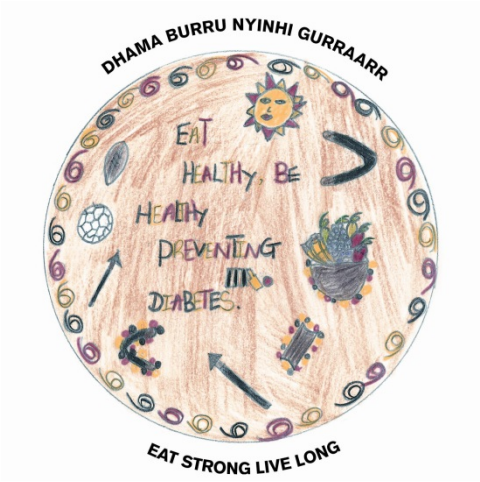
Many Rivers Diabetes Prevention Project

An Aboriginal community governed program of research and health promotion for children

NSW Ministry of Health
Final Report
AUGUST 2014



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Communities
Our thanks to the families, and in particular the children, of the participating communities.

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BACKGROUND

Chronic disease occurs much earlier in life for Aboriginal and Torres Strait Islander peoples than for non-Indigenous Australians, is more prevalent within their communities (1) and is responsible for 70% of the health gap between the two groups (2). Key risk factors are obesity, an unhealthy diet and low physical activity participation. Despite the magnitude of the health burden associated with these risk factors (3), there is little evidence regarding the impact of health promotion strategies which address these risk factors for Aboriginal people, and none for rural NSW Aboriginal children.

This report describes the design, impact and outcomes of the third phase of the Many Rivers Diabetes Prevention Project (MRDPP): a program of research and health promotion for Aboriginal and non-Indigenous rural children. The MRDPP commenced in 2001 at the request of Mr Stephen Blunden, then the CEO of Durri Aboriginal Corporation Medical Services (ACMS) in Kempsey on the Mid North Coast of NSW. Mr Blunden called for a program "to prevent children from growing up to get diabetes", and requested that this program for Aboriginal children be inclusive of non-Indigenous children. The MRDPP addressed the risk factors for type 2 diabetes of low physical activity participation, unhealthy food intake and overweight/obesity; is governed, delivered and supported by the participating Aboriginal communities; and is a partnership between Durri ACMS, Biripi ACMS in Taree , and the University of Newcastle.

In 2011 both the areas participating in the MRDPP were reported as having a higher than the national proportion of Aboriginal people (2.6%), with Kempsey at 11% and the Greater Taree area at 5.4% (4). Both areas have high levels of unemployment with the proportion of the population on the Newstart Allowance of income support for more than 1 year at around 70% in 2011. Both areas are also classified by the Australian Bureau of Statistics (ABS) as areas of high relative socio-economic disadvantage with Kempsey possessing the lowest Socio Economic Indexes for Areas (SEIFA), having a decile of 1 (with decile of 10 being those areas with least relative disadvantage), and Taree a SEIFA decile of 2 (5).

The MRDPP supported the NSW implementation plan **National Partnership Agreement on Closing the Gap in Indigenous Health Outcomes** in the following key areas: A Healthy Transition to Adulthood; Making Indigenous Health Everyone's Business; and Fixing the Gaps and Improving the Patient Journey (6). The MRDPP also aligned with the

National Partnership Agreement on Preventative Health particularly the *Healthy Children's Initiative* (7) in each of its objectives and outputs, and a number of its programs. The MRDPP also addressed the proposed new **Australian Research Priority Area (ARPA)** of *Enhancing Society, Culture and Communities* which includes *Indigenous Australia,* as well as the ARPA of *Promoting and Maintaining Good Health* (8).

There is a lack of published evidence regarding the impact of programs to improve the health of Aboriginal and Torres Strait Islanders in Australia (9). Only three studies (10-12) have examined the impact of such strategies for Aboriginal children, two of which address nutrition. Phase three of the MRDPP is the first Australian study at population level that examines the impact of program to promote healthy food intake and physical activity participation by Aboriginal children and one of a few to do so for rural children in general.

The MRDPP commenced in 2002 and consisted of 3 phases:

1. **PHASE ONE 2001 - 2004**: established the MRDPP and included: extensive community consultation; recruitment of the first Aboriginal project officers; conduct of community focus groups about risk factors for type 2 diabetes; and the commencement of the Aboriginal community governance structure.

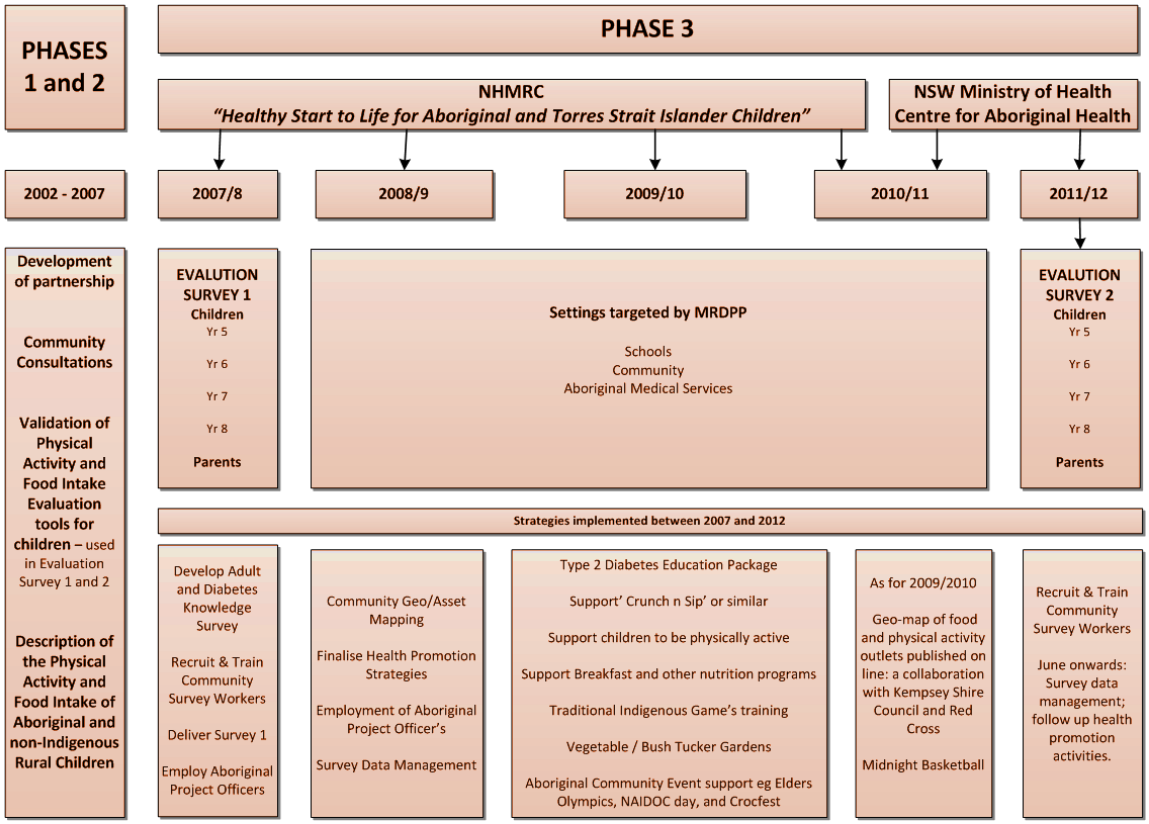
2. **PHASE TWO 2005 – 2006**: validated self-report measures of physical activity and food intake for rural Aboriginal and non-Indigenous children; described the food and nutrient intake and physical activity of those who participated in the validation study; committed to the capacity building of Aboriginal staff; continued to build the Aboriginal community governance structure. Study results are available as publications (13-15)

3. **PHASE THREE 2007 – 2012:** addressed the risk factors for type 2 diabetes of low levels of physical activity participation, unhealthy food intake and overweight/obesity; was governed, delivered and supported by the participating Aboriginal communities in Taree and Kempsey in partnership with the University of Newcastle; and cconsolidated the capacity building strategies and Aboriginal community governance structure of earlier phases. Phase 3 adopted a 'bottom-up,' primarily school-based approach for the

delivery of health promotion to children in the participating regions in school years 5 to 8. The first 5 years of this phase was funded by a National Health and Medical Research Council (NHMRC) *Healthy Start to Life for Aboriginal and Torres Strait Islander Children* grant, and this was extended for 2 year with funding from the NSW Ministry of Health - Centre for Aboriginal Health.

This report addresses the conduct and results of Phase 3 of the MRDPP, referred to in this report as MRDPP-3.

Figure 1: Timeline of the MRDPP.



The MRDPP-3 was delivered during a time when a range of international and national Action Plans were developed in response to the alarming and rapid rise in the prevalence of childhood obesity (16) (17). There was also a commensurate growth in international, national and regional childhood obesity prevention programs and research. In 2002 the NSW government convened a childhood obesity summit and the resulting government

Action Plan (18) was the impetus for the implementation of a wide range of obesity prevention programs in NSW including the Good for Kids (G4K) program in the Hunter

New England Local Health District (HNE LHD). The G4K program and MRDPP were rolled out in two overlapping rural and regional areas of NSW (with Taree the overlapping area), and both programs had similar aims, populations and evaluation methods.

In Australia there is little evidence regarding the impact of strategies (clinical nor health promotion) to address the health of Aboriginal and Torres Strait Islander children (9, 19). The MRDPP-3 aimed to contribute to the lack of evidence regarding strategies to improve the healthy food intake, physical activity participation, diabetes knowledge and body mass index (BMI) of rural Aboriginal children.

MANY RIVERS DIABETES PREVENTION PROJECT – Phase 3 (MRDPP-3)

AIMS:

1. Maintain an Aboriginal community governed research collaboration.
2. Build the capacity of Aboriginal project officers, Aboriginal Medical Services and the community to deliver, engage in and govern research projects in their communities.
3. Describe the determinants of physical activity participation and healthy food intake for Aboriginal children.
4. Develop and deliver a school based Aboriginal community governed health promotion program to Aboriginal and non-Indigenous children in school years 5 to 8 designed to: improve children's knowledge about diabetes; their healthy food intake; and physical activity participation.
5. Evaluate the impact of the health promotion program on children's:
    a. knowledge about diabetes
    b. physical activity levels
    c. fruit and vegetable intake
    d. sugary drink intake
    e. Body Mass Index.

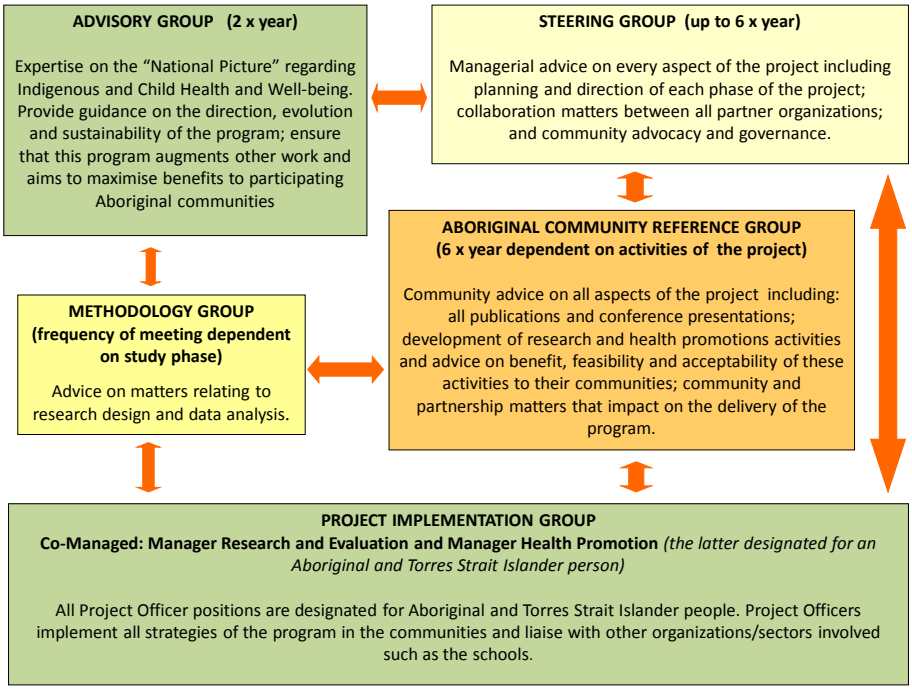
MRDPP-3 OUTCOMES

AIM ONE: Aboriginal community governance of the MRDPP-3.

Australian guidelines and principles on Aboriginal and Torres Strait Islander research include the key concepts of Aboriginal community engagement in and ownership of all phases of the research process involving their communities (20, 21). These concepts are central to Aboriginal community governance of research. Governance is defined by the Centre for Aboriginal Economic Policy Research (CAEPR) (22) as: "the evolving processes, relationships, institutions and structures by which a group of people, community or society organise themselves collectively to achieve the things that matter to them" (p9).

The MRDPP had strong engagement with the participating Aboriginal communities for over a decade and was governed by these communities through Aboriginal Community Reference Groups, a steering committee and an advisory committee (Figure 2). The MRDPP was shortlisted as an as an outstanding example of effective governance in the 2012 Indigenous Governance Awards which are conducted bi-annually by Reconciliation Australia.

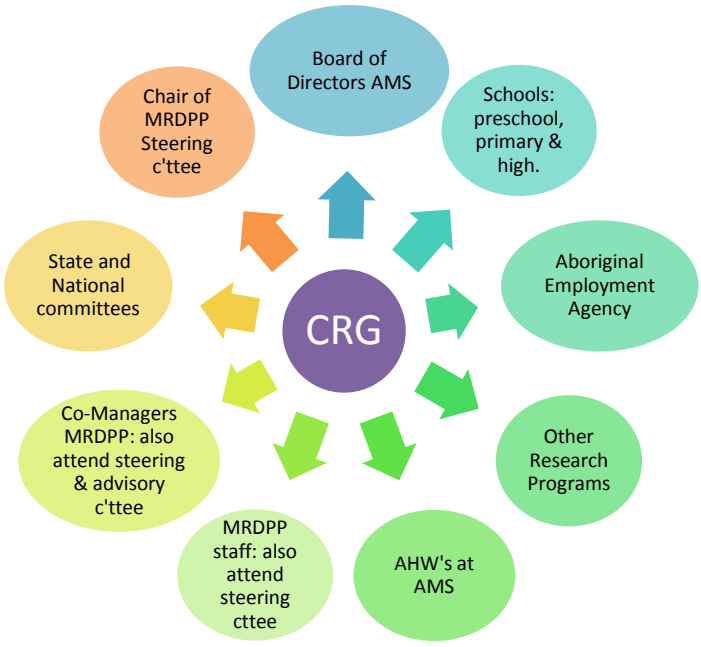
FIGURE 2: MRDPP Aboriginal Community Controlled Governance Structure.



The foundations for the Aboriginal community governance structures and processes of the MRDPP were established in Phases 1 and 2 of the MRDPP and included development work and research activity. These structures and processes enabled Aboriginal governance in every stage of the research. This structure was informed by Community Based Participatory Research methods (23) used elsewhere including in Canadian First Nations communities (24).

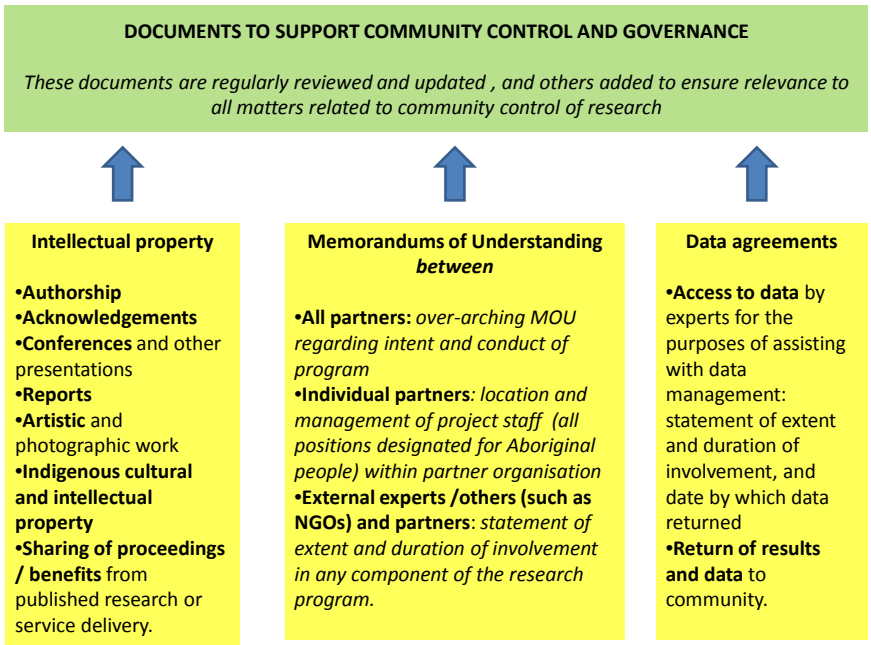
The Aboriginal Community Reference Groups (CRGs) were central to the conduct of the MRDPP, with one Aboriginal project officer likening it to "a tree from whose branches hangs all aspects of the research". The CRGs represented a wide cross section of the community and stake holders (Figure 3), assisted researchers (Aboriginal and non-Indigenous) to navigate the participating community(s) and, if members were unemployed, they were paid to acknowledge their expertise in community knowledge. The location of the CRG meetings was decided by the group, with one community holding their meetings at the AMS and the other at a University Department of Rural Health. Terms of reference were developed to guide the CRGs. Membership of the CRGs changed over time with each member's commitments and availability. Together the CRGs and Aboriginal employees held the project together, managed risks to the study and ensured benefit.

FIGURE 3: Community connectivity of the Community Reference group**.**



Whilst the structures described in Figures 2 and 3 support partnership and community governance, documentation such as that described in Figure 4 are the instruments to support actioning the theory of Aboriginal community governance into the practice of developing and implementing programs of research.

FIGURE 4: Documents to support Aboriginal community control and governance.



AIM TWO: Build the research capacity of Aboriginal project officers, the participating Aboriginal Medical Services and the community.

METHODS

Capacity building occurred at 3 levels: individual, organisational and community. The ways in which this occurred are described in Table 1 below. It is the experience of the MRDPP-3 that research projects must budget for capacity building (which is one of the NHRMC's criteria for research with Aboriginal communities' (25)) and allow sufficient time for capacity building to occur. Both of these factors will impact on the delivery of the research and it is important to plan for these when designing the research and applying for funding. Community members repeatedly told the MRDPP-3 research team that capacity building was the 'legacy' long after the project was completed.

The MRDPP team consisted of 4 full-time staff: 2 Aboriginal project officers (APOs), 1 Senior APO also Manager of Health Promotion and a Manger Research and Evaluation.

The latter 2 positions co-managed the project. Over 60 Aboriginal community members were employed on a casual basis between 2007 and 2012.

RESULTS

Three full-time Aboriginal Project Officers (APOs) worked on the MRDPP-3, and each was awarded their Diploma of Community Nutrition. In addition, one APO was awarded a Bachelor of Applied Science (Community Nutrition), another awarded a Graduate Certificate of Diabetes Education, and all attained a range of complementary certificates. The APOs were the only qualified Aboriginal Community Nutritionists in NSW for the duration of the MRDPP-3, with few existing nationally. In addition to delivering the MRDPP, the Project Officers (located within the partner Aboriginal Medical Services) sat on National and State committees including the Aboriginal Education Support Group (AECG) and Food Standards Australia and New Zealand (FSANZ); made annual conference presentations; and conducted seminars at the request of the NSW AHMRC and other groups. The MRDPP has also employed and trained over 60 casual Aboriginal survey workers on the conduct of the research, including the population-wide surveys. Collectively, these capacity building strategies 'infused' knowledge about risk factors for ill health into the participating communities and created a pathway to future employment. Support for such strategies was enabled through prioritising their implementation and resource provision by all partners to the MRDPP-3 (Table 1).

Seven domains of community capacity building have been identified (26):

1. *Learning opportunities and skills development*: Aboriginal Project Officers (APO) received paid study and other leave from project delivery to support completion of diplomas/degrees.
2. *Resource mobilization*: financial support (University and ACMS) to support APOs to attend conferences, become active members of a variety of state and national committees and be located within the ACMSs.
3. *Partnership/linkages/networking*: the MRDPP-3 formed a large number of partnerships for example with the ACMSs, Australian Red Cross, NSW Department of Education.
4. *Leadership:* APOs were mentored to occupy leadership positions locally and at state/national level, and to present at national and international conferences.

5. *Participatory decision-making*: Aboriginal community participation through a number of mechanisms including the CRGs (see Aim One).
6. *Assets-based approach*: The skills and expertise of Aboriginal community members were recognised in their participation in delivery and governance of MRDPP-3.
7. *Sense of community*: CRGs reflected the sense of place and community; guided the research to ensure it addressed diverse community needs and resulted in benefit for the community.
8. *Communication*: CRGs provided an environment where open communication was supported without censure, and the governance structure ensured that the researchers and the participating communities were in constant dialogue.
9. *Development Pathway*: The structure of the MRDPP-3 provided a pathway for community members to acquire work related skills and knowledge through their employment on the project, and supported staff to attain further qualifications. These strategies contributed to the community's social capital and health literacy.

TABLE 1: Capacity Building of the MRDPP: Individual, Organisational and Community.

Level	Capacity Building activities
Individual	All Aboriginal Project Officers (APO) were recruited from local communities and supported to: 1. Complete further education (diplomas/degrees/short courses), and paid whilst doing so. 2. Present at conferences at least annually. 3. Engage in all aspects of the research including data management. 4. Fulfill leadership positions in their communities eg Chair of committees (around 20). Increased skills acquired by APOs, CRG members and casual staff improved their skills/knowledge and opportunities for employment elsewhere once the research project finishes. This contributed to the social capital of the participating communities.
Organisational	Through locating APOs in the Aboriginal Medical Services (AMS) or other community organisations, and working with CRGs: 1. The research was embedded in the AMS organisational structure and de-stigmatised. 2. The benefits were mutual: a. The research was linked to the local community and the capacity of the research to address community needs was enhanced. b . Organisations and community gradually became familiar with the conduct of research and were exposed to the knowledge brought by the research team. 3. Aboriginal workforce across a number of organisations mentored by MRDPP Aboriginal research staff. 4. Community organisations were able to influence the research agenda.
Community	1. Around 60 local Aboriginal people were employed and trained on a casual basis to assist in the implementation of the study and to advise on all aspects of the project. This also provided opportunities for the study team to 'infuse' knowledge into the community via the casual staff and their community connections. 2. Access to information and skill through the 'pro bono' work of local PO when they undertake activities outside that of their job description (up to 10% of time/week). 3. POs as role models for ALL younger people eg delivery of Diabetes Education Package to all children at schools. 4. Strategies developed through the research have: a. continued on as part of other programs (eg. Diabetes Education Package). b. led to further research activity (eg. "Kids Kidneys" project). c. led to new services being introduced to the communities (eg School Liason worker at the AMS.).

AIM THREE: Understand the determinants of physical activity participation and healthy food intake for Aboriginal children.

This component of the MRDPP- 3 included 2 sections:

1. *Community Focus Groups: t*hese aimed to identify barriers to healthy food intake and physical activity participation among Aboriginal and Torres Strait Islander and non-indigenous rural children, and to guide the design and implementation of the MRDPP-3 Health Promotion strategies.
2. *Geo-Mapping* of food and physical activity outlets: This project aimed to describe the type of outlets and their location particularly in proximity to transport and to schools. The resulting maps were designed to:
    a. Inform and stimulate the Community Focus Group discussions.
    b. Inform organisations about the environmental influences on healthy food access and physical activity participation.
    c. Support the community and health workers in advocacy and planning around healthy food and physical activity services in the community.

METHODS

Design

1. *Community Focus Groups:* Aboriginal and non-Indigenous community members from two regional and one urban area on the north coast of NSW were invited to participate in the study in 2007. The study was approved by the Hunter/Hunter New England Area Health Service, the Mid North/North Coast Area Health Service, the University of Newcastle, the NSW Department of Education and Training, and the Aboriginal Health and Medical Research Council of NSW.

2. *Geo-Mapping*: Food and physical activity outlets in the participating communities were identified by Aboriginal Project Officers according to a protocol developed in consultation with geo-mapping, food security and physical activity determinant experts.

Participants in Community Focus Groups.

Community Focus Group participants were drawn from a range of Indigenous and non-Indigenous organisations, as well as from members of the Taree, Kempsey and Lower Hunter communities, using a snowball technique. The Lower Hunter communities were included as a result of their involvement in Phase 2 of the MRDPP. Individuals expressing

interest in participation were sent invitation letters, along with information about the focus groups, and consent forms. Follow-up telephone calls to participants were made two weeks before focus groups were held. A total of 128 people participated (55% Aboriginal people) from three regional communities: Taree (n= 35); Kempsey (n=59); and Lower Hunter (n=34).

PROCEDURE

1. *Community Focus Groups:* To ensure consistency among team members, training was conducted in administering focus groups. A focus group interview schedule was prepared as a basis for questions and prompts and to aid uniformity for the community focus groups. Focus groups were facilitated by University of Newcastle staff and included APOs from the participating communities. All community focus group discussions were tape-recorded and hand-written notes were made by a team member. At the commencement of each focus group discussion, the focus group moderator showed a geo-map of the area displaying all food and physical activity services.

2. *Geo-Mapping:* Food and physical activity outlets were recorded manually in the field on a purpose-designed hard-copy record sheet according to their category and location. Categories had been previously defined in consultation with experts in geo-mapping, food security and physical activity determinants, and were based on food groups according to the Australian Guidelines to Health Eating and types of physical activity conducted at the location. Geo-mapping software was then used to code the outlets and locate them on a map of the participating regions. Socio Economic Indicator data was overlaid on the maps along with transport routes, schools and emergency food providers. Finally as part of a collaboration between the MRDPP, Kempsey Shire Council and Red Cross Australia. The data from one region was placed on the Shire Council website for public access.

Analysis of Community Focus Groups.

An external transcriber produced verbatim transcripts of all community focus group recordings. Process and content analysis of the transcripts was then conducted by a team member. After reading each transcript, the transcriber made a brief summary of the main points discussed and the level of consensus among the focus group for each topic.

For quality control, a qualitative methodology specialist and a team member independently analysed the focus group transcripts and then compared differences. There were no important differences between the two analyses.

Hand-written notes from the community focus groups were also compiled to produce discussion summaries. Summaries were sent to all participants, along with feedback forms, to ensure accurate content of focus group discussions and allow further comments.

RESULTS

Barriers to healthy eating and physical activity participation

Barriers to Healthy Eating.

Environmental barriers reported included: lack of availability and high cost of fresh, healthy food; lack of accessibility of healthy food due to distance from residential areas to large shops; lack of private and public transport; ready accessibility of low-cost unhealthy food; and lack of affordability due to the high cost of healthy food, especially meat, fruit and vegetables.

Individual barriers reported included: low incomes; lack of knowledge about what constitutes healthy and unhealthy food; lack of appropriate parental role modelling of healthy eating habits; convenience of "junk" food; and unhealthy food advertising targeting children.

Barriers to Physical Activity Participation.

Environmental barrier reported included: lack of availability of sporting facilities; distance of sporting venues from residential areas; and the high cost of participating in organised sport.

Individual barriers reported included: lack of private transport; poor public transport; lack of parental role-modelling; and perceptions that play areas were unsafe for children.

'Additional Barriers' reported by the Aboriginal community participants that related to both healthy eating and participation in physical activity included: experiences of racism in the general community; poor community cohesion; 'welfare dependency'; and low self-esteem. These factors were seen to impact across all the barriers listed above.

The barriers identified in this study were similar to those identified in other studies nationally and internationally (27-29).These findings can be used to design effective, targeted interventions aimed at improving the diets and physical activity levels of Aboriginal and Torres Strait Islander and non-indigenous children.

Strategies for healthy eating and physical activity participation

Programs/strategies for improving diet and physical activity habits among Aboriginal and Torres Strait Islander and non-indigenous children living in regional areas must be designed to overcome barriers listed above.

Strategies to encourage healthy food intake and participation in physical activity included: engaging Aboriginal people in local programs to address these factors; assisting parents to develop the self-confidence, skills and knowledge to support healthy behaviours in their children; and increasing the availability and accessibility of healthy food and physical activity facilities in regional areas. State and local government agencies need to ensure equitable access to sufficient, safe, well-maintained facilities in all areas including those with a high proportion of disadvantaged Aboriginal and Torres Strait Islander people.

Geo-mapping

The geo-mapping project resulted in materials and information used to promote discussion within the community focus groups.

In 2010 the collaboration between the MRDPP, Kempsey Shire Council and Red Cross Australian resulted in information on food outlets (including emergency food services), and physical activity services, along with transport routes, being made available on the Kempsey Shire Council web site.
http://www.kempsey.nsw.gov.au/healthy/foodmaps.html.

AIM FOUR: MRDPP-3 Health Promotion Strategies

MRDPP-3 Health Promotion Strategies were designed in collaboration with the participating communities; addressed children's diabetes knowledge, healthy food intake, and physical activity participation; were largely delivered in schools; and differed in levels of intensity (frequency, reach and duration).

Development work for the Health Promotion Strategies delivered by the MRDPP-3 between June 2009 and June 2011 occurred during 2008/9. The processes to undertake this work were:

1. Continuation and further development of the Aboriginal community governance structure following the Community Based Participatory Research model.
2. Aboriginal community guidance in the planning of health promotion strategies for their communities.
3. Continuation of the capacity building strategies for staff, community and organisations.
4. Recruitment of 2 full-time APOs, one located in each participating community, and 1 Senior APO who was Manager of the Health Promotion Strategies and co-managed the MRDPP-3 along with the Manager for Research and Evaluation.
5. Literature search to identify evidence to support health promotion strategies for young people in general populations and in Australian Aboriginal communities in particular.
6. Consultation with experts in the fields of nutrition, physical activity and obesity.
7. Focus Groups to identify the barriers to and facilitators of healthy food intake and physical activity where undertaken in the participating communities (see AIM Three).
8. Evidence and information from previous phases of the MRDPP.
9. Examination of the feasibility of possible strategies for delivery in the participating communities within the constraints of the available funds and staff.
10. A scan of the environment for similar programs being implemented concurrently. This scan identified the G4K program (see Background) which was being conducted in a regional area which intersected with the MRDPP-3.

The MRDPP-3 health promotion strategies are listed below and details are provided in Tables 2 and 3.

1. School based Nutrition strategies:

a. Delivery of a Diabetes Education Package to primary and secondary schools which included a particular focus on encouraging less sugary drink consumption. This package was developed by one of the participating Aboriginal Medical Services, Durri ACMS in Kempsey
b. Supporting “Crunch ‘n Sip” (fruit and water intakes) and similar in primary schools.

c. Supporting breakfast programs at schools, and other nutrition programs as requested.

d. Supporting primary schools to establish vegetable and 'bush food' gardens.

2. School and Club based Physical Activity strategies:

a. Supporting "Get Skilled Get Active Go" (being more active) and similar in primary schools.

b. Traditional Indigenous Games – facilitating training of community members and students.

c. Midnight Basketball at PCYC for young Aboriginal people – Taree only.

3. Community level strategies addressing both Nutrition and Physical Activity:

a. Health Promotion information at annual Aboriginal community events such as the "NSW State Football Knockout", "Crocfest", "Elders Olympics" and "Young women's camps". MRDPP-3 promotions at these events particularly focussed on increasing fruit and water intakes.

b. Shire council geo mapping project – Kempsey only.

Strategies were delivered between June 2009 and June 2011 at varying intensities (i.e. frequency, reach and duration of delivery, Tables 2 and 3). Nutrition strategies were delivered at a higher intensity than other strategies, with physical activity strategies and community level strategies delivered intermittently or occasionally.

TABLE 2: Timeline of the Health Promotion Strategies MRDPP June 2009 – June 2011.

Health Promotion Strategies		**2009**	**2010**	**2011**
Nutrition *school based*	Diabetes Education Package	staff recruit and train: strategies finalised.		Deliver follow up survey into early 2012
	Supporting Fruit and Water intake			
	Breakfast and other Nutrition programs			
	Vegetable /Bush Food Gardens			
Physical Activity	Supporting Physical Activity			
	Traditional Indigenous Games			
	Midnight Basketball (PCYC)			
Community Level	'one off' community events.			
	GeoMapping project			

	School based Food Strategies		*Physical Activity Strategies*		*Community Stratgies*
	Continuous delivery all sites		*Intermittant Delivery*		*Monitored /supported /occasional*

TABLE 3: MRDPP-3 Health Promotion strategies delivered between June 2009 - June 2011.

Health Promotion/ Education Activities	Participants		INTENSITY			Acceptability	Barriers
	Individuals	Partners	Frequency	Reach	Duration		
Diabetes Education Package	2302 Primary and High school children in Yrs 5-8.	NSW Department of Education	1 to 2 sessions each term per class	All children in yrs 5 to 8 in all 26 primary and 5 Kempsey High schools. Other classes as requested.	2 hours per session. Delivered over 18 months.	High: Schools requesting more presentations on a regular basis, and delivery has continued in Kempsey now by Durri ACMS.	None from the school. Limited resources in Taree to deliver and Kempsey team members travel to assist
Crunch'n Sip (C'nS) and similar (ie fruit break or unregistered Crunch'n Sip). *State wide program primary schoolsonly.*	1102 children in Yrs 5 / 6.	NSW Department of Education	All schools over first year 6 months to assess need and deliver first response. As needed over following 18 months.	All children in yrs 5/6 in all primary schools. Other classes as requested.	2 years.	High for 'similar' .	Formal registration is a barrier to C'nS, and schools view fruit break as similar; 4 schools with high Aboriginal enrollment needed program augmented with fruit. Cost of fruit.
Breakfast Program Support and other nutrition.	Organisational level support.	NSW Department of Education	All schools over first year 6 months to assess need and deliver first response. As needed over following 18 months primarily in seeking funding.	All primary and high schools.	2 years.	A variety breakfast programs exist both formal and informal. Some sell breakfast or make time for breakfast. Regular requests for delivery of talks/information at school programs.	Funding is a big barrier to establishment of breakfast programs, which usually rely on donations. Some schools report a stigma attached to breakfast programs attendees. The school management of the program purpose and image is critical to its acceptability.
Gardens (Fruit and vegetable and/or Bush Tucker)	600 primary school children in Yrs 5 and 6 had regular involvement as part of curriculum	NSW Department of Education Red Cross Australia	Varied among schools from weekly over a term to support for grant applications at organisational level.	All children in yrs 5 to 8 in all schools. Other classes as requested.	18 months.	High	Funding
Get Skilled, Get Active, Go and similar. *State Wide Program Primary Schools only.*	Primarily organisational level support.	NSW Department of Education	As requested over 18 months.	All children in yrs 5/6 in all 26 primary schools. Other classes as requested.	18 months.	High for 'similar'.	Low formal registration rates among schools and many schools satisfied with their curriculum activities. Lack of funding for physical activity equipment and employment of Aboriginal workers.
Traditional Indigenous Games (TIG) training and competition: *MRDPP staff co-ordinated.*	Training: *74 trained .* TIG competition at schools: *120 participants.*	NSWDepartment of Education. Community Organisations. Dept of Sport and Recreation.	One-off' occurence	Training those who deliver TIGs at any school. Community /school /event support.	1 year	High. Schools and communities request further training.	Only one Aboriginal project officer with Department of Sport and Recreation to advise and support. Use of trainee skills is often limited to the special 'one-off'occasions and not consistant in schools.
Midnight Basketball. *NOTE: Taree only.*	60 young people played one night per week over 2 school terms.	Police Citizens Youth Club (PCYC).	1 x week (Friday evenings).	PCYC participants	4 hours /one night per week. Delivered over 6 months	High level engagment.	None
One Off' community events / camps / student days.	30 events.	Local and State government organisations and all schools.	Mostly 'One Off'	Varied from school camp to community event	2 years.	High - continual and repeated requests.	N/A
Geo-map of food and physical activity locations. *Web page 'live' in Kemsepy only: http://www.kempsey/nsw.gov.au/healthy/food maps.html*	N/A	Kempsey Shire Councils. Red Cross Australia	N/A	Both Participating Communities	1 year	High level of interest: Kempsey Shire Council provided Geomapping technical support; Red Cross Collaborated.	None in Kempsey. Taree staff member was not able to follow this through.

AIM FIVE: Impact of the MRDPP-3 health promotion strategies on children's diabetes knowledge, food intake, physical activity participation, and Body Mass Index.

METHODS

Study Design and Setting

Change in children's diabetes knowledge, food intake, physical activity levels and Body Mass Index was evaluated by conducting a repeat cross-sectional pre-post design study.

Over a similar time frame to that of the MRDPP-3, the NSW Ministry of Health (MoH) conducted 2 state wide surveys of children's nutrition, physical activity and overweight/obesity (2004 and 2010) the NSW Schools Physical Activity and Nutrition Survey (SPANS). These surveys were conducted as part of the NSW MoH monitoring of children's nutrition and physical activity. The MRDPP-3 and SPANS used similar self-report surveys as their measurement tools, and a comparison of results between the studies has been included here, thus enabling the MRDPP-3 findings to be examined in the context of state-level prevalence and trends.

The MRDPP-3 received ethics approval from the Hunter New England Health Area Human Research Ethics Committee (HREC), the North Coast Health Area HREC, the Aboriginal Health and Medical Council of NSW Ethics Committee, the University of Newcastle HREC and the NSW Department of Education and Training.

Measures

Anthropometric measurements (height, weight and waist circumference) were collected and self-report surveys of physical activity, food habits and diabetes knowledge were administered in the summer of 2007/8 and repeated in the summer of 2011/12. Demographic information on date of birth, gender, Indigenous status and year at school was also collected. The survey tools used to measure physical activity (Many Rivers Physical Activity Recall Questionnaire (MRPARQ)) and food habits (Many Rivers Short Food Frequency Questionnaire (MRSFFQ)) were validated in this population in MRDPP Phase 2. Parents of those participating were also asked to complete a survey on their diabetes knowledge, food habits and physical activity. Questions on family food and physical activity behaviours, as well as intent to change and determinants of these behaviours were also included.

The findings from the validation study in MRDPP Phase 2 (see earlier) have informed the interpretation of results in the discussion section of this report. The MRSFFQ includes measures of recent, 'usual', daily, or weekly food intake, reflects current recommendations regarding food intake, and includes some foods identified as important by Aboriginal and non-Indigenous rural child and parent focus groups conducted in Phase 1 with participants of the same age and from the same schools as those in the present study. Most of the short questions in this SFFQ are able to discriminate between different categories of food intake and provide information on relative intake within both Aboriginal and Torres Strait Islander and non-Indigenous populations of rural children. Many questions included in the MRSFFQ were also included in SPANS, with some differences in response categories. Children tend to over report consumption levels of healthy foods and under report consumption levels of unhealthy foods.

The MRPARQ is a variant of the Adolescent Physical Activity Recall Questionnaire (APARQ) which has been used as a New South Wales physical activity monitoring tool since 1994. The MRPARQ demonstrates modest correlation with objective measures of physical activity as for similar self-report measures internationally (14). Given culturally appropriate support, Aboriginal and Torres Strait Islander children provide self-report physical activity information that is at least as valid as non-Indigenous children.

The MRSFFQ and the MRPARQ can both be used to monitor and/or evaluate population-wide health programmes such as the MRDPP-3.

As there was no diabetes knowledge survey available for children nationally nor internationally at the time the surveys were conducted. The MRDPP developed its own survey in consultation with qualitative research and clinical experts including paediatric and adult Endocrinologists, as well as diabetes educators.

Participants

The target group in both Survey 1 and Survey 2 was rural north coast NSW Aboriginal, and non-Indigenous children in school years 5, 6, 7 and 8. Participants were recruited through all primary and high schools, including independent schools.

Survey One – 2007/8

Schools: All 38 schools (28 NSW Department of Education and Training and 10 independent) in the regional towns.

Children: a total of 1620 children elected to participate in the first survey in the summer of 2007/8. All children in years 5 to 8 were invited to participate. The response rate for those enrolled in school years 5 to 8 overall was 43% (61% of children were from Department of Education primary schools). A total of 251 Aboriginal or Torres Strait Islander children participated (55% of those enrolled) and 701 (43%) of all participants were boys. The participation rate for non-Indigenous children was 41%.

Survey Two – 2011/12
Schools: 36 of the 38 schools who took part in the previous survey elected to participate again, with 1 school no longer in existence and another with no children consenting.
Children: A total of 1035 children participated, an overall response rate for those enrolled in school years 5 to 8 of 29% (44% of children from Department of Education primary schools). A total of 240 Aboriginal or Torres Strait Islander children participated (44% of those enrolled) and 471 (46%) of all participants were boys. The participation rate for non-Indigenous children was 26%.

Aboriginal Project Officers from the participating communities managed the information and consent process within each region for all children during the delivery of Survey One and Two.

Survey Administration
To complete the Survey children were seated in a large group, given an introduction to the questionnaire, particularly regarding estimating the amount and frequency of foods, and members of the research team (in a ratio of at least one assistant to five children) were available to assist participants. Primary school children were seated along with a survey worker in small groups of approximately 5 to assist their completion of the MRPARQ (15).

The team administering the surveys to all children were predominately Aboriginal people from the participating communities.

Statistical Methods
The physical activity data cleaning and management followed the methods described by SPANS 2004 (30) and for the MRAPARQ (15) each child's mean daily MVPA was calculated in both surveys.

Generalized Estimating Equations (GEEs) were used to examine the differences between baseline and follow-up of the Many Rivers Diabetes Prevention Project in the following outcomes all by school year, gender and Indigenous status:

a) Proportions within each Body Mass Index (BMI) category (31).

b) Proportions who have met Australian physical activity guidelines.

c) Intake of key food groups including proportions meeting Australian guidelines for fruit and vegetable intake.

d) Diabetes knowledge.

GEEs were used so that the covariance pattern of the measurements for each subject within each school could be determined and taken account of to correctly estimate the standard errors. All models used an exchangeable working correlation matrix, and adjusted p-values derived from the Wald test was given to examine the strength of the association between each of the listed outcomes and time-point (baseline and follow-up).

Proportions of children within each BMI category, proportions who have met physical activity guidelines, and consumption levels of key food groups were compared between the second MRDPP-3 survey from 2011/12 and the SPANS 2010 survey. As slightly different SFFQ response categories were used by the MRDPP-3 and SPANS for the same short questions, categories were collapsed into larger similar categories for comparison purposes. SPANS 2004 was not included in the food intake analysis as their SFFQ response categories and questions differed from the MRSFFQ in some key questions and comparison was not feasible. P-values resulting from chi-square tests were used to examine differences in proportions for Year 6 and Year 8 groups separately. We also report change in SPANS results between 2004 and 2010 for physical activity and BMI category and change in MRDPP results over a similar timeframe (2007 to 2011/12). Data from MRDPP is presented side by side and compared with proportions seen in the SPANS survey. The physical activity data management method described by SPANS in 2010 (32)

calculated median MVPA and not mean MVPA as in 2004. Where a comparison of the changes in proportions of the MRDPP-3 and SPANS cohorts who report meeting physical activity guidelines is presented, results need to be interpreted in the context of the differing methods of data analysis.

RESULTS

Change in Diabetes Knowledge

Impact

No statistically significant difference was found in the proportions of either Aboriginal (p=0.87) and non-Indigenous (p=0.43) children correctly answering 90% of questions between the 2 surveys (refer to TABLE 4 below).

When examined by gender, a higher proportion (p=0.11) of Aboriginal boys compared with non-Indigenous counterparts correctly answered 90% of the diabetes knowledge questions in 2011/12 (29%) compared to 2007/8 (17%) a 70 % improvement.

TABLE 4: Proportion of children who correctly answered 90% of the diabetes knowledge questions, 2007/8 and 2011/12.

Aboriginal			non-Indigenous		
2007/8 *(n=292)*	2011/12 *(n=226)*	p-value	2007/8 *(n=1311)*	2011/12 *(n=740)*	p-value
All					
23 (n=57)	23 (n=56)	0.87	17 (n=224)	16 (n=107)	0.43
Boys					
17 (n=18)	29 (n=32)	0.11	17 (n=99)	17 (n=54)	0.88
Girls					
27 (n=39)	18 (n=24)	0.29	17 (n=125)	14 (n=53)	0.33

Both Aboriginal and non-Indigenous girls reported a non-significant decrease in the proportion correctly answering 90% of the diabetes knowledge questions (p=0.29 and p=0.33 respectively) between surveys.

Prevalence

A greater proportion of Aboriginal children (23%) than non-Indigenous counterparts (17%) were able to correctly answer 90% of the questions in both survey times.

Change in Consumption Of Foods And Drinks

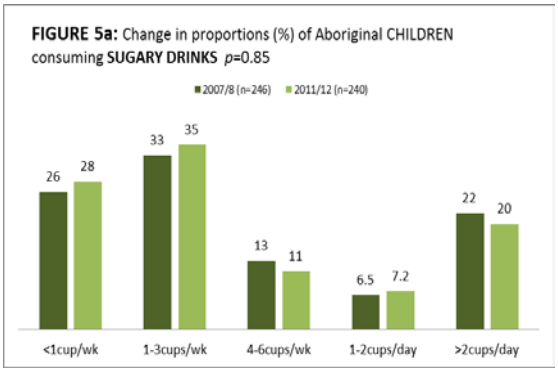
The results from the validity study undertaken in Phase 2 of the MRDPP (7, 14) found that the MRSFFQ (similar to other SFFQs) can discriminate between different categories of food intake and provide information on relative intake (not actual) within a given population. Reporting of results therefore describes changes in proportions across the response categories for each short question between surveys, and reporting against guidelines or cut points should be interpreted as an indicator only (14).

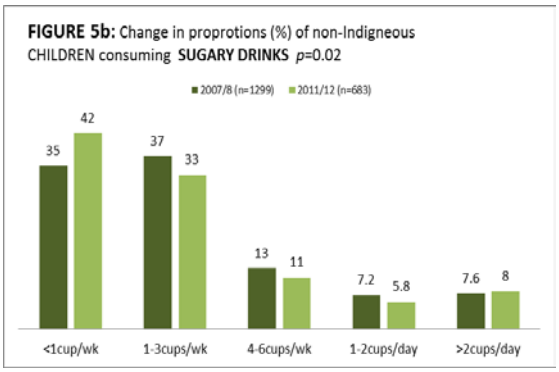
The food and drink intake results presented here are those whose intake levels are acknowledged to be of clinical relevance for health. Change in these 'key' food and drink intakes is presented by Indigenous status and then by gender for Aboriginal children only. Prevalence of key food and drink intake is presented by Indigenous status, and results from 2011/12 are compared with the 2010 SPANS data in school year group.

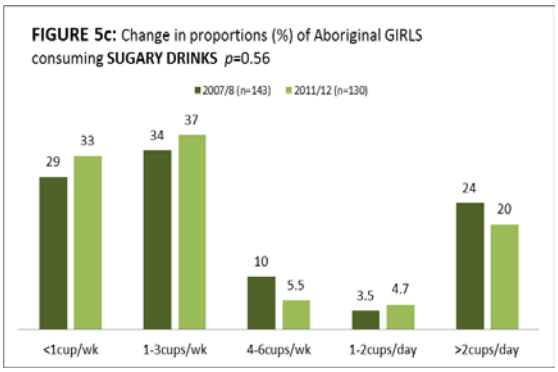
Change in Consumption Of Sugary Drinks, Fruit Juice And Water

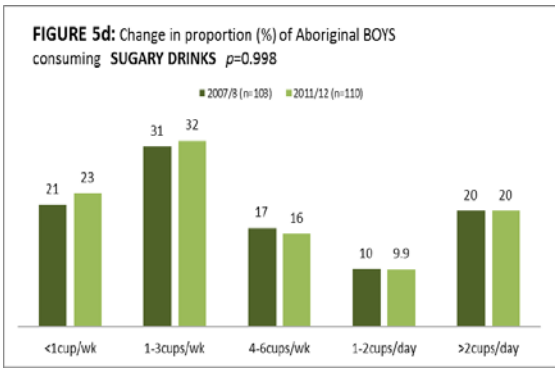
Sugary Drinks

Significantly more non-Indigenous children (p=0.02) reported consuming less sugary drinks in 2011/12 compared to 2007/8; however, Aboriginal children's reported intake remained stable (p=0.85) over this time (Figures 5a and 5b), regardless of gender (Figures 5c and 5d).



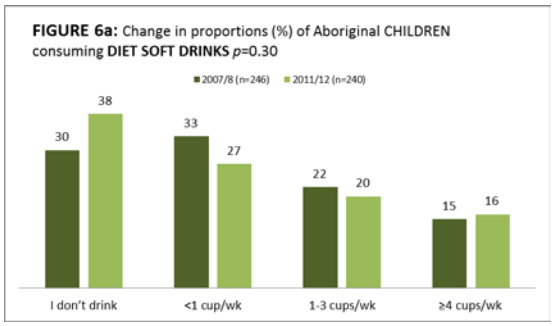


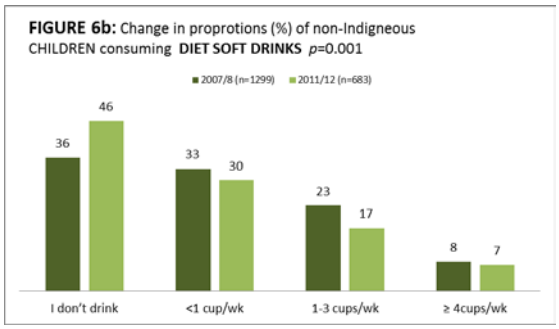




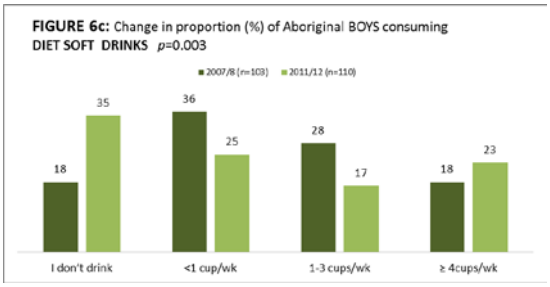
Diet Soft Drink

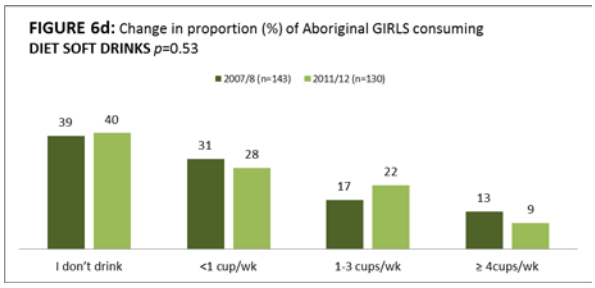
Significantly more non-Indigenous children reporting consuming less diet soft drink (p=0.001) in 2011/12 compared to 2007/8; however, Aboriginal children's reported intake remained stable (p=0.30) (Figures 6a and 6b).





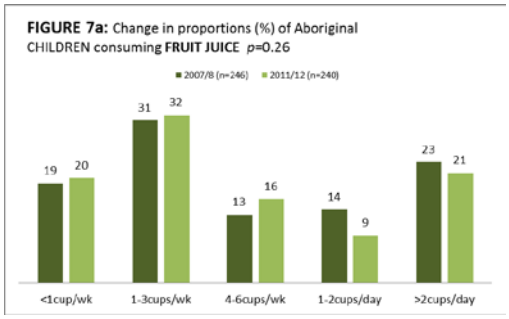
When Aboriginal children's results are examined by gender (Figures 6c and 6d) the change between surveys is significant for Aboriginal boys (p=0.0001) with more reporting consuming less diet soft drinks in 2011/12 compared to 2007/8. Whilst the dominant change in consumption pattern is to more boys consuming less diet soft drinks, the proportion of 'high end' consumers (≥ 4cups/week) also increased somewhat over this time.

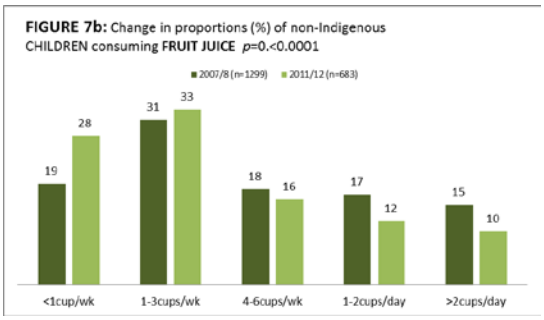


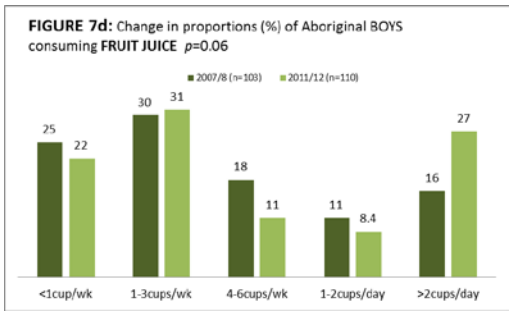


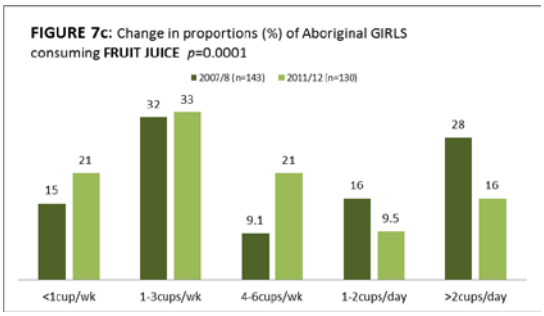
Fruit Juice

Significantly more non-Indigenous children reported consuming less fruit juice (*p*=<0.001) in 2011/12 compared to 2007/8; however, Aboriginal children's reported intake remained stable (*p*=0.26) (Figures 7a and 7b) .









When Aboriginal children's results are examined by gender (Figures 7c and 7d) the change between surveys is significant for girls, with more reporting consuming less fruit juice (p=0.0001) in 2011/12 compared to 2007/8, and non-significant for boys (p=0.06), with more reporting consuming more fruit juice in 2011/12 compared to 2007/8.

Water

Intakes of water remained stable for both Aboriginal and non-Indigenous children between surveys.

Comparison of diet soft drinks, sugary drinks, fruit juice and water intake between MRDPP-3 and SPANS

A comparison between the MRDPP-3 cohort and the SPANS state wide population reported intakes of key drinks is shown below in TABLE 5. Response categories listed are those that were comparable between studies.

A significantly higher proportion of children in the MRDPP-3 compared with the SPANS reported consuming ≥2 cups/day of diet drinks (only school years 5/6), sugary drinks, and fruit juice, and > 1 cup/day of water.

The difference for all but water is largely contributed to by the higher proportion of Aboriginal children reporting higher intakes (see Figures 5a and 5b, 6a and 6b and 7a and 7b). The higher difference in reported water intake by the MRDPP cohort compared to SPANS is consistent regardless of Indigenous status.

TABLE 5: Reported (%) consumption of diet drinks, sugary drinks a, fruit juice and water, in SPANS (2010) and MRDPP (2011/12).

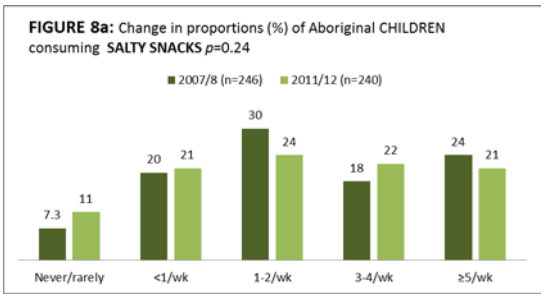
Food	Response Category (cups per day)	SPANS Yr 6 *(n=1279)*	MRDPP Yr 5/6 *(n=670)*	p-value [b]	SPANS Yr 8 *(n=1628)*	MRDPP Yr 7/8 *(n=327)*	p-value [b]
diet drinks	< 2 cups/day	98.9	97.2	0.0055	98.6	98.2	0.61
	≥ 2 cups/day	1.1	2.8		1.5	1.8	
sugary drinks	< 2 cups/day	97.7	89.0	<.0001	96.7	89.3	<.0001
	≥ 2 cups/day	2.3	11.0		3.3	10.7	
fruit juice	< 2 cups/day	95.1	86.0	<.0001	92.7	87.5	0.0017
	≥ 2 cups/day	4.9	14.0		7.3	12.5	
water	≤ 1 cup/ day	49.1	22.3	<.0001	39.8	23.5	<.0001
	> 1 cup/ day	50.9	77.7		60.3	76.5	

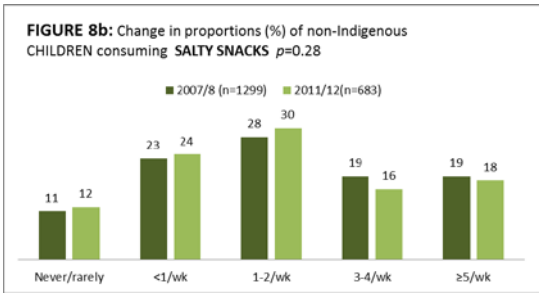
[a] the 'sugary drinks' category includes soft drinks, cordials and sports drinks; [b] p-value represents the significance of the difference in proportion of children in each response category in the SFFQ.

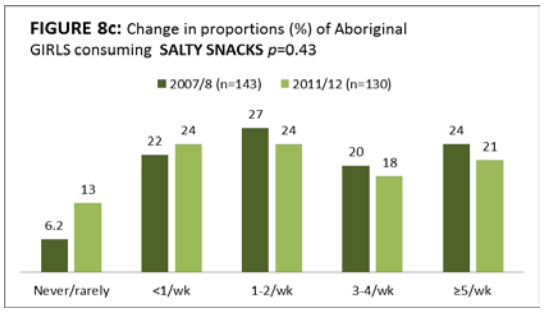
Change In Consumption Of Energy-Dense Nutrient-Poor (EDNP) Foods

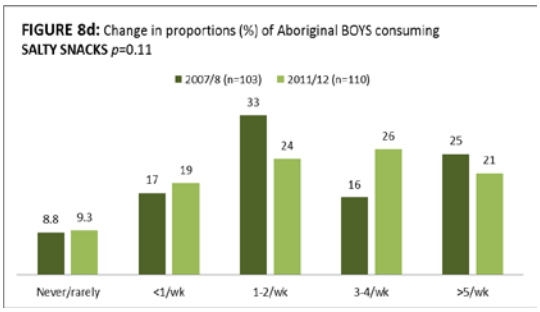
Potato Crisps and other Salty Snacks

Intakes of potato crisps and other salty snacks remained stable between Survey 1 and Survey 2 for both Aboriginal (p=0.65) and non-Indigenous children (p=0.28) regardless of gender (see Figures 8a to 8d)



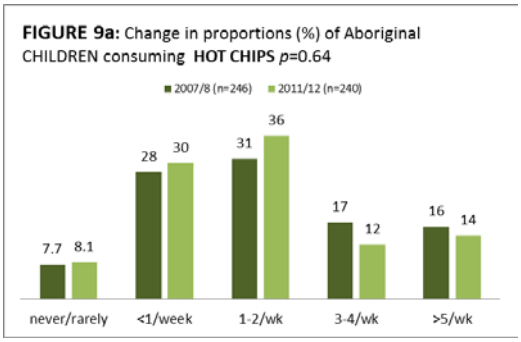


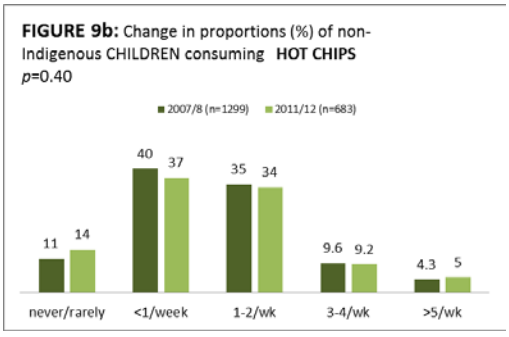


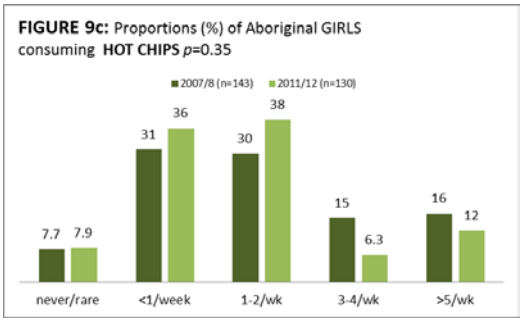


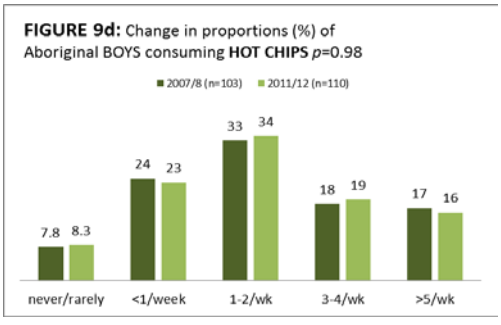
Hot Chips

Intakes of hot chips remained stable between Survey 1 and Survey 2 for both Aboriginal (p=0.65) and non-Indigenous children (p=0.40) regardless of gender (see Figures 8a to 9d).



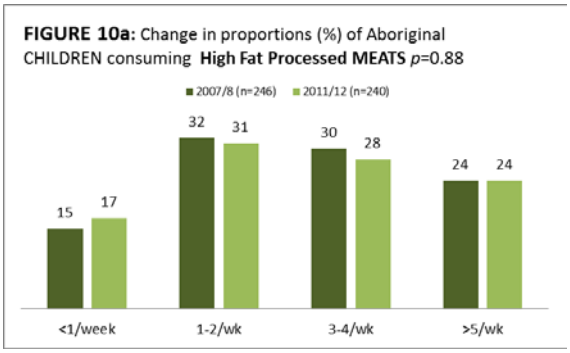


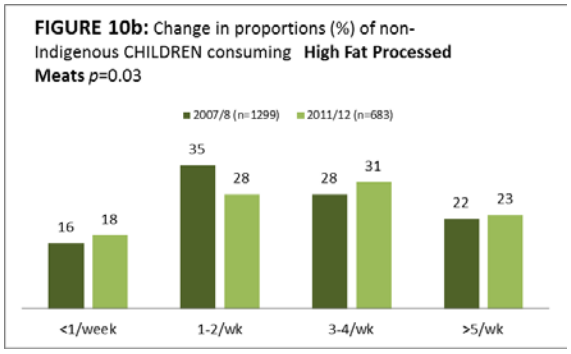


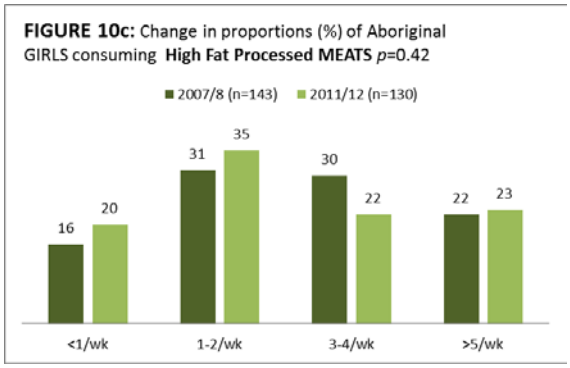


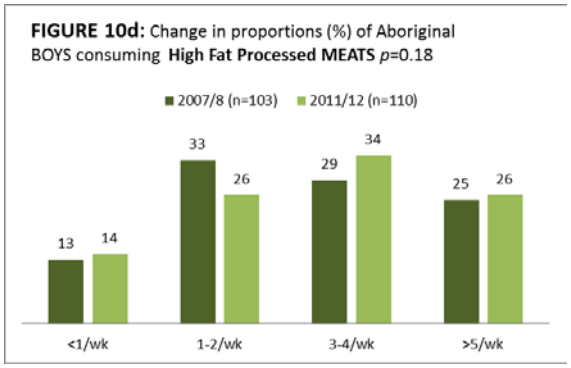
High Fat Processed Meat Products

Significantly more non-Indigenous children reported consuming more high fat processed meats (p=<0.03) in 2011/12 compared to 2007/8, however Aboriginal children's reported intake remained stable (p=0.88) (see Figures 10a and 10b). No difference in intake between surveys was found for either Aboriginal boys or Aboriginal girls.









Sweet foods (sweet biscuits, cakes or muffins)

Intakes of sweet foods remained stable for both Aboriginal and non-Indigenous children between surveys.

Comparison of Energy-dense nutrient-poor (EDNP) food intake between MRDPP-3 and SPANS

A comparison between the MRDPP-3 cohort and the SPANS state wide population reported intakes of EDNP foods is shown below in TABLE 6. Response categories listed are those that were comparable between studies.

A statistically significantly (p=<0.0001) higher proportion of the MRDPP-3 cohort compared with the SPANS cohort reported consuming high fat processed meat products ≥3 times/week. Conversely, a statistically significantly (p=<0.0001) lower proportion of the MRDPP-3 cohort than the SPANS cohort reported consuming sweet foods ≥ 3

times/week. A non-significantly (0.08) higher proportion of MRDPP-3 children in years 7/8 reporting consuming hot chips ≥3 times/week.

TABLE 6: Reported (%) consumption of energy dense, nutrient poor foods, in SPANS (2010) and MRDPP (2011/12)

Food	Response Category (serves per week)	SPANS Yr 6 *(n=1279)*	MRDPP Yr 5/6 *(n=670)*	p-value [a]	SPANS Yr 8 *(n=1628)*	MRDPP Yr 7/8 *(n=327)*	p-value [a]
Crisps	< 3 times/wk	65.5	65.0	0.81	59.0	62.7	0.22
	≥ 3 times/wk	34.5	35.0		41.0	37.3	
Hot chips	< 3 times/wk	84.6	83.3	0.45	85.8	82.0	0.08
	≥ 3 times/wk	15.4	16.7		14.2	18.0	
HFPM [b]	< 3 times/wk	66.9	47.7	<.0001	60.0	45.1	<.0001
	≥ 3 times/wk	33.2	52.3		40.0	54.9	
Sweet Food [c]	< 3 times/wk	60.1	77.4	<.0001	48.9	71.0	<.0001
	≥ 3 times/wk	39.9	22.7		51.1	29.0	

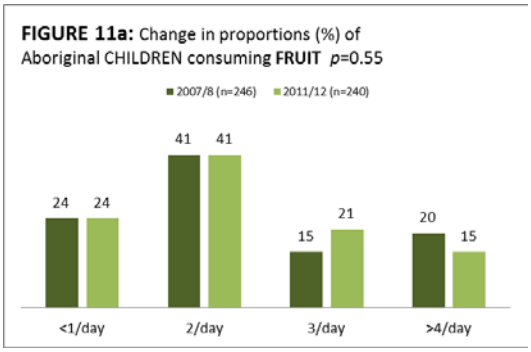
[a] p-value represents the significance of the difference in proportion of children in each response category in the SFFQ; [b] high fat processed meats; [c] includes sweet biscuits, cakes and muffins.

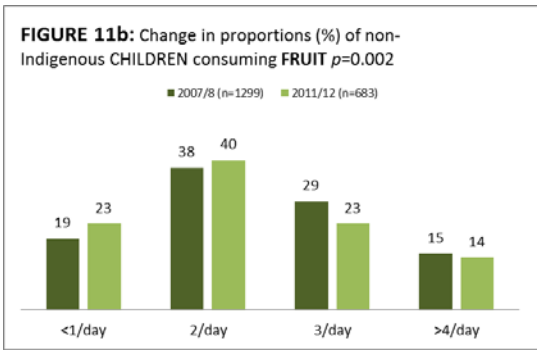
Change in Fruit and Vegetable Intake

Results are interpreted in the context of the 2013 Australian Dietary Guidelines for children http://www.eatforhealth.gov.au/guidelines . These recommend a minimum of 2 serves of fruit a day for children aged 9 years or over and a minimum of 5 serves/day of vegetables for all girls aged 9 years or over and boys between the ages of 9 and 11 years. It is recommended that boys aged 12 year or more consume a minimum of 5 ½ serves/day.

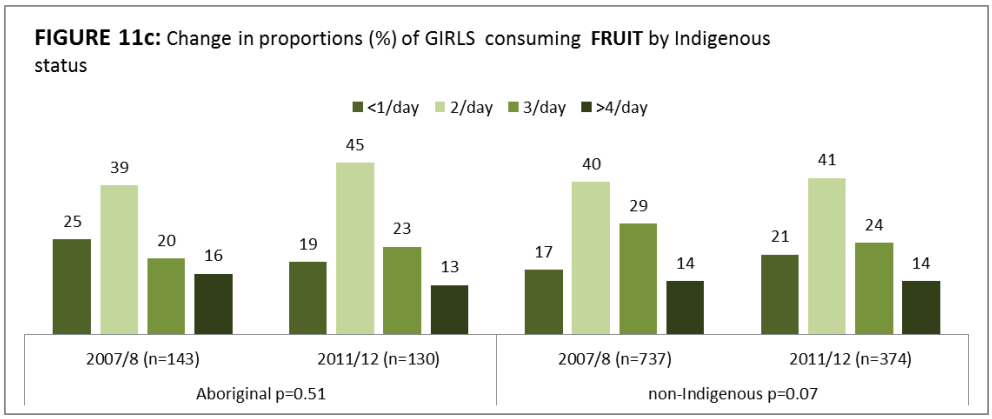
Fruit

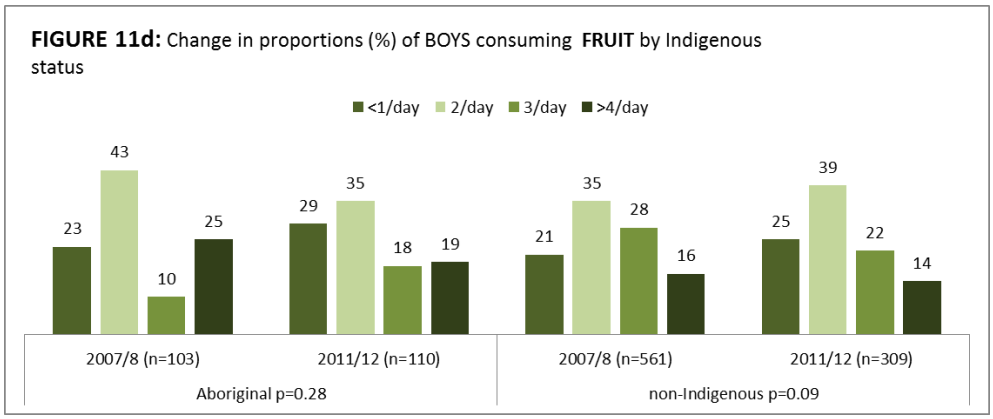
Significantly more non-Indigenous children (p=0.002) reported consuming less fruit in 2011/12 compared with 2007/8 (Figures 11a and 11b), whereas reported fruit intakes by Aboriginal children remained stable.





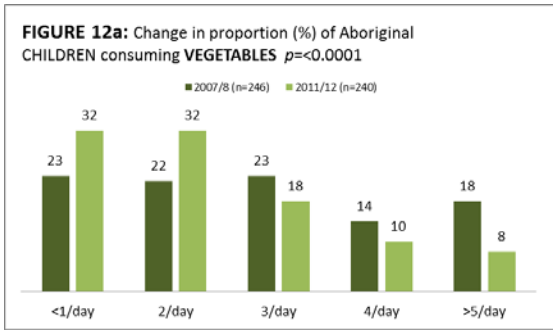
When results are examined by gender, marginally non-significant changes are apparent for more non-Indigenous girls (p=0.06) and boys (p=0.08) to report consuming less fruit (Figures 11c and 11d).

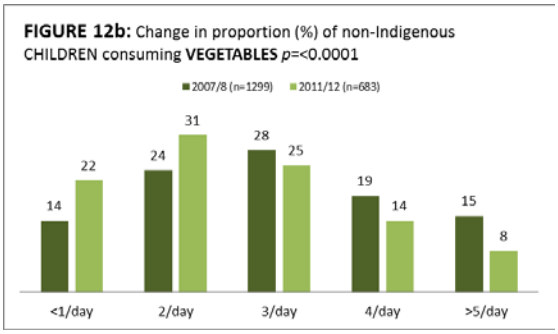




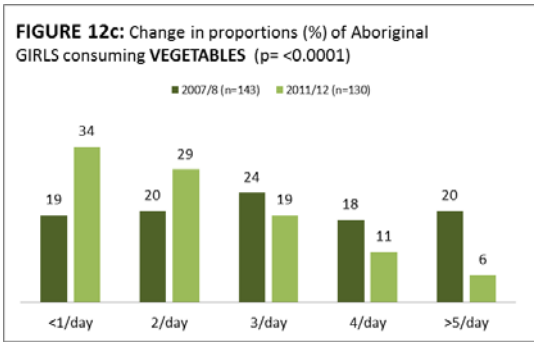
Vegetables

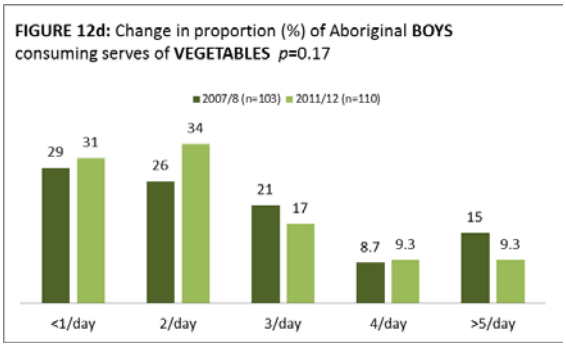
Regardless of Indigenous status there is a significant change (p=<0.0001) to more children consuming less vegetables in 2011/12 compared with 2007/8.





When results for Aboriginal children are examined by gender only boys' intake remained stable (p=0.17) between surveys, and significantly more girls (p=<0.0001) reported consuming less vegetables in 2011/12 compared to 2007/8 (Figures 12c and 12d).





Comparison of fruit and vegetable intake between MRDPP-3 and SPANS

A comparison between the fruit and vegetable intakes of the MRDDP cohort and the SPANS state wide population is shown below in Table 7.

TABLE 7: Reported (%) consumption of fruit and vegetables, in SPANS (2010) and MRDPP (2011/12).

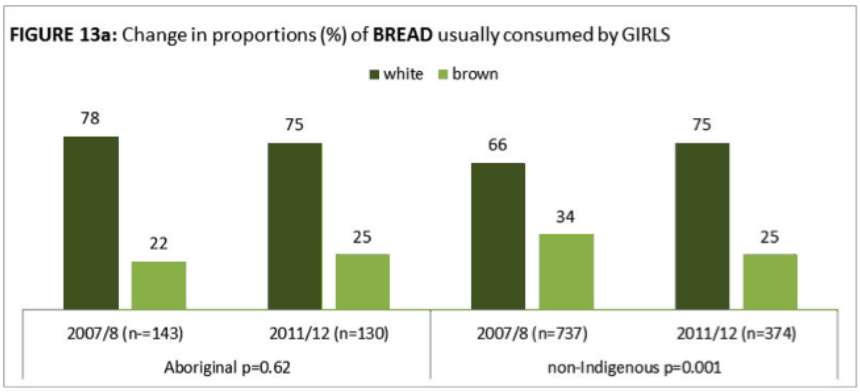
Food	Response Category (serves per day)	SPANS Yr 6 *(n=1279)*	MRDPP Yr 5/6 *(n=670)*	p-value [a]	SPANS Yr 8 *(n=1628)*	MRDPP Yr 7/8 *(n=327)*	p-value [a]
Fruit	< 2 serves/day	22.8	19.9	0.13	23.4	28.4	0.05
	≥ 2 serves/day	77.2	80.2		76.6	71.6	
Vegetables	< 5 serves/day	94.2	90.6	0.003	92.8	91.5	0.40
	≥ 5 serves/ day	5.8	9.4		7.2	8.5	

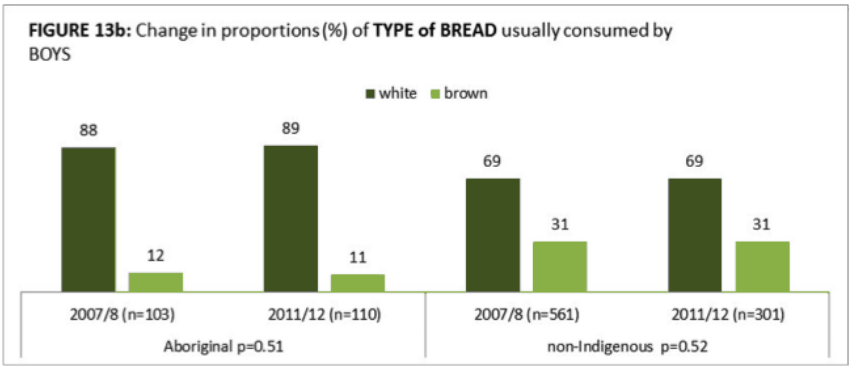
[a] *p-value represents the significance of the difference in proportion of children in each response category in the SFFQ.*

A significantly higher (p=0.003) proportion of MRDPP-3 children in years 5/6 report consuming the recommended amount of vegetables per day compared to the SPANS equivalent age group (see TABLE 6), and a significantly lower (p=0.05) proportion of MRDPP-3 children in years 7/8 report consuming the recommended amount of fruit per day compared to the SPANS equivalent age group.

Change in type of bread usually consumed.

Significantly more non-Indigenous girls report consuming white bread in 2011/12 compared to 2007/8.





Prevalence of key food and drink intakes.

Results from the MRDPP-3 also provide rare matched prevalence data on key food intake levels and physical activity participation for Aboriginal and non-Indigenous children, and it is appropriate to report on these here (33). The change in proportions of children's reported intake of key foods and drinks is presented below in Table 8.

The cut-points listed are based on Australian guidelines for fruit and vegetable intake, data distribution, and expert opinion regarding food and drink intake levels of critical clinical significance (that is, those levels indicating excessive intakes of energy-dense nutrient-poor foods).

The majority of children reported meeting the Australian guidelines for fruit intake, whereas the majority do not meet the Australian guidelines for vegetable intake.

Notable differences by Indigenous status exist in reported intakes of sugary drinks, diet soft drink and hot chips with more Aboriginal than non-Indigenous children reporting consuming excessive intakes of these foods.

At least 50% of all children report consuming excessive amounts of high fat processed meats.

The proportion of Aboriginal boys usually consuming white bread in both surveys was notably higher than for girls and for non-Indigenous children.

TABLE 8: Change [1] in the proportion (%) of children's reported intake of key foods and drinks by Indigenous status between Survey 1 (2007/8) and Survey 2 (2011/12).

Foods	Cut-points	Indigenous Status *Aboriginal (A) non-Indigenous (N)*	2007/8	2011/12	p-value[2]
Sugary drinks	≥1 cup/day	N	15	14	0.02
		A	29	27	0.85
Fruit juice	≥1 cup/day	N	32	22	<0.0001
		A	37	30	0.26
Diet soft drinks	≥4 cups/week	N	8	7	0.001
		A	15	16	0.30
Water	≥2 cups/day	N	82	80	0.74
		A	73	70	0.48
Hot Chips	≥5 times /week	N	4	5	0.40
		A	16	14	0.65
HFPM[3]	≥3 times /week	N	50	54	0.03
		A	54	52	0.88
Salty Snacks[4]	≥1 times/week	N	66	64	0.28
		A	72	67	0.24
Sweet Foods[5]	≥1 times/week	N	60	61	0.88
		A	52	53	0.47
Fruit[6]	≥2 serves/day	N	81	77	0.002
		A	76	76	0.55
Vegetables[6]	≥5 serves/day	N	15	8	<0.0001
		A	18	8	<0.0001

[1] Generalized Estimating Equations (GEE's) were used to examine differences between surveys, accounting for the correlation of children belonging to the same school, and p-values were derived from the Wald test; [2] statstically significant p< 0.05 level; [3] High Fat Processed Meats including meat pies; [4] includes potato crisps; [5] sweet biscuits, cakes and/or muffins; [6] cut-points represent Australian dietary guidelines for fruit and vegetable intake for this age-group.

Change in Proportions of Children Meeting Australian Guidelines for Physical Activity

The Australian guidelines for physical activity state that children aged 5 to 17 years should accumulate at least 60 minutes per day of Moderate to Vigorous Physical Activity (MVPA).

The proportion of the MRDPP cohort who reported meeting the Australian guidelines for MVPA declined significantly in 2011/12 compared with 2007/8 regardless of season or Indigenous status (see Tables 9 and 10 below).

TABLE 9: Proportion (%) of children in school years 5 to 8 who report meeting Australian Guidelines for daily physical activity between 2007/8 and 2011/12 by Indigenous Status.

Season	Aboriginal			non-Indigenous		
	2007/8 (n=246)	2011/12 (n=240)	p-value	2007/8 (n=1299)	2011/12 (n=683)	p-value
Summer	72	59	0.0015	79	70	0.0007
Winter	53	35	0.0002	59	50	0.0051

Similar to the SPANS cohort, a significantly lower proportion of MRDPP-3 children met the Australian guidelines for physical activity in 2011/12 compared with 2007/8 regardless of season or school year, other than the year 7/8 group in winter (refer to TABLE 10).

TABLE 10: Proportion (%) of children who report meeting the Australian Guidelines for daily physical activity for MRDPP (between 2007/8 and 2011/12) and SPANS (between 2004 and 2010).

Season	School year	Many Rivers			SPANS[a]		
		2007/8	2011/12	p value	2004	2010	p value
Summer	Yr 5/6	83.8 (n=789)	69.13 (n=477)	<0.0001	84.3 (n=825)	58.3 (n=746)	<0.0001
	Yr 7/8	70.41 (n=464)	63.64 (n=210)	0.03	82.10 (n=658)	64.10 (n=1044)	<0.0001
Winter	Yr 5/6	64.01 (n=603)	46.81 (n=323)	<0.0001	78.00 (n=764)	45.00 (n=576)	<0.0001
	Yr 7/8	50.08 (n=330)	45.45 (n=150)	0.17	73.00 (n=585)	50.50 (n= 822)	<0.0001

[a] *Years 6 and 8 only*

Prevalence of Children Meeting Australian Guidelines for Physical Activity

Proportions of children who reported meeting the Australian guidelines appear lower in winter and in the older age group (see Tables 9 and 10). A lower proportion of Aboriginal children compared with non-Indigenous children reported meeting guidelines in 2011/12 regardless of season (see Table 9).

A higher proportion of MRDPP-3 primary school aged children (years 5/6) than SPANS children (yr 6) met the guidelines in summer in 2011/12.

Change in the Proportions of Children who are over the Healthy Weight Range

The proportions of children classified as over the healthy weight range remained stable regardless of Indigenous status or gender (see TABLE 11).

TABLE 11: Prevalence (%) in each BMI category a by gender and Indigenous status between 2007/8 and 2011/12.

Gender	BMI category	Aboriginal			Non-Indigenous		
		2007/8 (n=105)	2011/12 (n=118)	p-value	2007/8 (n=566)	2011/12 (n=330)	p-value
Boy	Underweight	2.1	5.2	0.38	2.2	2.5	0.70
	Healthy Weigh	63.0	63.0		70.0	71.0	
	Overweight	24.0	16.0		20.0	21.0	
	Obese	11.0	15.0		7.2	5.4	
Girl	Underweight	2.2	3.5	0.74	4.7	5.8	0.76
	Healthy Weigh	63.0	55.0		65.0	65.0	
	Overweight	22.0	24.0		22.0	21.0	
	Obese	13.0	18.0		8.9	8.0	

[a] *Body Mass Index (BMI) cateories according to Cole cut-off points (27).*

Similar to the total MRDPP-3 population data, the statewide SPANS also reported no statistically significant change in the proportions within each BMI category between the 2 time periods (see TABLE 10).

Table 12: Proportion (%) of children in each BMI a category in MRDPP (between 2007/8 and 2011/12) and SPANS (between 2004 and 2010).

BMI Category	MRDPP			SPANS[b]		
	2007/8	2011/12	p-value	2004	2010	p-value
	Year 5/6					
	n= 906	*n=588*		*n=979*	*n=1278*	
Underweight	3.5	3.9	0.94	NA	7.6	0.12
Not O'wght/Obese	65.6	64.5		72.2	65.4	
Overweight	21.4	21.4		18.9	20.4	
Obese	9.5	10.2		8.6	8.6	
	Year 7/8					
	n=638	*n=300*		*n=801*	*n=1627*	
Underweight	3.1	5.0	0.48	NA	7.8	0.38
Not O'wght/Obese	66.8	67.3		74.9	70.1	
Overweight	22.4	20.0		18.6	17.3	
Obese	7.7	7.7		6.5	4.7	

[a] *Body Mass Index (BMI) cateories according to Cole cut-off points (27);* [b] *Years 6 and 8 only.*

Prevalence of children who are over the healthy weight range.

The prevalence of children who are classified as obese is higher among Aboriginal children than non-Indigenous children regardless of gender (see Table 11).

DISCUSSION

Diabetes Knowledge

There was an improvement in Aboriginal boys' knowledge about diabetes (Table 4), an important result given the high rates of this disease in Aboriginal communities compared to the Australian population in general (1). The lower overall proportion of non-Indigenous children compared with their Aboriginal counterparts who correctly answered 90% of the survey questions is a concern. Given the predicted rise of type 2 diabetes in the general population over the next decade (3) it is important that all children possess a sound knowledge base regarding the risk factors for this disease, and consideration should be given to continuing an education program in all schools, such as the Diabetes Education Package delivered by the MRDPP-3 (Table 3). This program had high acceptability with delivery of the package occurring at least twice in all primary schools in the participating communities, and in all high schools in Kempsey.

Children's Food Intake

Sugary drinks, diet soft drink, fruit juice and water

Change: The changes to more children consuming less sugary drinks, diet soft drink and fruit juice intake between the 2 surveys align with the high intensity and primary focus of the health promotion strategies on discouraging consumption of energy-dense nutrient-poor foods, particularly sugary drinks, and encouraging fruit intake. These changes were most apparent among non-Indigenous children however also existed amongst Aboriginal children for fruit juice and diet soft drink (boys only). These changes also align with the high level of skills attained by the APOs in nutrition and in program delivery over the duration of the MRDPP-3. The findings for intake of sugary drinks in our cohort are in contrast to international trends which have seen a rise in the consumption of sugary drinks (34), as well as to results for same age children from a large NSW childhood obesity prevention program Good4Kids (G4K) (35) conducted over the same time period. The G4K study found no significant change in sugary drink intake for children in school years 6, 8 and 10 and, in contrast to the MRDPP-3, found no decline in fruit juice intake when the results were examined by gender. These results may be indicative of an intervention effect, and in the future similar programs should include robust evaluations such as using controlled or comparison groups to confidently establish their effectiveness.

Prevalence: A greater proportion of Aboriginal children compared with non-Indigenous children report consuming excessive intakes of sugary drinks, findings first identified in a MRDPP study conducted in 2005/6 (13) (See Table 8). These intake levels are of major concern for the future health of rural Aboriginal children as soft drink consumption is associated with a range of morbidities including obesity and diabetes (36) which are already present at high rates in their communities (1). These findings are in contrast to results from a national study which found (similar to the non-Indigenous children in the MRDPP-3 cohort) that 14% of Australian adolescents were consuming sugary drinks on a daily basis (37). The same study also found higher intakes amongst adolescents from lower socio-economic position areas. Significant differences in sugary drink intake by Indigenous status have recently reported at state level (36), and high intakes reported internationally among first nations children (38) (39). The higher proportion of MRDPP-3 children reporting consuming $\geq$ 2 cups/day of sugary drinks and fruit juice compared to the state SPANS data is concerning amongst this rural disadvantaged population and is largely contributed to by the higher proportion of Aboriginal children reporting excessive intakes. Children tend to under report consumption of unhealthy foods (and over report consumption of healthy foods) (14) making it likely that the actual proportion of children with high intakes of sugary drinks is larger than reported. There is strong evidence to support the need for future health promotion programs in rural communities, particularly Aboriginal communities, to focus on reducing the levels of sugary drinks consumption as a priority.

The significantly higher proportion of MRDPP children (76%) than the state cohort (between 50% to 60%) reporting consuming at least 1 cup/day of water is very encouraging and particularly important in the light of Aboriginal children's excessive intakes of sugary drinks. The validity of this question has been demonstrated to be high (14) for non-Indigenous children but not so for Aboriginal children. Results therefore need to be interpreted with caution amongst this group.

Energy Dense Nutrient Poor (EDNP) Food Intake

Change: Whilst the finding that there was no increase in the proportions of Aboriginal children reporting consuming more EDNP foods is encouraging, the change to more non-Indigenous children reporting consuming more high fat process meats (HFPM) is concerning. Such foods possess high fat and salt content (37) and high proportions of the

MRDPP-3 cohort consume excessive intakes of these foods compared to state (32) and national (37) levels. An earlier study conducted by the MRDPP in the same communities as those in this study, found that the primary HFPM food consumed by participants was hot meat pies (13).

Prevalence: Excessive intakes of EDNP foods by the MRDPP- 3 population, particularly by Aboriginal children for hot chips, were first identified in a previous study by the MRDPP (13) and findings here demonstrate that this is a continuing trend. The high consumption of EDNP foods is regarded as a risk factor for chronic disease (40, 41) which is present in Aboriginal, rural and disadvantaged communities at a higher rate than the general population (1, 3).

The finding of no statistically significant difference between the SPANS and MRDPP-3 cohorts in proportions consuming hot chips at ≥3 times/week masks the notably higher Aboriginal than non-Indigenous child consumption of hot chips, particularly at the MRSFFQ response category of ≥ 5 x day (see Figures 9a and 9b). This finding along with that of lower sweet food and higher high fat processed meat consumption of Aboriginal than non-Indigenous children has been shown to be a feature of this population's EDNP food intake in previous research (13). A recent national report has described higher intakes of hot chips and high fat processed meats among Australian adolescents (42) compared to the rest of the population. This, along with our findings of excessive intakes of these foods amongst our cohort particularly Aboriginal children, supports the need for future health promotion programs to focus on reducing the intake levels of these foods as a priority among young people.

Fruit and Vegetables Intake

Change: Similar to national findings (1), the majority of participants in the MRDPP-3 report meeting Australian guidelines for fruit intake in both surveys and for Aboriginal children this proportion remained stable over both surveys. This finding for Aboriginal children is in contrast to non-Indigenous children and to results from children of the same age range in the G4K program, were a decline in the proportion of children consuming the recommended intake was reported (35).

Among the MRDPP-3 cohort there is a significant shift to more children consuming less vegetables between Surveys for all except Aboriginal boys and this is in keeping with results from SPANS (32).

Prevalence: The higher proportion of the younger MRDPP-3 than SPANS cohort reporting consuming the recommended intake for fruit is encouraging for these rural children. Nonetheless the majority of the MRDPP-3 participants similar to the SPANS cohort, did not eat the recommended amount of vegetables and this also aligns with national findings (37).

Bread:

Change: The increase in the proportion of non-Indigenous girl's reporting usually consuming white bread is in contrast to boys and Aboriginal children. A previous study conducted in phase 2 of the MRDPP (13) identified that the white bread consumed by children from the participating communities was predominately poor quality. The magnitude of change reported by girls is therefore concerning for their health.

Prevalence: Relatively high intakes of white bread have been previously identified among Aboriginal boys in phase 2 of the MRDPP (13). Their consumption levels may be driven by the need to satisfy hunger during the adolescent growth phase, in an environment of financial stress. Results from this study indicate an ongoing trend for high intakes of poor quality white bread among Aboriginal boys when compared to other participants.

Children meeting Australian physical activity guidelines

Change: The significant decline in the proportion of all children reporting sufficient daily physical activity to meet Australian guidelines aligns with finding from the G4K program (35), as well as state (32), national (43) and international (40, 41) trends. It should also be noted that the MRDPP-3 health promotion strategies for physical activity participation were much less intense than for the food strategies and did not possess their frequency nor reach.

The decline in the proportions of children participating in the recommended amount of physical activity between surveys was more notable among Aboriginal children than their non-Indigenous counterparts. This may be in part contributed to by the differential

participation rates for Aboriginal and non-Indigenous children in 2011/12 (see Study Characteristics below), and by the barriers to physical activity participation discussed in this report (See AIM Three Outcomes).

The MRDPP-3 is one of the few studies in Australia to identify the barriers to physical activity among Aboriginal children and findings should inform further intervention studies to address this important risk factor for good health.

Prevalence: Nationally there is little physical activity data available regarding Aboriginal children; however, one report noted that Aboriginal people are more likely than their non-Indigenous counterparts to engage in low levels of physical activity (1). However, a recent study found little apparent difference by Indigenous status in the proportion of children meeting the guidelines for daily physical activity (36).

Evidence (15) points to children being more active in summer and this is apparent here, possibly reflecting the influence of weather and environment on the activity of this rural coastal population.

Finally, internationally there is a consensus that far too few children meet activity guidelines (44, 45), with those from disadvantaged communities such as the ones participating in this study being notably less active (40).

Prevalence of overweight and obesity

Change: The findings of stability in the prevalence of children who are overweight and obese are similar to international trends that indicate that the increase in obesity that began over 25 years ago is attenuating in developed countries (46), and aligns with national (3, 47) and state trends (40). Results here are also similar to those for children of the same age participating in a the G4K obesity prevention project (35), which found also found stability in the proportions of children classified as overweight or obese. These results are not unexpected given the complex causal pathways to obesity (including environmental and intrauterine), the constraints on the delivery of the MRDPP-3 health promotion strategies (staffing levels and time frames see *'Study Characteristics"* described below) and an intervention that primarily focussed on school based nutrition.

Prevalence: The higher proportion of Aboriginal than non-Indigenous children classified as obese in this study, regardless of gender, is in accord with results from state (36) and national surveys (1). Given the high prevalence of obesity among Aboriginal children there is an urgent need to comprehensively address this risk factor for ill health for current and subsequent generations.

High prevalence rates of overweight and obesity in the general Australian population have been reported elsewhere (47). There is strong evidence that a child who is overweight or obese is likely to continue to be so as they grow into adulthood and that their risk for chronic disease is magnified compared to children in the healthy weight range (48).

Risk factor prevalence and adolescent mental health

The persistently high intakes of sugary drinks and hot chips by Aboriginal children, along with high proportions classified as over the healthy weight range, are concerning for their mental health. A recent study of Australian adolescents identified higher odds of depressive symptoms in girls who consumed high intakes of sugary drinks and in boys who were overweight or obese (49). Depressive symptoms were also identified amongst all children who exceeded guidelines for screen time leisure activity such as Aboriginal children as found in another recent study (36).

Study Characteristics that may have impacted on results

The following study characteristics of the study and its environment were evident and may have impacted on results:

1. The lower numbers of Aboriginal participants has meant that the study may have been underpowered to detect changes in proportions responding to short questions on food intake, and across BMI categories.
2. A selection bias may exist in this study with differential participation rates for Aboriginal and non-Indigenous children (in 2007/8: 55% and 41% respectively, and in 2011/12: 44% and 26%), and lower participation rates for non-Indigenous children in 2011/12 compared to 2007/8. This is possibly a result of the support provided to Aboriginal and Torres Strait Islander communities by APOs in the recruitment stage. The lower participation rate of non-Indigenous children in 2011/12 may reflect a bias towards families more motivated to healthy behaviours. This is turn may lead to a

falsely healthier risk factor profile for non-Indigenous compared to Aboriginal children in 2011/12. However, evidence points to differences by Indigenous status identified in both surveys being in keeping with that found in national surveys (1) and other studies (36).

3. The co-existence of a large number of local, state and national childhood healthy obesity prevention initiatives implemented over the same period of time (see earlier) may have confounded the evaluation of the MRDPP.
4. The health promotion strategies described above in AIM Four were delivered:
    a. Over 2 regional areas.
    b. In communities of high relative disadvantage.
    c. By only 2 full-time APOs with the support of 1 senior APO.
    d. On a very modest budget.
    e. Between 6 months to 2 years each in varied intensities (Tables 2 and 3), with nutrition strategies being delivered at a highest intensity, followed by the physical activity strategies and then community level strategies.

Changes described in food intake, physical activity, diabetes knowledge and BMI should be considered in this context.

CONCLUSION

The MRDPP-3 demonstrates that a long-term Aboriginal community governed collaboration can be developed and maintained, can deliver health promotion strategies to children in disadvantaged rural areas regardless of Indigenous status and may have an impact on risk factors when sufficiently high levels of strategy intensity and staff skills are available.

The MRDPP-3 delivered a number of positive outcomes in the participating communities and demonstrated that:

1. A program of research and health promotion for children initiated and governed by an Aboriginal community can be successfully developed and implemented. Outcomes can be measured using tools validated with the participating communities.
2. Strong local partnerships need to be formed to enhance program delivery. In this case partnerships were formed with schools, Police Citizens Youth Clubs, local shire councils and Aboriginal Medical Services.

3. A research partnership with Aboriginal communities can deliver:
    a. The development of high level skills in research and the delivery of a health promotion program by full-time Aboriginal staff.
    b. The employment and training of a large number of casual Aboriginal staff in the delivery of a population level health promotion program. This involvement can be a pathway to more permanent employment elsewhere in disadvantaged rural areas, which possess chronically high levels of unemployment.
2. Barriers to healthy food intake and physical activity participation identified here align with those found elsewhere within Indigenous, disadvantaged and rural communities. Results presented here add to the national calls to address such findings. The 'Additional Barriers' reported by Aboriginal people require further investigation.
3. Non-Indigenous children can participate in and benefit from health promotion and education programs designed for Aboriginal children and delivered by members of the Aboriginal community.
4. The predominately school-based MRDPP-3 showed the following encouraging results amongst those who participated in Survey 2 when compared with those who participated in Survey 1:
    a. More non-Indigenous children reported consuming less sugary drinks, diet soft drinks and fruit juice in 2011/12 than 2007/8, with results differing by gender.
    b. More Aboriginal boys reported consuming less diet soft drinks and girls less fruit juice.
    c. A non-significantly a higher proportion of Aboriginal boys correctly answered 90% of the diabetes knowledge questions.
    d. Stability in the proportions of Aboriginal children regardless of gender who reported meeting the Australian guidelines for children over 9 years of age for fruit intake (2 serves/day). There was a significant decline in fruit intake by non-Indigenous children.
    e. Stability in the prevalence of children in the MRDPP-3 who were over the healthy weight range, with no significant changes apparent between the two surveys.

RECOMMENDATIONS

1. Aboriginal community governed research and/or health promotion projects for Aboriginal and non-Indigenous rural children have the potential to positively impact on stubborn health risk factors such as poor nutrition. To achieve positive change, such projects should have the following characteristics:
    a. *Aboriginal community governanc*e. A Community Based Participatory Research model should be adopted when undertaking research in collaboration with Aboriginal communities. Of particular importance is the establishment of Aboriginal community reference groups. It is recommended to include up to one extra year at the commencement of similar programs to support the establishment of governance procedures.
    b. *A strong emphasis on Capacity Building* activities. Sufficient time and funds for these activities must be built into the planning and execution of the project. Education and training should aim to contribute meaningful building blocks to staff members' skill development and future employability past the duration of their current role.
    c. Project strategies should be delivered by Aboriginal staff who are receiving *high levels of education / training* in the content being addressed - preferably at diploma or degree level.
    d. *Developed in partnership* with participating Aboriginal communities.
    e. *Delivery in partnership* with local agencies to enhance the reach of project strategies into the participating communities.
    f. *Include rigorous evaluation,* for example one that uses a controlled or comparison group, to establish effectiveness.

2. Governments need to develop a clear plan to address the barriers to healthy food intake and physical activity in rural areas such as those identified by the MRDPP-3 and by other studies nationally.

3. Further investigation is required to identify and explore the barriers to healthy food intake and physical activity identified by Aboriginal people in this study.

4. Prevalence and trend data from the MRDPP-3 provide strong evidence for the need to target the following risk factors for good health among rural children from disadvantaged communities:
    a. Persistently high intakes of sugary drinks, fruit juice, and hot chips by Aboriginal children.
    b. Very low reported vegetable intake by all children.
    c. Decline in children's physical activity.
    d. The ongoing higher proportion of Aboriginal children compared with non-Indigenous children who are classified as obese.

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