THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

Healthier vending machines in workplaces: both possible and effective

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Abstract

Aim To develop healthier vending guidelines and assess their effect on the nutrient content and sales of snack products sold through hospital vending machines, and on staff satisfaction.

Methods Nutrition guidelines for healthier vending machine products were developed and implemented in 14 snack vending machines at two hospital sites in Auckland, New Zealand. The guidelines comprised threshold criteria for energy, saturated fat, sugar, and sodium content of vended foods. Sales data were collected prior to introduction of the guidelines (March–May 2007), and again post-introduction (March–May 2008). A food composition database was used to assess impact of the intervention on nutrient content of purchases. A staff survey was also conducted pre- and post-intervention to assess acceptability.

Results Pre-intervention, 16% of staff used vending machines once a week or more, with little change post-intervention (15%). The guidelines resulted in a substantial reduction in the amount of energy (-24%), total fat (-32%), saturated fat (-41%), and total sugars (-30%) per 100g product sold. Sales volumes were not affected, and the proportion of staff satisfied with vending machine products increased.

Conclusions Implementation of nutrition guidelines in hospital vending machines led to substantial improvements in nutrient content of vending products sold. Wider implementation of these guidelines is recommended.

Snack vending machines are part of an obesogenic environment that promotes easy access to energy-dense, nutrient-poor foods. Typically, vending machines offer few healthy options.[1] Thus, they make the *un*healthy choice the easy choice, which is contrary to the goals of public health nutrition.[2] They are therefore an appropriate target for interventions to improve the nutrition environment.

Previous research has examined the effect of reduced price and/or promotion of healthier choices in vending machines.[3-7] However, no studies to date have assessed the impact of vending nutrition guidelines on the nutrient profile of products sold from vending machines.

Nutrition guidelines have been used in a variety of interventions and situations. Positive effects have been seen in schools in the United States. Implementation of nutrition guidelines has lead to increased proportion of snacks meeting guidelines stocked in vending machines,[8] decreased consumption of snacks with low nutritional value,[9] and decreased purchasing of less healthy meals.[10]

Recent research on the feasibility of point-of-purchase interventions strongly recommended pilot studies which examine sales figures, consumer satisfaction, and

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practical feasibility prior to implementation.[11] This pragmatic community intervention study aimed to assess the effect of implementation of healthier vending guidelines on the nutrient content of products sold, sales, and customer satisfaction.

Specific objectives were to develop nutrition criteria for vending machines (Better Vending for Health [BVFH] guidelines)[12] and assess their effect on the amount of energy, total fat, saturated fat, sugar and sodium sold from snack vending machines; measure total product sales; and assess staff satisfaction with vending machine product choices. Vending machines selling beverages were excluded.

Methods

Study setting—The study was carried out at two hospital sites in Auckland, New Zealand (North Shore Hospital and Waitakere Hospital) between March 2007 and May 2008. Hospital vending machines were accessible by staff and some visitors. Staff working at the hospitals included administrators, managers, health professionals, cleaning and catering staff, security, and clerical staff. At baseline 4700 staff (4000 Full Time Equivalent positions [FTE]) worked at the two hospitals.

Study phases—There were three phases to the study: development of nutrition criteria; staff surveys pre-intervention and midway through the intervention; and collection and analysis of 3 months of vending machine sales data pre-intervention and post-intervention. Sales data were linked to a specially compiled nutrient database of vending snack products. The Northern X Regional Ethics Committee stated that ethical approval was not required for the study.

Nutrition criteria development (BVFH guidelines)—Nutrition criteria for the BVFH guidelines were developed by eight nutrition professionals representing local District Health Boards, the Auckland Regional Public Health Service, the National Heart Foundation of New Zealand, and the University of Auckland. The nutrition criteria (Figure 1) focused on energy, saturated fat, sodium, and portion sizes of confectionery. They were based on existing New Zealand food and nutrition guidelines and classification systems, including the Food and Beverage Classification System for schools, and modelling of the discretionary energy allowance for snacks.

Two levels of classification were developed: 'better' and 'other' choices. Products had to meet one of these classifications to be stocked in vending machines, and the ratio of 'better' to 'other' choices could be adjusted to suit individual workplaces. To be a 'better choice' item, foods were required to contain ≤800kJ per packet, ≤1.5g saturated fat per 100g, ≤450mg sodium per 100g, and not be confectionery. 'Other choice' items were only required to meet the energy criteria (≤800kJ/packet).

Preliminary modelling work was conducted to assess how many current vending snack foods met the criteria, to ensure foods were classified in a way that was consistent with foods generally considered as healthier options, and to ensure the guidelines were appropriate and feasible. The guidelines were intended to be simple and straightforward to facilitate use by vending contractors, and able to be written into the vending contract. The vending contractor was trained how to use the guidelines, and was responsible for ensuring machines were stocked correctly.

In this study, vending machines were stocked with 50% better choices and 50% other choices. Examples of 'better choice' vending items included small packets of rice crackers, dried fruit, tuna and crackers, dried fruit bars, and soup mix sachets. 'Other choice' items included finger-sized chocolate bars, small cookies (30g) with reduced saturated fat content (1.5g), lower fat potato chips, some puffed snack products, some muesli bars, and small packets of confectionery.

'Other choices' were included in the guidelines because of limited availability of products for vending machines that met 'better choice' guidelines. Furthermore, it was recognised that allowing inclusion of some 'treat' type foods would provide more flexibility for individual worksites adopting the guidelines. The 800kJ cap on 'other choices' ensured that these treat foods were in appropriate serving sizes, and eliminated the traditional vending range of high-energy foods.

Figure 1. Criteria for snacks sold through vending machines (Better Vending for Health guidelines) at two hospital sites in Auckland, New Zealand in 2007-08

BETTER CHOICES	**ENERGY**	**SATURATED FAT**	**SODIUM**
	≤ 800Kj per packet*	≤ 1.5g/100g	≤ 450mg/100g
	Excludes confectionary items: i.e. soft / hard lollies (candy), marshmallows, licorice, chocolate, carob, or chewing gum. Sugar-free varieties are also excluded.		
OTHER CHOICES	≤ 800kJ per packet	Not restricted	Not restricted

* For packets containing more than one serve of an item, it is the packet size (not the serving size) that must meet these guidelines.

Implementation of guidelines—BVFH guidelines were gradually phased into all vending machines at the two main hospital sites over a 2-month period. Products meeting the criteria were identified from the existing vending contractor's product range, and additional suitable products were also sourced. An implementation manual was developed for vending contractors to provide guidance on how to identify suitable products.

The guidelines were introduced as part of an overall District Health Board (DHB) workplace food and nutrition policy that was in the process of being developed and implemented. Under the same policy, sugary beverages had previously been removed from DHB beverage vending machines. Staff were informed of planned changes to vending machines in a monthly staff newsletter, following a baseline staff survey. Vending products were not signposted in the machine as 'better' or 'other' choices.

Staff surveys—Two staff surveys were conducted: one before and the other midway through the intervention phase. Surveys were web-based, and staff were informed of the survey by email. The surveys assessed where staff usually obtained the food they ate at work, frequency of snack vending machine use, reasons for non-use of vending machines, food usually purchased from vending machines, number of items purchased, whether staff tried to choose healthier items, satisfaction with vending machines, suggestions for additional foods they would like in vending machines, and socio-demographic data.

The second survey, during the intervention period, also assessed self-reported change to vending machine purchases following introduction of the BVFH guidelines.

Sales data—Sales data (the number of items re-stocked) were collected from all snack vending machines across two hospital sites (n=14 machines). In addition, a stocktake of each vending machine was completed at the beginning and end of the data collection period. During the stocktake the quality of data collection was monitored and stock was checked for compliance with the guidelines.

Baseline (pre-intervention) sales data were collected for 3 complete months from March to May 2007 and intervention sales data were collected 1 year later from March to May 2008. This time period was chosen to minimise seasonal variation in vending machine purchases. The changeover to healthier vending options was carried out gradually over a 2-month period (October to November 2007).

Sales data were linked to a nutrient database, which contained the energy, total fat, saturated fat, total sugars, and sodium contents of vending products based on the mandatory nutrition information panel information on their packaging.

Study outcomes and analyses—The primary outcome was the effect of the intervention on energy density (kJ/100g) and energy per packet (kJ). Secondary outcomes were sales of total fat, saturated fat, sugars and sodium per 100g of food sold from vending machines; change in machine sales (absolute amount and dollar value); and staff satisfaction.

Product nutrient and sales data were entered into an Excel spreadsheet and extracted into SAS Version 9.1 for analysis. Descriptive analyses were undertaken for both sales data and staff surveys. Measures of variability (e.g. confidence intervals) were not calculated for sales data due to the clear difference in outcomes following intervention.

Total sales value ($) over the 3-month baseline and intervention period were estimated by multiplying product price by number of items sold per product. The price of products at the start of intervention was used for both baseline and intervention price calculations to avoid confounding due to price increases between assessment periods.

Data from the first stocktake at the beginning of the baseline period could not be used due to missing data. However, monthly stocktakes were conducted throughout, and the stocktake from the end of the first month was used as a surrogate starting point for the baseline stocktake. In order to determine whether this made a difference to sales results, a sensitivity analysis was conducted. Sales volumes were also estimated based on number of products restocked only (starting and end stock were not included) as a surrogate for sales.

Results

Staff surveys—The baseline web survey was completed by 18% of all DHB staff (n=835); 84% were female, 57% were health professionals, and 82% were NZ European or Other ethnicity (non Māori, Pacific or Asian), with a mean age of 43 years. The follow-up survey was completed by 13% of all DHB staff (n=611), with similar demographics to the baseline survey, which are generally representative of the staff population (80% female, average age 44 years[13]).

Most respondents either *never* or *infrequently* used vending machines (84% at baseline, 85% at intervention). Vending products preferred by machine users were chocolate and potato chips/crisps, and most users only bought one item at a time (84% and 85%). At least half (51% and 53%) claimed to try to choose healthier items. At baseline, 27% of staff who used vending machines were *somewhat* or *very satisfied* with the vending range, and this increased to 46% post-intervention.

After introduction of the BVFH guidelines, 87% of staff who used vending machines had noticed healthier snacks were available. Forty-seven percent thought the range had improved, 27% thought it was about the same, and 26% thought the range was worse. One-tenth (11%) reported they now used vending machines at work more frequently. Over half (54%) of the staff who used vending machines had changed their choices, with one-third (31%) reporting this change was in order to make healthier choices.

Sales data and effect on nutrient content of products sold—During the 3-month baseline period, 13,749 individual items of food were sold (611 kg total weight) through snack vending machines. In the post-intervention period, 17,425 items (611 kg) were sold, an increase of 3676 items. Total weight (kg product sold) did not change, as some products were sold in smaller-sized packets. Staff numbers also increased over the same time period, by around 400 FTE. When taking staff numbers into account, 3.4 items were purchased from vending machines per FTE over the 3-month baseline period. During the intervention period, 4.0 items were purchased per FTE, giving an average increase in sales of half a packet (0.5 items).

Implementation of the BVFH guidelines decreased average energy content per product sold from 939kJ per packet to 563kJ per packet—a 40% reduction (Figure 2). Per 100g, average energy content reduced by 24% to 1606kJ/100g. The average total fat content per 100g of products sold reduced by 32% (from 28g/100g to 19g/100g) (Figure 3).

Saturated fat also reduced, by 41% to an average of 7g/100g, primarily due to removal of most cookies and some potato chip/crisp varieties. This level is higher than the

'better choice' guideline threshold of ≤1.5g/100g because only 50% of products stocked were 'better choices', and 'other choices' did not have a specified saturated fat threshold. The average percentage of total sugars in products sold decreased by 30%.

Figure 2. Change in the amount of energy per 100g and per packet sold through vending machines at baseline (2007) and post-intervention (2008)

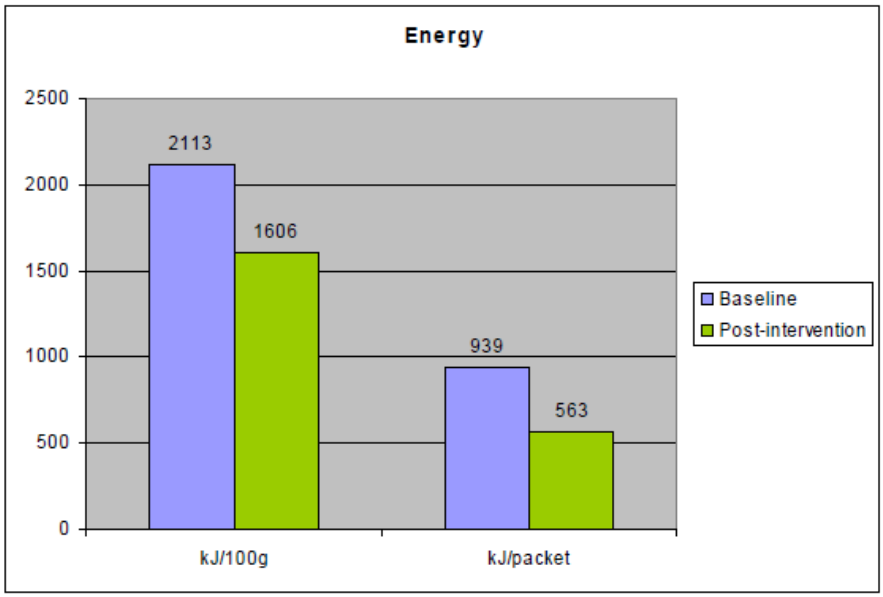
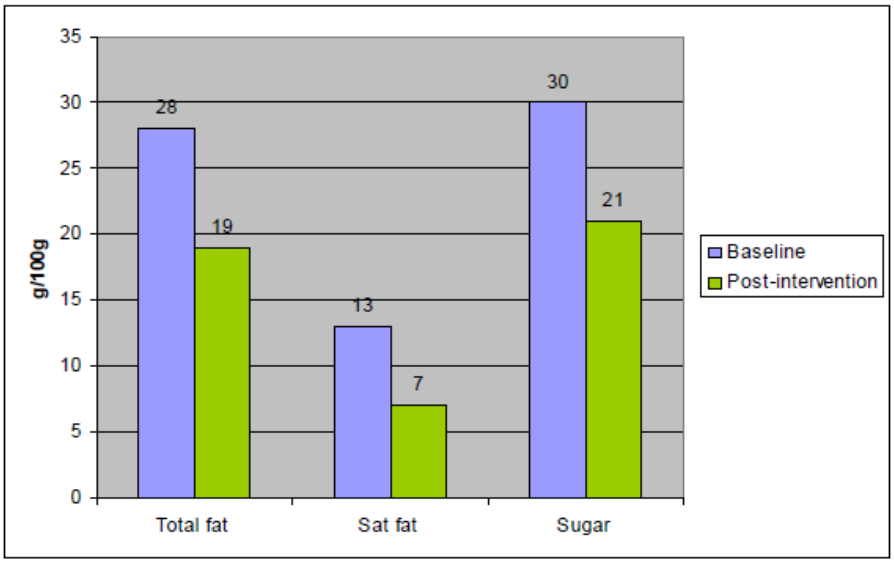
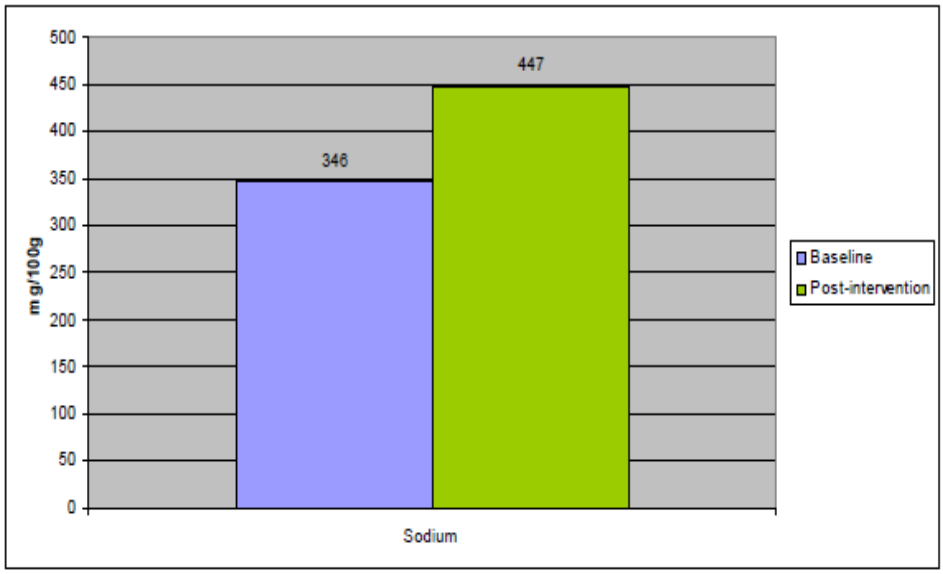


Figure 3. Change in fat and total sugars per 100g product sold through vending machines at baseline (2007) and post intervention (2008)



Sodium was the only nutrient that did not show changes in the direction expected (Figure 4). Overall, levels stayed within the guidelines for 'better choices' (<450mg/100g). However, there was an overall increase of 101mg/100g (29%) sodium in products sold. This increase was largely due to increased sales of puffed snack and potato chip/crisp products.

Figure 4. Change in sodium per 100g product sold through vending machines at baseline (2007) and post-intervention (2008)



The top-selling items (over 500 items sold) during the intervention were reduced-fat chips and puffed savoury snacks, small chocolate bars, small reduced-fat cookies, small packets of lollies, and rice crackers. Of the 'better choice' options, as well as rice crackers, apple crisps (n=328 packets sold), tuna and crackers (n=316), dried fruit (n=232), and soup mixes (n=200) were the most popular items.

Between baseline and post-intervention, the total sales value increased by a total of NZ$1538. Per staff FTE, sales over the 3-months were NZ$5.70 for baseline sales and NZ$5.53 post-intervention. The average price per item sold at baseline was NZ$1.66 and the average price per item sold under the BVFH guidelines was NZ$1.40. The reduced price was due to the lower cost of smaller packet sizes, especially the chocolate bars. Some 'better choice' items in the intervention were more expensive than average, such as cooked rice meals ($3), and tuna and crackers ($2.50). Potato chip/crisps and puffed savoury snacks remained the same price.

Discussion

This study examined a pragmatic intervention aimed at improving the food environment by introducing healthier snack choices into workplace vending machines. Introduction of the BVFH guidelines led to a substantial decrease in energy, total fat, saturated fat, and sugars sold through vending machines. Over a 1-year period, this was equivalent to the removal of approximately 12,400MJ, 210kg of total fat, 130kg of saturated fat, and 220kg of sugars from vending machines at these sites.

Furthermore, machine sales did not decrease (which is an important consideration for vending contractors), and staff reported improved satisfaction with the vending range. Thus, implementing the BVFH guidelines more widely could make a small but important difference to the diet of people who frequently buy snacks from vending machines.

This research adds to the existing body of evidence on vending machines by showing the effectiveness of nutrition guidelines. To date, much vending research has focused on pricing or promotion interventions.[5,6,14-16] Lowering the price of healthier options, however, appears to lead to increased sales of both healthier and less healthy options.[5]

Likewise, promoting healthier choices may increase sales of both healthy and less healthy choices.[15] The current study did not use promotions or price discounts to encourage 'better choices', and instead focused on assessing the effect of increased availability of healthier options, and elimination of products that did not meet the BVFH guidelines.

Whilst introduction of the BVFH guidelines resulted in beneficial changes in most nutrients, the sodium content of products sold post-intervention increased, mainly due to potato chip/crisp or puffed snack sales. As these were a top-selling item, vending machines were stocked with a wide selection. There can be substantial variation in sodium content between flavours in a product range and between crisp or puffed snack products. Including flavours or products with lower sodium contents could therefore potentially reduce the amount of sodium sold. Consideration could also be given to introducing sodium criteria for 'other choices'. Nevertheless, average sodium remained below the guideline threshold and the overall impact of the BVFH guidelines on nutrition was still largely positive.

Introduction of the BVFH guidelines did not result in any substantial changes to usage of vending machines or amount of product purchased. Whilst one-tenth of vending machine users reported that they were using vending machines more frequently, one-third used them less often, and the overall usage remained very low (85% of staff infrequently or never used vending machines).

Average sales per staff member only increased by half a packet over the 3 months, with no change in total weight of product sold. Whilst there was an increase in total sales value, this may have been largely driven by an increased staff FTE. If the FTE had not increased, total sales value may have decreased due to the lower average price per item, due to smaller packet sizes. There was demand from around half of the staff who replied to the survey for healthy options to be supplied in vending machines, although a minority opposed changes.

The BVFH guidelines served to introduce a range of healthier options for those who previously did not have that choice, whilst still providing some 'treat' type options in appropriate serving sizes. It has been said that to succeed in changing diets, healthier foods must first be available,[17] and the BVFH guidelines assisted in increasing availability in vending machines.

Of the nine products that sold over 500 items in the 3-month intervention period, only one was a 'better choice' item (rice crackers). The remaining items were 'other choice' products. Thus, there is potential to improve the range of 'better choice' items to increase demand, although there are currently limited options from which to select, mainly because products are often made in specific packet sizes for vending machines.

Should the BVFH guidelines be implemented widely across worksites, schools and other locations in New Zealand, they should provide an incentive for food manufacturers to reformulate products to meet 'better choice' criteria, thus improving the range of options available. Some manufacturers have demonstrated willingness to reformulate to meet nutrition guidelines such as these, as was the case following introduction of national nutrition guidelines for food and drinks sold in schools in New Zealand.[18] As a wider range of 'better choice' products become available, the ratio of 'better' to 'other' choices stocked in vending machines can be increased to provide more 'better choice' options.

Successful implementation of the BVFH guidelines depends on active participation of both worksites and vending contractors. For this study, initial support for the vending contractor in identifying suitable products was provided by a public health dietitian at the DHB. Similar support could be provided by public health organisations to assist worksites and vending contractors in successfully implementing the BVFH guidelines elsewhere.

Vending machines are likely to remain a part of the nutrition environment. This study therefore provides some reassurance to vending contractors and host institutions regarding the feasibility and acceptability of introducing healthier products into vending machines, in the context of the limitations discussed below.

These results should be used to support the implementation of the BVFH guidelines on a wider scale. Examples of suitable venues would be schools that host vending machines (in combination with the Food and Beverage Classification system), leisure facilities such as gyms, and other worksites. Further research into the additional effects of price and/or promotion interventions on sales in vending machines with the BVFH Guidelines would be useful.

Study limitations and strengths—The strengths of the study include its assessment of the implementation of healthier vending criteria in a real-world setting; its multi method design; the use of sales data as a robust, objective measure of effect; and the extended length of time over which sales data was collected, which minimised any effect of seasonal variability.

The staff survey achieved very low response rates and cannot be considered representative; however, demographics of respondents did not appear to differ substantially from the general hospital staff population (in terms of sex, age, profession, and ethnicity). The study was also conducted in a hospital/health provider

setting, and thus results may not be generalisable to all workplaces. Nevertheless, staff at the hospitals comprised a diverse range of health professionals, administrative, clerical and manual workers.

Price changes could potentially have influenced sales, but this likely worked in both directions. Prices for some of the products reduced due to smaller packet sizes, some remained the same, and others increased.

Finally, we did not assess dietary intakes so cannot estimate the impact of the intervention on overall dietary intake of individuals. It is possible that some compensation may occur at other times of the day that could minimise the overall impact of the vending intervention.

Conclusion

Introduction of healthier vending guidelines led to improved nutrient profile of products sold through worksite vending machines, increased staff satisfaction with the product range, and had no adverse impact on total sales. The results show such guidelines are feasible and acceptable for both consumers and vending contractors. Similar interventions with a wider reach are indicated.

Competing interests: None known.

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Acknowledgments: The study was completed with the support of Waitemata District Health Board, and funding from Public Heath Operations at the Ministry of Health. Our thanks go to the vending contractor and the vending company for their work in expanding the range of suitable vending products, and for the extra work undertaken in recording sales data and stocktakes.

The BVFH guidelines* were developed by Julie Carter from Waitemata District Health Board, Penny King and Kate Sladden from Auckland District Health Board, Franica Yovich from Counties Manukau District Health Board, Elizabeth Stewart from Auckland Regional Public Health Service, Dave Monro from the National Heart Foundation, and Cliona Ni Mhurchu and Delvina Gorton from the Clinical Trials Research Unit at the University of Auckland.

*A copy of the guidelines are available at:
http://www.arphs.govt.nz/promoting_health/downloads/BVFH%20A4%20Booklet%20-%20FINAL%20-%20110108.pdf

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