Reduced Prevalence of Impaired Glucose Tolerance and No Change in Prevalence of Diabetes Despite Increasing BMI Among Aboriginal People From a Group of Remote Homeland Communities

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OBJECTIVE — To examine trends in glucose tolerance and coronary risk among Aboriginal people from a group of homeland communities in central Australia during a 7-year follow-up period.

RESEARCH DESIGN AND METHODS — Community-based screenings of adult volunteers were performed in 1988 (n = 437; 93% response rate) and in 1995 (n = 424; 85% response rate). A health promotion intervention program commenced after the 1988 survey that focused on the benefits of exercise and appropriate diet.

RESULTS — Mean (95% CI) BMI increased significantly from 22.8 kg/m^2 (22.3–23.2) to 24.2 kg/m^2 (23.8–24.7) during the follow-up period ($P < 0.001$). This increase was similar for men and women and across all age-groups. The increase in BMI was greater among subjects residing adjacent to a store compared with those residing in communities located far from a store ($P < 0.001$). Decreases were evident in the prevalence of impaired glucose tolerance (IGT) (from 22.5 to 10.1% among women, $P < 0.001$; from 12.2 to 6.5% among men, $P = 0.074$) and hypercholesterolemia (from 36.7 to 25.8% among women, $P < 0.01$; from 52.4 to 44.0% among men, $P = 0.147$), but no change was evident in the prevalence of diabetes. Smoking remained rare among women (<4%) and decreased among men (from 52.9 to 40.8%, $P < 0.05$).

CONCLUSIONS — The trends in glucose intolerance were clearly better than have been observed in other Aboriginal communities. The institution of an intervention program corresponded with reductions in the prevalence of IGT, hypercholesterolemia, and smoking. The prevalence of diabetes remained unaltered despite a significant increase in mean BMI, possibly because of the promotion of increased physical activity levels.

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Numerous reports have documented the high prevalence of obesity, diabetes, impaired glucose tolerance (IGT), dyslipidemia, hypertension, and smoking in many Australian Aboriginal communities (1–5). In the Northern Territory Aboriginal population, coronary mortality is increasing (6) in association with higher prevalence rates of diabetes, a situation parallel to that in remote North American Indian communities (7). Efforts to address this problem elsewhere have included community-based exercise interventions for high-risk groups (8,9) and more comprehensive community-wide programs (10). As in other indigenous populations, the trend toward the increasing prevalence of coronary heart disease (CHD) risk factors among Australian Aboriginal people occurs in association with exposure to Western influences (2). In contrast, in situations in which aspects of the traditional Aboriginal lifestyle are maintained, protective factors appear to be operating against such chronic diseases (11–13). For example, health outcomes for central Australian Aboriginal people living in homeland communities were considerably better than for people in centralized settlements (11). Part of the cohort examined in that study (11) included some subjects who form part of the present survey sample.

Communities in central Australia have a history of Aboriginal people congregating under varying degrees of coercion on missions and other settlements away from their traditional lands. The present study population resides in several remote homeland communities scattered over a large area (11). This land was held by white pastoralists as a livestock grazing lease until the 1970s when it was returned to the traditional owners. This allowed many family groups to return to their homelands. Concerns about health by community members after the premature death of several senior men led to the initial survey of diabetes and CHD risk factors conducted in 1988 (11). The results of the

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Abbreviations: CHD, coronary heart disease; IGT, impaired glucose tolerance; NHF, National Heart Foundation.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

initial survey generated interest by community members in lifestyle factors that may contribute to or prevent the occurrence of diabetes and CHD. This led to the institution by the local health service of an ongoing health promotion strategy aimed at improving dietary quality, promoting regular exercise, and preventing excessive weight gain.

This report examines trends in anthropometry, glucose tolerance, plasma lipids, and smoking after 7 years of follow-up from the baseline survey in 1988.

RESEARCH DESIGN AND METHODS

— This study was carried out with the approval of the Deakin University Ethics Committee and the Alice Springs Institutional Ethics Committee. Screening procedures and rationale were explained to participants in the local language. All subjects gave written informed consent before participating in screening procedures.

Data were collected in the course of community-based risk factor prevalence surveys conducted in October 1988 and March 1995. Participation in screening was voluntary and open to all adult (≥15 years of age) community members. The age ranges of the baseline and follow-up survey samples were 15–84 and 15–83 years, respectively. Community members decided the timing, order, and site of screening in each homeland community. The proportion of eligible adults present in the community at the time of survey who took part in screening procedures was determined by household census and was high at both baseline (93%) and follow-up (85%). Thus, the survey sample in both cases was highly representative of the total population regarding age and sex distribution. At baseline, a single store was located at one of the homeland communities, and the other homelands were up to 100 km away from this store. A mobile food vendor also supplied a small proportion of food consumed, and several stores on neighboring grazing properties were used sporadically by community members. Between 1988 and 1995, a second store opened ~100 km from the first.

Blood samples were collected in the early morning after an overnight fast and immediately before administration of a 75-g oral glucose load and were then placed in fluoride-heparin tubes or lithium-heparin tubes for use in glucose and lipid assays, respectively. A second blood sample was collected 2 h later for the glucose assay. Blood samples were kept on ice until centrifugation (within 6 h of collection), and plasma samples were frozen immediately thereafter for transport to laboratories for analysis as described previously (11). Body weight was measured to the nearest 0.1 kg and height to the nearest 1 cm. BMI was expressed as weight in kilograms divided by height in meters squared.

Diabetes and IGT were diagnosed according to World Health Organization criteria (14). Hypercholesterolemia was defined as a plasma cholesterol level ≥5.5 mmol/l, and dyslipidemia was defined as the combination of fasting plasma triglyceride levels ≥2.0 mmol/l and HDL cholesterol levels ≤0.90 mmol/l. Overweight and obesity were defined as a BMI of 25–30 and >30 kg/m^2, respectively.

Intervention strategies

Extensive discussions regarding diabetes and the role of diet and exercise in its treatment and prevention were held with the community council, health council, health workers, and community members. Intervention strategies included informal education by clinicians carried out as part of their routine practice. These sessions involved small group meetings during visits to homeland communities at which specific dietary advice was given to eat bush food whenever possible, to cut fat from meat before cooking, to use less fat during cooking, and to avoid too much sugar, carbonated beverages, and confections. The benefits of exercise (including exercise involved in hunting) were also promoted. During the weeks after the first survey, 2 of the investigators (T.M., A.G.) returned to the community to provide feedback on the results. Apart from advising individuals, general messages about diet and exercise were reinforced among family groups and the wider community. Examples of healthy foods and less healthy foods from the store were displayed and discussed. In some cases, A.G.'s knowledge of the family history of affected people enabled a discussion of the contribution of heredity to take place. In addition to providing feedback to individuals, the investigators informed the community health service of the results to facilitate treatment of newly diagnosed diabetes, hypertension, or hyperlipidemia, and aggregate data were presented as plain language reports to the community council and individual homeland groups. After the baseline survey, the community health service employed a health educator to continue this work for 1 to 2 years. A.G. returned 2 years later and accompanied the health educator on visits to many homeland communities, again reinforcing diet and exercise messages. Ongoing health promotion over the subsequent years was carried out by health service staff members. Thus, the nature of the intervention process in this community has been largely one of using health promotion messages as a means of prevention within existing clinical practice (initiated in response to interest from the community regarding the health of its members) and the widespread dissemination of and response to these messages by community members.

Statistical analyses

The follow-up survey sample included 267 persons screened at baseline. Because the main aim of the present study was to describe population trends in risk factors, for the purposes of this analysis, we have assumed that the samples are purely cross-sectional, which is a conservative assumption given that greater statistical power could be obtained by considering repeated measures. To examine trends over time, continuous variables were stratified by age-group (15–24, 25–34, and ≥35 years) and sex and were analyzed with analysis of variance using the General Linear Modelling function on SPSS Version 8.0 statistical software (Chicago). Models included all first-order interactions. Second-order interaction was tested and omitted from the final models if found to be nonsignificant to maximize statistical power. Because the response rate for each survey was high, the data were assumed to be highly representative of true mean values for each variable, and inflation of variance to account for nonindependence of observations was not carried out. A secondary research question involved trends with time at different locations (adjacent to or remote from a store), and this was performed with multiple linear regression analysis to test for significance of the interaction between location and time trends. The regression model included year of survey, age-group, sex, and location, and interaction terms for location × year, location × age-group, year × age-group, and location × year × age-group. Categorical variables (overweight/obesity, glucose tolerance, hyperlipidemia, smoking) were tested with the Mantel-Haenszel age-weighted χ^2 test. Subjects were categorized into 10-year age-groups for these analyses.

RESULTS

Anthropometry

Mean (95% CI) body weight for the aggregated population rose from 64.5 kg

Table 1—*Trends in BMI and plasma lipids stratified by age and sex*

	Men			Women			
	15–24 Years	25–34 Years	≥35 Years	15–24 Years	25–34 Years	≥35 Years	P_{year}
n							
1988	60	43	86	76	64	108	
1995	65	40	79	66	58	116	
Weight (kg)							
1988	63.1 (59.9–66.3)	68.6 (64.8–72.4)	73.0 (70.2–75.8)	55.4 (52.4–58.3)	62.8 (59.6–66.0)	64.0 (61.5–66.6)	
1995	67.2 (64.1–70.4)	71.0 (67.2–74.9)	75.5 (72.6–78.4)	60.0 (56.9–63.1)	65.7 (62.4–69.1)	67.0 (64.5–69.4)	0.001
Height (cm)							
1988	173 (171–174)	174 (172–175)	175 (174–176)	161 (160–162)	164 (162–165)	162 (161–163)	
1995	172 (171–173)	172 (171–174)	174 (172–175)	161 (159–162)	162 (161–163)	161 (160–162)	0.004
BMI (kg/m^2)							
1988	21.0 (20.0–22.0)	22.8 (21.6–24.0)	23.9 (23.0–24.7)	21.3 (20.1–22.5)	23.3 (22.0–24.6)	24.2 (23.3–25.2)	
1995	22.8 (21.8–23.7)	23.7 (22.5–25.0)	25.0 (24.2–25.9)	23.1 (21.9–24.4)	25.0 (23.7–26.4)	25.7 (24.8–26.7)	<0.001
Total cholesterol (mmol/l)							
1988	5.2 (4.9–5.5)	6.0 (5.6–6.3)	5.9 (5.6–6.2)	4.9 (4.6–5.1)	5.0 (4.7–5.3)	5.7 (5.4–5.9)	
1995	5.1 (4.8–5.4)	5.8 (5.4–6.2)	5.8 (5.5–6.1)	4.5 (4.2–4.8)	4.8 (4.5–5.1)	5.2 (5.0–5.4)	0.001
HDL cholesterol (mmol/l)							
1988	0.79 (0.74–0.84)	0.89 (0.83–0.95)	0.83 (0.79–0.87)	0.98 (0.92–1.03)	0.95 (0.90–1.01)	0.94 (0.89–0.98)	
1995	0.79 (0.75–0.84)	0.78 (0.72–0.84)	0.77 (0.72–0.81)	0.92 (0.86–0.98)	0.86 (0.80–0.93)	0.83 (0.79–0.87)	<0.001
LDL cholesterol (mmol/l)*							
1988	3.4 (3.2–3.7)	3.7 (3.4–4.0)	3.4 (3.2–3.6)	3.2 (3.0–3.5)	3.3 (3.0–3.5)	3.6 (3.5–3.8)	
1995	3.4 (3.1–3.6)	3.7 (3.4–4.0)	3.2 (3.0–3.4)	3.0 (2.8–3.2)	3.1 (2.8–3.4)	3.2 (3.0–3.4)	0.003
Triglycerides (mmol/l)							
1988	2.0 (1.7–2.3)	2.5 (2.1–3.0)	2.9 (2.6–3.3)	1.3 (1.1–1.4)	1.4 (1.2–1.6)	2.1 (1.9–2.3)	
1995	1.9 (1.6–2.1)	2.4 (2.1–2.9)	3.3 (2.9–3.7)	1.3 (1.1–1.5)	1.5 (1.3–1.7)	2.2 (2.0–2.5)	0.242

Data are *n* or estimated marginal means (95% CIs). *Calculated using the Friedewald equation: LDL = total − HDL − (triglycerides/2.2).

(63.1–65.9) to 67.7 kg (66.3–69.2) for the 1988 and 1995 survey samples, respectively ($P < 0.005$) (Table 1). The increase was similar for all age- and sex-specific categories because no significant interactions were evident between year of survey and age ($P = 0.735$) or sex ($P = 0.809$) (Table 1). A statistically significant difference was evident in mean height between the 2 survey samples (height 168 cm [167–169] and 167 cm [166–168] in 1988 and 1995, respectively, $P < 0.005$). This difference was similar in all age ($P = 0.616$) and sex ($P = 0.869$) subgroups (Table 1) and is not likely of biological significance.

Mean BMI for the aggregated population rose from 22.8 kg/m^2 (22.3–23.2) to 24.2 kg/m^2 (23.8–24.7) for the 1988 and 1995 survey samples, respectively. The increase was similar for all age- and sex-specific categories because no significant interactions were evident between year of survey and age ($P = 0.857$) or sex ($P = 0.537$) (Table 1). A significant increase was evident in the prevalence of overweight among both men ($\chi^2 = 6.8$, $P = 0.009$) and women ($\chi^2 = 5.4$, $P = 0.020$) (Fig. 1*A*). Although a trend was evident toward increased prevalence of obesity in men and women, this did not reach statistical significance (Fig. 1*A*) ($\chi^2 = 1.7$, $P = 0.193$ for men; $\chi^2 = 2.4$, $P = 0.125$ for women).

Glucose tolerance

Among nondiabetic subjects, a significant decrease was evident in fasting plasma glucose levels from 4.6 mmol/l (4.5–4.7) to 4.3 mmol/l (4.2–4.4) between 1988 and 1995. No significant effects of age-group ($P = 0.899$) or sex ($P = 0.960$) were evident on the change in mean fasting glucose concentrations (data not shown). Plasma glucose concentrations 2 h after a 75-g oral glucose load in nondiabetic subjects were significantly lower in 1995 (5.6 mmol/l [5.5–5.8]) compared with 1988 (6.1 mmol/l [6.0–6.3]). The interaction term between time and age-group approached significance ($P = 0.078$), and the largest declines in mean 2-h glucose levels were observed in the 2 younger age-groups (data not shown). No effect of sex was evident on the change in 2-h plasma glucose levels ($P = 0.461$). These changes in plasma glucose levels were reflected in declines in the prevalence of IGT among women ($\chi^2 = 12.7$, $P < 0.001$) and to a lesser extent among men ($\chi^2 = 3.2$, $P = 0.074$) during the intervention period (Fig. 1*B*). No significant change was evident in the total prevalence of diabetes among men ($\chi^2 = 0.1$, $P = 0.804$) or women ($\chi^2 = 0.2$, $P = 0.626$) (Fig. 1*C*). The apparent increase in prevalence of diabetes with fasting hyperglycemia (fasting glucose ≥7.8 mmol/l) (Fig. 1*C*) was not statistically significant in men ($\chi^2 = 0.7$, $P = 0.409$) or women ($\chi^2 = 0.5$, $P = 0.463$), nor was the change in diabetes without fasting hyperglycemia among men ($\chi^2 = 2.6$, $P = 0.106$) or women ($\chi^2 = 0.02$, $P = 0.899$).

When diabetes was defined using current American Diabetes Association criteria based on fasting plasma glucose concentrations (15), no significant change was evi-

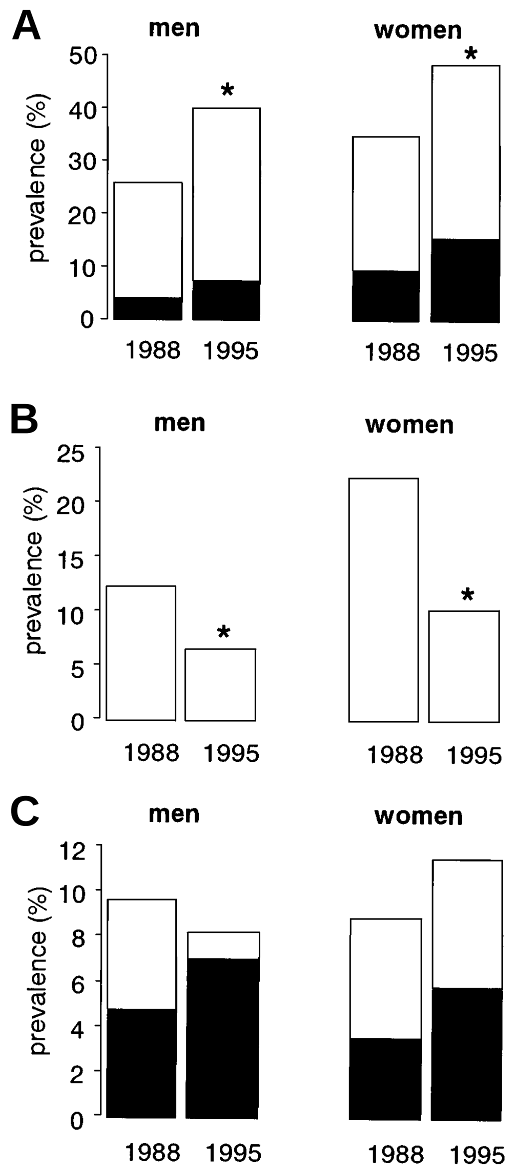

Figure 1—A*: Prevalence of overweight (□) and obesity (■) by year of survey stratified by sex.* B*: Prevalence of IGT by year of survey stratified by sex.* C*: Prevalence of diabetes without fasting hyperglycemia (□) and diabetes with fasting hyperglycemia (■) by year of survey stratified by sex. *Significant difference between years.*

dent in prevalence (6.5 and 8.6% in 1988 and 1995, respectively; $\chi^2 = 0.6$, $P = 0.449$).

Plasma lipids

A small statistically significant decrease was evident in total plasma cholesterol concentrations from 5.4 mmol/l (5.3–5.5) in 1988 to 5.2 mmol/l (5.1–5.3) in 1995. No significant effect of age ($P = 0.894$) or sex ($P = 0.155$) was evident on the magnitude of this change, although the analysis was somewhat underpowered to detect an interaction with sex, and the largest falls appeared to be among women (Table 1). The prevalence of hypercholesterolemia was lower in 1995 than in 1988 among women (37 and 26% in 1988 and 1995, respectively; $\chi^2 = 7.7$, $P = 0.006$) but was not significantly so among men (52 and 44% in 1988 and 1995, respectively; $\chi^2 = 2.1$, $P = 0.147$). Mean HDL cholesterol concentrations fell significantly from 0.89 mmol/l (0.87–0.92) in 1988 to 0.83 mmol/l (0.80–0.85) in 1995. No significant interaction with age ($P = 0.150$) or sex ($P = 0.215$) was evident on the magnitude of this change (Table 1). A small but statistically significant fall in mean estimated LDL cholesterol concentrations was evident from 3.4 mmol/l (3.3–3.6) in 1988 to 3.3 mmol/l (3.2–3.4) in 1995 ($P < 0.005$). No significant interaction with age ($P = 0.316$) or sex ($P = 0.226$) was evident on the magnitude of this change. Mean fasting plasma triglyceride concentration did not change significantly during the intervention period (Table 1). No significant change was evident in the prevalence of dyslipidemia (elevated triglycerides plus low HDL cholesterol) in men (47 and 54% in 1988 and 1995, respectively; $\chi^2 = 2.1$, $P = 0.152$) or women (21 and 30% in 1988 and 1995, respectively; $\chi^2 = 2.6$, $P = 0.110$).

Smoking

A significant fall was evident in the proportion of men who reported current smoking (53 and 41% in 1988 and 1995, respectively; $\chi^2 = 5.2$, $P = 0.023$). The proportion of female smokers was very low in 1988 (2%) and remained so in 1995 (4%) ($\chi^2 = 1.2$, $P = 0.272$).

Comparison of changes in communities with a store versus more remote communities

Figure 2 shows mean BMI stratified by age-group and location for the 2 surveys. Although no overall difference was evident in mean BMI between store and remote communities ($P = 0.139$) in multiple regression analysis, a significant interaction was evident between time and location ($P = 0.032$). Examination of mean BMI values showed that this change was greater among community residents with a store than in more remote communities. This increase was particularly evident among subjects <35 years of age living in communities with a store (Fig. 2), although the 3-way interaction of location, age, and time did not reach significance ($P = 0.126$). No significant interactions were evident between location and change in lipid levels over time (data not shown).

CONCLUSIONS

— In this group of remote Aboriginal communities located on traditional lands in central Australia during a 7-year period, no increase was evident in the prevalence of diabetes, decreases were evident in the prevalence of IGT and hypercholesterolemia, and, among men, a lower prevalence of smoking was evident. Smoking among women was almost nonexistent at baseline and remained so at follow-up. However, a significant increase was evident in BMI among this population across all age-groups and in both men and women.

In the period between the 2 surveys, the community implemented an intervention program for chronic lifestyle-related diseases. Although the study design precludes attributing a cause-and-effect relationship between the trends described here and the implementation of intervention strategies, comparisons with trends elsewhere in the Northern Territory suggest that this community has been largely successful in addressing the problems of the increasing risk of chronic disease. The trends in glucose tolerance contrast strongly with the increasing diabetes prevalence that we have documented at another central Australian Aboriginal community during the same period in which IGT remained at 8%, and diabetes increased in prevalence from 12 to 21% (16a). For the 1988 cohort, mortality from cardiovascular, endocrine, and renal causes to 1995 was ~400 cases/100,000 person-years (16) compared with a figure of ~530 cases/100,000 person-years in the Northern Territory Aboriginal population generally in 1991 (6). The fall in circulating cholesterol concentrations, although modest, was at least as large as that seen in the National Heart Foundation (NHF) Risk Factor Prevalence surveys of the wider Australian population during the period 1980–1989 in which no significant change was evident among men, and a fall of 0.1 mmol/l was evident among women (17). However, the rate of weight gain in the present study population, although somewhat less than what we have observed in another central Australian Aboriginal community (in which mean BMI increased by 2.3 kg/m^2 during approximately the same period [16a]), was considerably greater than that reported in the NHF surveys (17). This weight gain causes some concern because, although mean BMI remained within the "healthy" range as defined for populations of European descent (20–25 kg/m^2), incidence of diabetes for Aboriginal people with BMI <25 kg/m^2 was reported to be >10 cases/1,000 person-years (18) compared with rates of <3 cases/1,000 person-years in European and U.S. populations (19,20). Reversal of established obesity is extremely difficult, and primary prevention probably requires nutrition intervention in childhood and prevention of excessive weight gain in early adulthood (10). Similarly, established diabetes is difficult or impossible to reverse, and prevention is the only long-term solution. In contrast, reductions in CHD risk factors (hyperlipidemia, IGT, and smoking) are achievable as demonstrated here and elsewhere (21,22).

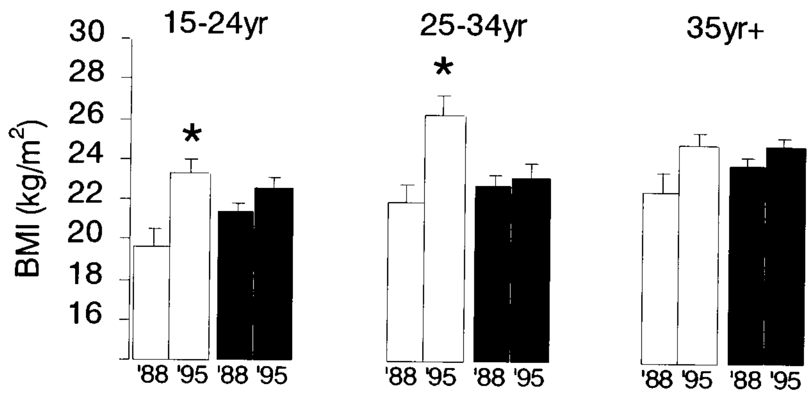

Figure 2—*Changes in BMI stratified by age and location (□, data for subjects adjacent to a store; ■, subjects remote from a store). Data are means ± SEM. *Significant differences from baseline. Number of observations for each category is as follows from left to right: 14, 54, 122, 78, 12, 37, 95, 62, 33, 67, 161, and 128.*

A limitation of the present study is the lack of formal cause-and-effect evaluation regarding the implementation of the intervention strategies. Clearly, a collective decision was made to address the problem of lifestyle-related disease in these communities, and this led to a health promotion program that was associated with improved glucose tolerance at the community level. However, we are not able to identify on an individual level whether increased physical activity and/or improved diet was directly associated with the trends observed. The appointment of a health educator for a period of several years suggests that policy support from the health council was an important contributor to the intervention process. Stability of health staff members at these communities has been good (by remote area standards), and thus continuity of care and health service knowledge were maintained. Strict attention to providing feedback of results in an appropriate format by researchers and health staff members was carried out.

The present data suggest that one of the benefits of living in remote homeland communities (although probably not one of the reasons for doing so) may be limited access to store-bought foods, particularly foods high in saturated fat and refined carbohydrates. This benefit is suggested by the greater increase in mean BMI occurring among residents of the 2 communities located adjacent to a store compared with people who live far from a store. At baseline, estimates indicated that reliance on store-bought foods ranged from 10–100% of energy intake, depending on proximity to a store (A.J. Lee et al., unpublished data). A major health promotion message was to encourage hunting for traditional foods. This would have been more readily achieved by residents of the more remote communities in which population pressures on bush food are less and is consistent with the smaller increase in BMI in remote locations compared with communities adjacent to a store. Some improvement was evident in dietary quality of foods sold through the store at the time of the follow-up survey, with major increases in the nutrient densities of vitamin C and β-carotene, but intake of saturated fats and refined carbohydrate remained higher than recommended (A.J. Lee et al., unpublished data). Hence, living in remote locations in this case is likely to be associated with advantages of greater dietary quality and variety and regular physical exercise as well as greater control over life and environment. We have previously reported that, among persons living adjacent to what at the time was the only store in this community, a greater prevalence of abnormal glucose tolerance was evident than among persons living far from the store (11). Such an effect was not apparent at follow-up because a highly significant fall was evident in the prevalence of IGT among people living adjacent to stores despite a significantly increased BMI. That this decrease in IGT occurred despite an increase in mean BMI to a level associated with a high prevalence (23) and incidence (18) of glucose intolerance in Aboriginal people suggests that successful preventive strategies (including promotion of increased physical activity as in the Malmö study [24]) were implemented. Increased physical activity has also been shown to result in lower triglyceride and total and LDL cholesterol levels and to prevent decreases of HDL cholesterol associated with a low-fat diet (25). However, these effects are generally seen in the context of weight loss or weight maintenance. In the present study, small decreases were evident in total, LDL, and HDL cholesterol levels, and no change was evident in triglyceride levels, but a concurrent increase in BMI was evident. The effects of increased physical activity may have protected this population from a deterioration of lipid profiles that would normally arise from weight gain. We cannot exclude the possibility that seasonal variations in availability of certain bush foods (which affects both dietary quality and physical activity) contributed in part to these effects on glucose tolerance and plasma lipids, although the extreme heat of the summer months before the follow-up survey may, if anything, discourage physical activity. Hence, in this community, an apparently dynamic relationship exists between location, weight gain, the effects of intervention strategies, and possibly seasonal variation on health outcomes.

The strength of traditional culture is likely to be largely responsible for the favorable risk factor profiles in these communities, both in facilitating positive dietary and exercise habits and in and of itself through psychosocial mechanisms (26,27). A positive social environment may confer a considerable advantage for the implementation of lifestyle interventions (22). Promotion of traditional practices such as hunting appears to be an effective means of improving diet and exercise practices in remote communities (22,28), and the maintenance of traditional culture and access to homelands enabled effective use of this message in the present study. In common with the Kahnawake Schools Diabetes Prevention Project (10), the present intervention was characterized by high levels of community control, delivery of appropriate health messages, respect for local culture and values on the part of health professionals, and high participation rates.

In summary, the trends in CHD risk factors, including glucose intolerance, in this group of remote Aboriginal communities compare favorably with other Aboriginal communities and the wider Australian population, although weight gain is excessive and requires further attention. Increases in BMI were particularly marked among people residing adjacent to a store versus those living in more isolated homeland communities. The implementation of intervention strategies aimed at prevention through ongoing health promotion may have contributed to the relatively positive trends in risk factor profiles. Further work is required to identify factors that contributed to the positive effects observed. The lack of change in the prevalence of diabetes and the increased prevalence of overweight are consistent with observations elsewhere and highlight the need for intervention at an early age for the primary prevention of these conditions.

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