 (–7, 25)	–14 (–28, –1)¶	10 (–8, 28)	18 (2, 35)¶

* Adjusted for other variables in the table using multilevel linear regression models. † Adjusted for repeated measures and health centre clusters. ‡ $P < 0.01$. § $P < 0.025$. ¶ $P < 0.05$.

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4 Potential roles of Aboriginal health workers (AHWs) related to components of community health care systems for chronic illness care

Component	Roles of AHWs	Strategies to reinforce AHWs' roles
Health care organisation	Management and planning	Including AHWs in setting goals and business plans for chronic illness care for health centres and valuing their input.
Community linkages	Community service facilitator	Designating AHWs to ensure active coordination between the health centre and community service agencies and facilitating use of community-based resources by patients.
Self-management	Educator and promoter	Training AHWs to use self-management techniques and ensuring that AHWs play a leading role in helping patients and their families acquire the skills to manage their chronic illness.
Decision support	Guideline disseminator	Supporting AHWs to develop specific materials that inform patients about guidelines and help them achieve guideline adherence.
Delivery system design	Services provider and cultural broker	Training AHWs to deliver routine periodic tasks (eg, laboratory tests for diabetic patients, eye examinations, foot examinations). Empowering AHWs to maintain cultural competency of practice teams.
Clinical information systems	Reminder system responder	Supporting AHWs to operate information systems and to ensure patient visits to the health centre in line with reminder systems. ◆

practitioners, inputs of health board management and other community conditions.

During the course of the CCTs, there was wide variation among community health centres in the degree to which AHWs were involved in chronic illness care.[5] There was a view that improved management practices could enhance the role and contribution of AHWs, in part by strengthening local delineation of roles and responsibilities for acute and chronic illness care. Other studies have supported this view.[12-15]

The effect of the quality of AHW–nurse relationships on AHW attendance and on the number of AHWs working in health centres has been highlighted by work in Central Australia.[3] In remote health centres, high turnover among nurses reduces the likelihood of their forming significant relationships with AHWs. Jackson and colleagues, in a qualitative study of the relationship between AHWs and nurses, suggested that enhancing understanding of workplace equity and skill sharing could improve AHW–nurse relationships.[16] A World Health Organization report recommends a teamwork approach to improve the attitude of health personnel towards community health workers.[17]

The inherent logic relationships between delivery of diabetes services and patient intermediate outcomes can be summarised in the following steps: (A) improvement in regular testing and monitoring increases (B) the likelihood of proper use of medications, and consequently increases (C) the likelihood of good intermediate outcomes. AHWs and RNs are involved in step A, and doctors are involved in both steps A and B. Step C is a product of teamwork.

As our study showed, employment of AHWs (and RNs) was associated with a higher level of delivery of services, but was not independently (and necessarily) associated with improvement in intermediate outcomes. The association between higher adherence to guidelines and having visiting doctors may arise from visiting doctors' greater exposure to guideline implementation processes (as they are based primarily in Darwin, where much of the CCT guideline-related work occurred). On the other hand, health centres with resident doctors were associated with better control of HbA_{1c} levels. A possible explanation is that a resident doctor may provide more timely medication adjustment for patients, which directly contributes to better glycaemic control.

Our findings should provide an incentive to further develop the role of AHWs in community health care systems — for example, in areas of counselling and health promotion and in some areas of basic measurement — at least as a precursor to referral to other practitioners. Potential roles of AHWs in relation to components of the community health care system[18,19] are summarised in Box 4. It is important for health service managers to clarify and prioritise AHWs' roles in managing chronic illness, and also to define the roles of doctors and nurses.

The importance of AHWs in primary health care is recognised in high-level policy statements such as the Aboriginal and Torres Strait Islander Health Workforce National Strategic Framework.[20] The Aboriginal and Torres Strait Islander health performance indicators include information on the numbers of AHWs working in primary health care centres by state and territory.[21] The NT government's "rule of thumb" is that there should be one full-time AHW position for every 100 Aboriginal people.[3] None of the participating health centres reached this standard at baseline audit, and during the study period only one centre ever achieved this goal. Our study underlines the need for strategies to increase the numbers of AHWs employed and to clarify and support their roles in the multidisciplinary primary health care setting.

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COMPETING INTERESTS

None identified.

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