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Food and beverage price discounts to improve health in remote Aboriginal communities: mixed method evaluation of a natural experiment

Megan Ferguson,^{1,2} Kerin O'Dea,² Stacey Holden,³ Eddie Miles,⁴ Julie Brimblecombe¹

Poor nutrition underlies the poor health status of Indigenous Australians living in remote communities.¹ There is strong evidence to support targeting increased fruit and vegetable and reduced soft-drink consumption as two strategies for dietary improvement.² Affordability is one of the key drivers in food choice generally^{3,4} and is the case for Indigenous Australians living in remote areas, where the cost of food is high and incomes are low.⁵⁻⁷

There is growing interest in the role of food pricing policy on dietary intake and health outcomes. However, evidence of impact is limited and inconclusive. Modelling studies suggest that fruit and vegetable subsidies (i.e. price reduction or food at no cost) can have positive impacts on dietary intake, health outcomes and potential cost benefits, including in remote Aboriginal communities.^{8,9} Three supermarket-based randomised controlled trials of price discounts on healthier foods,¹⁰ fruit and vegetables,¹¹ and fruit, vegetables and beverages,¹² reported a positive impact on purchases of targeted foods, with the exception of bottled water and low-calorie beverages.¹² These studies provided discounts of 12.5%, 20% and 50%.¹⁰⁻¹²

Research priorities in this emerging field include considering the impact of price changes on outcome measures for different population groups, including disadvantaged populations¹³⁻¹⁸ and determining the magnitude^{13,19} and duration¹⁶ of the subsidy

Abstract

Objective: Retrospectively evaluate food price discounts in remote Aboriginal community stores.

Methods: Four price discount strategies of 10% were designed in 2010, aiming to influence grocery, fruit, vegetables and diet soft-drink sales. This natural experiment across a group of stores was evaluated using an explanatory, sequential mixed method design through analysis of store point-of-sale, document, observation and interview data. The outcome was measured by change in: 1) percentage of grocery sales to total food and beverage; 2) fruit and vegetable sales; and 3) diet soft-drink sales. Qualitative data enabled the interpretation of outcomes through understanding perceived success and benefits, and enablers and barriers to implementation.

Results: Eighteen community stores and 54 informants participated. While targeted price discounts were considered important to improving health, no discernible effect was evident, due to inadequate design and communication of discount promotion, and probably inadequate magnitude of discount.

Conclusions: Strategy impact on food and beverage sales was limited by promotion and magnitude of discount.

Implication for Public Health: This study demonstrates key factors and commitment required to design, communicate, implement and monitor strategies to improve health in this challenging remote retail context. Evaluation of natural experiments can contribute evidence to policy-making.

Key words: remote Aboriginal, food pricing policy, discount, consumer behaviour, diet quality

or tax (i.e. price increase) required to achieve the desired outcome. Taking advantage of natural pricing experiments through well-designed evaluations presents an opportunity to contribute further evidence on the design and impact of food pricing policies.^{14,18,20,21}

A range of food pricing strategies have been implemented in remote Indigenous Australian communities including: 100%

subsidy of freight on fresh, frozen, canned and dried fruit, vegetables and fresh milk; lower mark-up on healthy food products such as fresh fruit and vegetables, and water and artificially sweetened beverages.^{22,23} As this remote retail industry is committed to contributing to the development of quality evidence for health improvement,²⁴ evaluation of such strategies could inform policy-making in the context of remote

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stores and possibly more generally for other disadvantaged populations.

There is good evidence to suggest which foods to target for dietary improvement in remote Australian Indigenous communities,² however, there is limited evidence to support the design of pricing strategies, including type of instrument (e.g. subsidy or tax), magnitude of the fiscal measure, essential elements of the strategy such as promotion²⁵ and evaluation design (e.g. including process and impact measures).²⁶

This paper presents the findings of an opportunistic, retrospective evaluation of a natural experiment that aimed to describe the pricing strategies implemented, and examine impact on food and beverage sales, perceived level of success, key enablers and barriers to implementation, and perceived benefits associated with pricing strategies.

Methods

Context

Outback Stores Pty Ltd is a retail management company that offers services to remote stores owned by Indigenous community residents.²⁷ In 2010, Outback Stores introduced four food and beverage price discount strategies:

- 1) Grocery: a reduced mark-up on a range of grocery products, referred to here as shelf (e.g. cereals), refrigerator (e.g. fresh milk) and freezer groceries (e.g. frozen vegetables);
- 2) Fresh fruit and vegetable point-of-sale scales (F&V point-of-sale scales): for the sale of loose fresh fruit and vegetables (expected to be lower unit cost than pre-packed produce);
- 3) Fresh fruit and vegetables at landed cost

(F&V landed cost): where the freight mark-up only was applied to the cost price; and 4) Diet soft-drink discount: a reduced mark-up on diet soft-drinks (i.e. artificially sweetened carbonated beverages) compared with soft-drinks (i.e. sugar sweetened carbonated beverages) (Supplementary Table 1). The aim of these strategies was to increase sales of targeted products by enhancing affordability of grocery products and fruit and vegetables and discouraging soft-drinks. These strategies were in line with the company's mission and in response to community feedback^{23,28} to improve access to nutritious and affordable food, and support consumers to make healthier food choices.

Study design

An explanatory, sequential mixed methods approach was used to conduct a retrospective evaluation of the four price discount strategies (Figure 1). The mixed methods approach was employed during the study design stage.^{29,30} Initially, priority was given to the quantitative data collection, though following preliminary analysis, it was clear that the qualitative data were likely to provide the most informative results.³⁰ The qualitative methods were connected to the quantitative method through the development of the interview guide, observation record and document review process. The results were integrated through a narrative, contiguous approach, with the qualitative data related to the outcomes of the quantitative data.^{29,30} First, point-of-sale data (aggregated monthly per store) were used to assess the population-level impact on the primary outcome measures:

change in, 1) percentage of grocery sales (\$) to total food and beverage sales (\$); 2) fruit and vegetable sales (kg); and 3) diet soft-drink sales (litres), with secondary measures of water and soft-drink sales (litres). As this was a natural experiment and not an experimental study design, it was considered that store sales alone may not provide all the information required to evaluate success. The study design therefore included a second phase, the design and collection of qualitative data to provide insight into the findings from store point-of-sales data. At the outset of the study, it was considered that perceptions in relation to success and benefits of the strategies and enablers and barriers to implementation would be the areas of qualitative inquiry that would contribute most to interpreting strategy effectiveness; we used key informant interviews, store observation and document review to assess these factors.

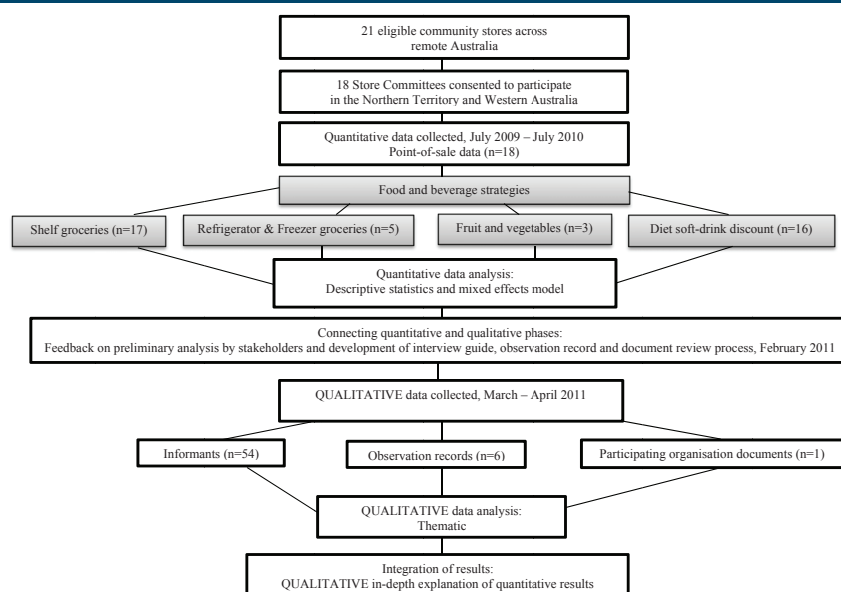
Study setting and sample

In July 2010, 21 remote Aboriginal communities accessing retail management services through Outback Stores were invited to participate in the study, with 18 communities in the Northern Territory and Western Australia consenting to do so. Detail on participating communities is provided elsewhere.³¹ Six of the 18 were purposively selected to ensure representation and capture differences of stores in central and northern Australia, and were invited to participate in the key informant interview and store observation component; all agreed to participate. Observations were made by MF in all six stores and interviews were conducted with a purposive sample of 54 participants (ranging from seven to 12 in each community); local store committee members, store managers and staff and customers. Most (78%) were Aboriginal; there were similar numbers of men and women; and the majority (89%) were older adults (Table 1).

Quantitative data collection

Retrospective electronic point-of-sale data were accessed through Outback Stores for each month from July 2009 to December 2010, including the product description, unit volume, quantity sold, and value of sales, for each participating store. Point-of-sale data were imported into a purpose built Access 2003 database (Microsoft Corporation, Redmond, Wash, USA). Food and beverage items were grouped and weights and volumes determined.

Figure 1: Study flow chart, data collection and sampling.



Qualitative data collection

The qualitative data collection methods were informed by the feedback provided by a group of stakeholders (two Store Committee Chairpersons from participating communities, four Outback Stores staff and four researchers) on a preliminary analysis of the point-of-sale data presented at a meeting in February 2011. The interview guide focused on recall and perceived impact of strategies on customer purchasing, perception of pricing strategies to improve access to nutritious and affordable food, and enablers and barriers to strategy implementation including methods recommended to communicate discounts. Individual and group key informant semi-structured interviews were conducted by an interviewer (EM or MF) and scribe (MF or SH) in March and April 2011. Having a dedicated scribe to capture the data was considered the preferred method within the context and the most effective use of resources.³² Interviews were recorded near verbatim. The three staff who conducted the interviews were known in the communities from their current or former roles with Outback Stores; one (MF) was present at all interviews. Having experience in, or being situated within, the remote retail context positioned the research staff to develop rapport and contextualise the study for participants.³³ This was considered an asset where time pressures are high for store staff, and also supported a natural dialogue with Aboriginal participants. The researchers planned each community visit to coincide with a pre-arranged time considered suitable to the store committee and management. The researchers remained in each community for two to three days providing opportunity to meet with community members and staff at a time that suited them. All interviews were conducted in English. In some groups a participant assumed the role of translator between English and the local Aboriginal language. Following each interview, the team confirmed the written interview notes, which were typed within 24 hours and re-checked by the other team member. In-store

observation of a short list of factors including the fresh fruit and vegetable and beverage supply (range, quality, type of infrastructure, placement), operation of fruit and vegetable scales used at point-of-sale, promotion of strategies and price ticketing was recorded in a field journal and reproduced in a word document. Documents relevant to strategy implementation, including data such as changes to mark-ups applied to retail categories, were provided by Outback Stores.

Quantitative data analysis

The point-of-sale data were first described for the entire data period, with the month/s in which the strategy commenced excluded from these analyses. The Grocery strategy analysis was limited to July 2009 – July 2010 to exclude the period of the Diet soft-drink discount strategy implementation as beverages were included in the grocery 'shelf' category. Data were also excluded for stores where there was substantiating evidence, through checking of unit price and document review, of the strategy not being applied as intended. Document review revealed that soon after implementation of the Grocery strategy, there was a change in the freight mark-up (i.e. 1–2 months later, in April 2010). Data were excluded for stores (n=1, shelf grocery strategy; n=13, refrigerator and freezer grocery strategies) where this was >5%. The Diet soft-drink discount strategy was delayed by one month in two stores and these were excluded from beverage analysis. The introduction of the F&V point-of-sale scales strategy resulted in sales history being deleted from the system for products no longer supplied (i.e. most pre-packed fruit and vegetable lines). Retrospective data on these products prior to the set-up of the F&V point-of-sale scales were therefore not available for analysis (Supplementary Table 1 and Table 2).

For all available data a comparison of pre- and post- outcome measures was made. A mixed effects model with a random effect intercept that adjusted for correlation of monthly sales with the same store was used to

investigate the impact of the discounts. AR(1) (autoregressive model) temporal correlation was assumed; and calendar month adjusted for in models involving beverages, as there was sufficient data to adjust for seasonal variation. Point-of-sale data were analysed using Stata Version 14.0 (Stata, College Station, Texas, USA).

Qualitative data analysis

The qualitative data were analysed by two members of the research team (JB, MF). One researcher has extensive experience engaging the remote retail sector in research and the other, industry knowledge as a previous employee in the remote retail sector. These experiences strengthened the data analysis by ensuring research quality and relevance. All interview and observation notes were independently examined by the two researchers without any pre-existing codes or frameworks. The researchers then agreed on a set of codes that were categorised and themes were then developed. The dataset was subsequently coded by one author (MF) using the agreed codes in NVivo (NVivo qualitative data analysis software; QSR International Pty Ltd Version 9, 2010). The coded data were analysed with similarities or disparities across groups considered. Document review was conducted manually and contributed to the description of strategy design and implementation (Supplementary Table 1). The qualitative themes were brought together with the quantitative data outcomes to ensure a richer understanding of the situation. The key findings were reviewed with a research team member (JB) and staff from Outback Stores (SH, EM).

Ethics

This study was conducted with the approval of the Human Research Ethics Committee of Northern Territory Department of Health and Menzies School of Health Research, the Central Australia Human Research Ethics Committee and the Western Australian Aboriginal Health Information and Ethics Committee.

Table 1: Characteristics of key informants interviewed.

	Ethnicity				Gender				Age ^a			
	Aboriginal		Non-Aboriginal		Female		Male		<35 years		>35 years	
	n	%	n	%	n	%	n	%	n	%	n	%
Store committee members	30	100%	0	-	12	40%	18	60%	4	13%	26	87%
Store staff	7	41%	10	59%	12	71%	5	29%	2	12%	15	88%
Other community members	5	71%	2	29%	4	57%	3	43%	0	-	7	100%
TOTAL	42	78%	12	22%	28	52%	26	48%	6	11%	48	89%

a: In most cases estimated by the research team.

Results

The four price discount strategies are described in Supplementary Table 1.

Impact on sales

No discernible impact of the discounts on groceries, fresh fruit and vegetables and diet soft-drinks on store sales/turnover was detected. There was a non-significant reduction of diet soft-drinks; however, there were reductions of similar magnitudes in all drink categories. A mean change of -1.3% per store ($p=0.01$) was observed for the contribution of refrigerator groceries (e.g. fresh milk) to food and beverage sales (Table 2).

Qualitative data provide evidence that contributes to explaining the lack of discernible impact on purchasing. The data revealed two key themes and a number of sub-themes in relation to: i) implementation fidelity, and ii) design factors affecting outcomes, which could be improved.

Implementation fidelity

Three sub-themes, discount application, store infrastructure and discount promotion were identified in relation to implementation fidelity and have been summarised in Supplementary Table 1.

Discount application

An assessment of product unit prices provide evidence that the Grocery, F&V landed cost and Diet soft-drink discount strategies were applied as intended in nearly all stores.

Store infrastructure

Point-of-sale scales were required for the transition from the supply and sale of pre-packaged fresh fruit and vegetables to a largely loose range of fresh fruit and vegetables. This infrastructure was purchased and installed in all stores³⁴ and was observed to be functioning in the six stores visited (Supplementary Table 1).

Discount promotion

Promotional material was designed and distributed for three of the strategies to all participating stores.³⁴ The material was reported as received in all six stores visited. Varying levels of use of the promotional materials were reported; the two F&V strategies were promoted while the Grocery strategy was promoted in a limited way or not at all (Supplementary Table 1).

Interview data suggested that customers' understanding of the F&V point-of-sale scales, the strategy promoted the most in stores, was a barrier to the potential effectiveness of the strategy.

'Some people don't understand; they still buy it [i.e. fruit and vegetables] though. It would be good to understand the way it [i.e. F&V point-of-sale scales] works and more about it.' (Male, Aboriginal, Store Committee member)

One store manager suggested that an educational component was needed alongside the strategy to enhance its effectiveness.

'... there's no price on something that they are picking up. The benefit of cheaper is probably

not immediately obvious to the customer.' (Male, non-Aboriginal, Store Manager)

Design factors impacting on strategy outcome

There was strong support for the use of price discounts in improving access to nutritious and affordable food. There was unanimous support from store managers, store staff, store committee members and customers for reducing the price of basic, nutritious, routinely purchased food and beverages. Lower retail prices were expected to increase the volume of food and beverage purchases.

'If the prices were down, they'd get more and more.' (Male, Aboriginal, Store Committee member)

One customer referred to the price of food relative to income.

'Price should be down a little bit because we don't get good money out of this CDEP [i.e. Community Development Employment Program].' (Male, Aboriginal, Customer)

Most non-Aboriginal participants commented that discounts specifically on fruit and vegetables would have no impact on sales; conversely most Aboriginal participants believed they would. Store committee members had considered the potential to fund a price discount on fruit and vegetables through store profits or price increases on unhealthy foods and beverages.

A range of sub-themes were identified as important in strategy design for an effective outcome: i) product characteristics, ii) store infrastructure, iii) magnitude of discount, iv) design of promotion, and v) complementary strategies.

Product characteristics

Despite the perceived lack of understanding of the operation of the F&V point-of-sale scales, the introduction of loose fruit and vegetables seemed to be appreciated. Interviewees also referred to the importance of having produce that was of high quality, consistently available, attractively displayed and with the price displayed, although the challenges in consistently achieving these standards were noted.

Store infrastructure

Store infrastructure was also considered an enabler to strategy implementation. Store managers interviewed generally reported having adequate and functioning refrigeration and display units to stock

Table 2: Mean change in store sales after the month/s the strategies were introduced compared to before the strategies were introduced in 18 remote stores, July 2009 to December 2010.^a

Strategy	Outcome measures	N stores	Mean at baseline	Absolute Change	
				Mean (95% CI)	p-value
Grocery	Per cent (%) shelf groceries to total food and beverage sales (\$)	17	65.7	-0.2 (-1.3, 0.9)	0.7
	Per cent (%) refrigerator groceries to total food and beverage sales (\$)	5	9.5	-1.3 (-2.2, -0.3)	0.01
	Per cent (%) freezer groceries to total food and beverage sales (\$)	5	12.4	-0.03 (-1.2, 1.1)	0.97
Fresh fruit and vegetables at landed cost	Fruit turnover ^b (kg)	3	616	-3% (-37, 49)	0.9
	Vegetable turnover ^b (kg)	3	496	-8% (-35, 30)	0.6
Diet soft-drink discount	Diet soft-drink turnover ^b (litres)	16	567	-17% (-33, 2)	0.08
	Water turnover ^b (litres)	16	441	-11% (-29, 11)	0.3
	Soft-drink turnover ^b (litres)	16	2,978	-19% (-28, -10)	<0.001

a: Using a mixed effects model with random effect intercept which adjusted for correlation of monthly sales with the same store. AR(1) temporal correlation was assumed; and calendar month was adjusted for in models involving beverages, as there was sufficient data to adjust for seasonal variation.

b: Turnover refers to volume of product sold.

groceries, fresh fruit and vegetables, and beverages.

Magnitude of discount

Aboriginal and non-Aboriginal participants referred to the concept of 'price thresholds' in relation to the Diet soft-drink discount. It was suggested that the difference in drink prices being below or above a whole dollar, had an impact on purchasing.

'Under \$5.00 seems to make them [i.e. the children] buy the diet [drinks].' (Female, Aboriginal, Store Committee member)

'They [i.e. customers] will buy the one [1.25 litre diet soft-drink] under the dollar mark if that's all they have.' (Male, non-Aboriginal, Store Manager)

The magnitude of the price discount also needed to be of a size that was considered to be of value, particularly by the store staff who would promote it. Store staff did not feel that the Grocery discount was of value and/or sustained, and for this reason did not promote it.

'When it did happen, I could see in the price tickets that it wasn't a big deal. Not noticeable, therefore we didn't carry on and promote it ...' (Male, non-Aboriginal, Store Manager)

'[We] received the poster. But half [of the products] were dearer at the time so it wasn't a good story to advertise. We didn't put it up [i.e. the poster].' (Male, non-Aboriginal, Store Manager)

Design of promotion

The interviewees reported that a discount must be made explicit to customers and that promotional material be simple, colourful and pictorial, with Aboriginal participants also reporting the need for the current and previous price, along with the savings to be included. Various methods of communicating strategies were thought appropriate, including price tickets, shelf-talkers, small posters, large banners, chalk boards and static displays on television screens in addition to involving Aboriginal store committee members in communicating the strategies to consumers.

Complementary strategies

Interviewees referred to the use of complementary activities to promote uptake of the discounted products including tastings and demonstrations of fruit and vegetables and high visibility and consumer education of healthy beverage options.

Discussion

This study describes the type of food pricing strategies (discounts on grocery products, fresh fruit and vegetables and diet soft-drinks) implemented by a remote retail organisation with the aim of improving access to nutritious and affordable food. While we were unable to discern any change in sales, the qualitative data indicate that implementation fidelity and design factors, including discount promotion and magnitude, were barriers limiting the impact of these strategies. There was strong support for the use of food pricing policy in nutrition improvement. This study demonstrates factors to be considered and the commitment required to fully implement and monitor strategies to improve health in this challenging remote retail context.

While the qualitative data indicate that discount application and infrastructure were strengths of strategy implementation across stores, the strategies were ineffective because of poor communication with store owners, staff and customers in relation to promotion of the discount. The promotional materials were used for both F&V strategies, although did not seem to have been understood well by customers. The Grocery strategy promotional material was used in a limited way or not at all in stores – the discount was not valued by staff as it was considered to be of small magnitude and short duration. The design of the Diet soft-drink discount strategy did not include promotional material. Promotion is considered a key factor required for the success of discount strategies;²⁵ an element that was considered a weakness in the design and implementation of these strategies. Greater communication with store managers, staff and store committee members may have improved the outcome of these strategies.³⁵ The need for monitoring of strategy implementation was also highlighted.

This study also highlights potentially important elements of price strategy design. The literature shows that there is a gap in understanding the magnitude of a subsidy or tax required to achieve the desired outcome.^{13,19} Mostly, the pricing strategies, at about 10%, were of a small magnitude and lower than that of supermarket trials, which have demonstrated impact on purchasing healthier foods, fruit and vegetables at 12.5%, 20% and 50% discount.¹⁰⁻¹² The data indicated that a 'threshold value', i.e. under or over a

dollar mark (e.g. \$1.95 or \$2.20) may influence purchasing decisions particularly for drinks, and that it is important that both staff and customers value the level of discount applied.

The key strength of this evaluation was the use of a mixed methods design, where sequentially connecting qualitative with quantitative methods provided an understanding of a lack of impact of price discount strategies within this context. Quantitative point-of-sale data can be used to measure outcomes in response to implementation of strategies.³⁶ The qualitative data were crucial to interpreting the quantitative results and to provide an understanding of why the expected outcomes were not achieved and insights to inform future strategy design.

The design of the strategies did not include a prospective evaluation component. Strategies that are being implemented by retail associations and remote stores offer a unique opportunity as a natural experiment to add to the limited evidence on the impact of food pricing policy to promote health,^{14,21} especially considering the impact for a specific population group.¹³⁻¹⁸ The lack of an evaluation component in the design of the strategy, however, limited the scope of this work. The available data set was limited by the level of implementation, number of stores and the number of months before and after discount implementation. These factors are likely to have a significant impact on measuring impact in a setting that experiences wide, within-store and between-store variation in month-to-month sales, with low baseline sales and/or small changes in sales expected based on available price elasticity data. Some strategies such as the F&V point-of-sale scales may take time to show an effect, which may not have been captured in the period of evaluation. The evaluation was unable to account for factors that potentially influence sales such as population movement, seasonal effects (for some strategies), interruptions to supply and store management practices. The timing of the interviews occurred from five to up to 12 months after the first strategy was implemented. The interviewees were over-represented by people over 35 years of age. It was a challenge to engage customers, though store committee members, who act on behalf of community residents, were well-represented in the sample.

Implications

This is the first published evaluation of store-initiated strategies to effect price reduction on targeted lines in remote Aboriginal Australia. Explanatory qualitative data identified flaws with strategy design and implementation that were likely to have contributed to the lack of discernible impact on purchasing observed. This evaluation highlights that for food pricing policy to be effective in this context: i) magnitude (including 'price threshold'), duration and promotion must be considered in design; ii) customers, store owners and staff should contribute to design to ensure it is valued; and, iii) monitoring of implementation should occur. The literature to inform food pricing policy has grown rapidly since the implementation of these policies, including in relation to magnitude,^{10-13,37} which in addition to the finding related to a 'threshold value' of this study, would be valuable to informing the design of future food pricing policy. The feasibility and sustainability of these would need to be considered by the implementing organisation or store.⁹ Robust evaluation of natural experiments, as presented here, is vital to inform policy within an organisation or store and to contribute to broader policy. To minimise the limitations of retrospective study, evaluation should be considered prospectively as part of strategy design, to ensure the conduct of a robust evaluation, with concurrent collection of appropriate quantitative and qualitative data.

These price discount strategies were implemented in direct response to feedback provided by Aboriginal leaders and customers in remote communities and make a contribution to reducing the high cost of food in remote communities. This study demonstrates that food pricing policy continues to be considered a priority for nutrition improvement. Aboriginal leaders and retailers are seeking solutions to nutrition improvement and are committed to effecting positive change through the food supply. There is an opportunity to make a difference through collaborations that support well-designed and evaluated strategies or intervention studies, particularly in such a complex environment to service such as remote Australia.

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References

- Vos T, Barker B, Begg S, et al. Burden of disease and injury in Aboriginal and Torres Strait Islander Peoples: The Indigenous health gap. *Int J Epidemiol*. 2009;38(2):470-7.
- Brimblecombe J, Ferguson M, Liberato S, O'Dea K. Characteristics of the community-level diet of Aboriginal people in remote northern Australia. *Med J Aust*. 2013;198(7):380-4.
- Australian Institute of Health and Welfare. *Australia's Food and Nutrition 2012*. Catalogue No.: PHE 163. Canberra (AUST): AIHW; 2012.
- Glanz K, Basil M, Maibach E, et al. Why Americans eat what they do: Taste, nutrition, cost, convenience, an weight control concerns as influences on food consumption. *J Am Diet Assoc*. 1998;98(10):1118-26.
- Department of Health. *Northern Territory Market Basket Survey 2014*. Darwin (AUST): Northern Territory Government of Australia; 2015.
- Biddle N. Socioeconomic Outcomes. In: *CAEPR Indigenous Population Project 2011 Census Papers. Paper 13*. Canberra (AUST): Australian National University; 2013.
- Brimblecombe J, O'Dea K. The role of energy cost in food choices for an Aboriginal population in northern Australia. *Med J Aust*. 2009;190(10):549-51.
- Eyles H, Ni Mhurchu C, Nghiem N, Blakely T. Food pricing strategies, population diets, and non-communicable disease: A systematic review of simulation studies. *PLoS Med*. 2012;9(12):e1001353.
- Magnus A, Moodie ML, Ferguson M, et al. The modelled economic credentials of price discounts to improve diet in remote Australian indigenous communities. *Aust N Z J Public Health*. 2016;40 Suppl 1:36-41.
- Ni Mhurchu C, Blakely T, Jiang Y, et al. Effects of price discounts and tailored nutrition education on supermarket purchases: A randomized controlled trial. *Am J Clin Nutr*. 2010;91(3):736-47.
- Waterlander W, de Boer M, Schuit A, et al. Price discounts significantly enhance fruit and vegetable purchases when combined with nutrition education: A randomized controlled supermarket trial. *Am J Clin Nutr*. 2013;97(4):886-95.
- Ball K, McNaughton SA, Le HN, et al. Influence of price discounts and skill-building strategies on purchase and consumption of healthy food and beverages: Outcomes of the Supermarket Healthy Eating for Life randomized controlled trial. *Am J Clin Nutr*. 2015;101(5):1055-64.
- Epstein LH, Jankowiak N, Nederkoorn C, et al. Experimental research on the relation between food price changes and food-purchasing patterns: A targeted review. *Am J Clin Nutr*. 2012;95(4):789-809.
- Powell LM, Chaloupka FJ. Food prices and obesity: Evidence and policy implications for taxes and subsidies. *Milbank Q*. 2009;87(1):229-57.
- Thow A, Jan S, Leeder S, Swinburn B. The effect of fiscal policy on diet, obesity and chronic disease: A systematic review. *Bull World Health Organ*. 2010;88(8):609-14.
- Liberato S, Baillie R, Brimblecombe J. Nutrition interventions at point-of-sale to encourage healthier food purchasing: A systematic review. *BMC Public Health*. 2014;14:919.

- Niebylski ML, Redburn KA, Duhany T, Campbell NR. Healthy food subsidies and unhealthy food taxation: A systematic review of the evidence. *Nutrition*. 2015;31(6):787-95.
- Shemilt I, Hollands GJ, Marteau TM, et al. Economic instruments for population diet and physical activity behaviour change: A systematic scoping review. *PLoS One*. 2013;8(9):e75070.
- Kane RL, Johnson PE, Town RJ, Butler M. A structured review of the effect of economic incentives on consumers' preventive behavior. *Am J Prev Med*. 2004;27(4):327-52.
- Powell L, Chiqui J, Khan T, et al. Assessing the potential effectiveness of food and beverage taxes and subsidies for improving public health: A systematic review of prices, demand and body weight outcomes. *Obes Rev*. 2013;14(2):110-28.
- Capacci S, Mazzocchi M, Shankar B, et al. Policies to promote healthy eating in Europe: A structured review of policies and their effectiveness. *Nutr Rev*. 2012;70(3):188-200.
- The Arnhem Land Progress Aboriginal Corporation. *Nutrition Policy* [Internet]. Darwin (AUST): ALPA, 2014 [cited 2014 Feb 9]. Available from: <http://www.alpa.asn.au/pages/Nutrition-Policy.html>
- Outback Stores. *Nutrition Strategy* [Internet]. Darwin (AUST): Outback Stores; 2013 [cited 2014 Feb 11]. Available from: <http://outbackstores.com.au/wp-content/uploads/2013/09/Nutrition-Strategy.pdf>
- Brimblecombe J, Ferguson M, Liberato S, et al. Stores Healthy Options Project in Remote Indigenous Communities (SHOP@RIC): A protocol of a randomised trial promoting healthy food and beverage purchases through price discounts and in-store nutrition education. *BMC Public Health*. 2013;13:744-54.
- Hawkes C. Sales promotion and food consumption. *Nutr Rev*. 2009;67(6):333-42.
- Gittelsohn J, Rowan M, Gadhoke P. Interventions in small food stores to change the food environment, improve diet, and reduce risk of chronic disease. *Prev Chronic Dis*. 2012;9:10015.
- Outback Stores. *Homepage* [Internet]. Darwin (AUST): Outback Stores, 2015 [cited 2015 Nov 20]. Available from: <http://www.outbackstores.com.au/>
- Outback Stores. *Project Report - Improving Community Capacity to Deliver Healthy Food: A Partnership Approach with the WYN Health Board and the Department of Health and Families*. Darwin (AUST): Outback Stores; 2010.
- Fetters MD, Freshwater D. Publishing a methodological mixed methods research article. *J Mix Methods Res*. 2015;9(3):203-13.
- Ivankova NV, Creswell J, Stick SL. Using mixed-methods sequential explanatory design: From theory to practice. *Field Methods*. 2006;18(1):3-20.
- Thomas DP, Ferguson M, Johnston V, Brimblecombe J. Impact and perceptions of tobacco tax increase in remote Australian Aboriginal communities. *Nicotine Tob Res*. 2013;15(6):1099-106.
- Halcomb EJ, Davidson PM. Is verbatim transcription of interview data always necessary? *Appl Nurs Res*. 2006;19(1):38-42.
- Hansen EC. *Successful Qualitative Health Research, A Practical Introduction*. Crows Nest (AUST): Allen and Unwin; 2006.
- Gunther A. *Nutrition*. Darwin (AUST): Menzies School of Health Research; 2015.
- Gardiner B, Blake M, Harris R, et al. Can small stores have a big impact? A qualitative evaluation of a store fruit and vegetable initiative. *Health Promot J Austr*. 2013;24(3):192-8.
- Brimblecombe J, Liddle R, O'Dea K. Use of point-of-sale data to assess food and nutrient quality in remote stores. *Public Health Nutr*. 2012;16(7):1159-67.
- An R. Effectiveness of subsidies in promoting healthy food purchases and consumption: A review of field experiments. *Public Health Nutr*. 2013;16(7):1215-28.

Supporting Information

Additional supporting information may be found in the online version of this article:

Supplementary Table 1: Characteristics and implementation fidelity of food and beverage strategies.