

BMJ Open Towards global benchmarking of food environments and policies to reduce obesity and diet-related non-communicable diseases: design and methods for nation-wide surveys

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ABSTRACT

Introduction: Unhealthy diets are heavily driven by unhealthy food environments. The International Network for Food and Obesity/non-communicable diseases (NCDs) Research, Monitoring and Action Support (INFORMAS) has been established to reduce obesity, NCDs and their related inequalities globally. This paper describes the design and methods of the first-ever, comprehensive national survey on the healthiness of food environments and the public and private sector policies influencing them, as a first step towards global monitoring of food environments and policies.

Methods and analysis: A package of 11 substudies has been identified: (1) food composition, labelling and promotion on food packages; (2) food prices, shelf space and placement of foods in different outlets (mainly supermarkets); (3) food provision in schools/early childhood education (ECE) services and outdoor food promotion around schools/ECE services; (4) density of and proximity to food outlets in communities; food promotion to children via (5) television, (6) magazines, (7) sport club sponsorships, and (8) internet and social media; (9) analysis of the impact of trade and investment agreements on food environments; (10) government policies and actions; and (11) private sector actions and practices. For the substudies on food prices, provision, promotion and retail, 'environmental equity' indicators have been developed to check progress towards reducing diet-related health inequalities. Indicators for these modules will be assessed by tertiles of area deprivation index or school deciles. International 'best practice benchmarks' will be identified, against which to compare progress of countries on improving the healthiness of their food environments and policies.

Dissemination: This research is highly original due to the very 'upstream' approach being taken and its direct policy relevance. The detailed protocols will be offered to and adapted for countries of varying size and income in order to establish INFORMAS globally as a new monitoring initiative to reduce obesity and diet-related NCDs.

Strengths and limitations of this study

- This research will fill a much-needed gap in the information available regarding food environments and policies internationally.
- This research will contribute to informing, and strengthening the case for, policies to improve the healthiness of food environments.
- This project consists of 11 substudies, each of which are important in their own right, but provide a unique assessment of a country's food environment when combined.
- There are undoubtedly challenges for data collection, especially with larger countries, but the International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support (INFORMAS) has developed several step-based strategies to address this (eg, minimal, expanded and optimal steps of data collection depth; comprehensive, representative or sentinel site sampling for data collection breadth).
- Long-term funding will be necessary to achieve the greatest benefit from this work.

INTRODUCTION

The most recent estimates from the Global Burden of Disease (GBD) studies have shown the continued rise of the global burden of non-communicable diseases (NCDs) between 1990 and 2010, and the increased contribution of the nutrition-related risk factors to this burden.¹ Previous research has shown that the prevailing drivers of population weight gain are the 'push' effects from the food supply,²⁻⁴ which is dominated by increasingly widely available, inexpensive, heavily promoted and highly palatable, energy-dense foods high in saturated fats, salt and added sugars. There is

consensus^{5–7} on the general areas for action by the various sectors of society^{8–12} and it has been shown that many specific, food-related policies to change food environments are likely to be very effective and cost-effective at reducing obesity.^{10 12–14} In spite of all this, serious action from governments and the food industry has been slow and inadequate, in part due to the successful pressure of commercial food and media sectors on governments.^{15–17}

Monitoring and ensuring accountability for progress on reducing obesity and NCDs have been identified by the WHO as key roles for researchers as part of civil society. The 2013 World Health Assembly adopted a global plan on the control and prevention of NCDs and a monitoring framework to measure progress on 25 indicators towards nine targets.⁷ This framework, however, is very deficient in monitoring food policies and environments.

Food environments are the collective physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence people's food and beverage choices and nutritional status (adapted from refs. 18–20). Current food environments are driving unhealthy diets and energy overconsumption.² Therefore, a broader set of 'upstream' indicators is needed to complement current WHO monitoring efforts.²¹ The International Network for Food and Obesity/NCDs Research, Monitoring and Action Support (INFORMAS), established at Bellagio, Italy in November 2012²² aims to fill this important gap. It is a global network of public-interest organisations and researchers (currently 9 universities, 5 global NGOs, WHO and FAO) that aims to monitor, benchmark and support policies and actions to create healthy food environments and reduce obesity, NCDs and their related inequalities. INFORMAS is coordinated by the University of Auckland. Upstream indicators are more immediately responsive to policy changes than downstream indicators like mortality, but they are more difficult to measure. However, to be effective in influencing decision-makers, monitoring measures need to be robust, so that a country's policy efforts (eg, on food marketing to children or salt in the food supply) can be reliably compared to international best practice.

The INFORMAS monitoring framework contains 10 modules. The two process modules^{23 24} measure the implementation of priority policies and actions by governments and the food industry. The seven impact modules^{25–31} measure key aspects of food environments: composition; labelling; promotion; provision (eg, in schools and early childhood education (ECE) settings); food availability in-store and in communities; prices and affordability of healthy versus current diets; and food-related components of trade and investment agreements. The public health rationale for including each of these modules within the INFORMAS framework has been outlined in the overview papers.^{25–31} Other impact modules may be added to INFORMAS (food production, food waste) at a later stage. INFORMAS also

developed an outcome module to monitor population diet quality³² between countries and over time. The module leaders, as identified elsewhere,²² will be responsible for the development and oversight of each of the modules. They will provide support for country teams and contribute to capacity building activities in countries. Most of the modules are step based with a minimal approach collecting data for all countries, and expanded and optimal approaches for more detailed data as resources and capacity permit. INFORMAS is designed to be robust yet cost-effective for repeated measures in low and middle income countries (LMICs).

The vision is that INFORMAS will improve food environments and reduce obesity and NCDs by creating international benchmarks of public and private sector policies and actions, and indicators of the healthiness of key aspects of food environments; measuring progress towards achieving those benchmarks, including trends over time and comparisons between countries; creating an open-access global database for research into the determinants of obesity and NCDs and for evaluating the impact of policy solutions; providing a communication tool to promote accountability of the public and private sectors for their actions on food environments; building research capacity in LMICs; and contributing to global NCD monitoring efforts (complementing the work of WHO). Increasing accountability through benchmarking is powerful because it readily cuts through to the attention of decision-makers and it has changed policy/practice in other areas.^{33–35} This research is specifically designed as 'Strategic Science' (ie, solution oriented and policy relevant).

New Zealand will organise the first-ever national study on food environments and policies. Similar studies are currently planned for Australia, Fiji, Thailand, Chile, Mexico, Brazil and Guatemala. The objectives of the New Zealand national study are:

1. To provide representative data on the healthiness of food environments and related policies and actions of the government and the private sector.
2. To develop equity indicators: to use the data across a range of relevant food environments to create 'environmental equity' indicators so that progress on reducing diet-related health inequalities can be measured.
3. To benchmark progress: to identify best practice benchmarks internationally against which to compare New Zealand's (and other countries') progress on improving the healthiness of food policies and environments.

DESIGN AND METHODS

Eleven cross-sectional substudies are planned. Subject to funding, they will be repeated regularly over time. For some of the seven impact modules, surveys will be combined, as sampling and/or data collection methods/tools are similar: (1) composition, labelling and promotion of packaged foods (using the existing composition data and

food pictures in the New Zealand *Nutritrack* database); (2) prices, shelf space and placement of foods in different outlets (mainly supermarkets); (3) food provision in schools/ECE services and outdoor food promotion around schools/ECE services. Separate national surveys will be organised on: (4) density of and proximity to food outlets in communities, food promotion via (5) television, (6) magazines, (7) sports club sponsorships and (8) internet and social media.

The food trade module (9) and the public sector (10) and private sector (11) modules will involve desk-based analyses of documents and/or interviews and/or workshops. The New Zealand survey on food environments and policies will use the optimal INFORMAS approach and will compare the results with the minimal approach as part of validity checking.

Ethics statement

Ethical approval for the substudies on government actions and policies, food marketing through sport club sponsorships and food provision in schools/ECE services has been obtained from the University of Auckland Human Participants Ethics Committee. An informed consent form will be obtained from all public health experts participating in the rating workshops, sport club representatives and schools. Other countries using these methods and protocols will have to seek approval from their own ethical committee.

Sampling of areas in New Zealand

Some substudies require area sampling for field studies and in New Zealand this will be carried out using a stratified (North Island/South Island), probability-proportional-to-size (PPS) sampling design to select a representative sample of the 66 territorial authorities (TAs: 13 city councils, 53 district councils excluding Chatham Islands). To keep the field work feasible, 22 out of 66 TAs (17 North Island, 5 South Island reflecting the 3:1 population ratio) will be selected via PPS using electoral roll numbers. The selection will be systematic to include both rural and urban councils.

Definitions of foods as 'healthy' or 'unhealthy'

Two main systems will be used across several modules (eg, food promotion, labelling) for classifying foods into 'healthy' or 'unhealthy': the Food Standards Australia New Zealand (FSANZ) nutrient profiling system³⁶ (*nutrient-based system*), and; the New Zealand Food and Beverage Classification System (FBCS) 2007 (rebranded as Fuelled4Life³⁷), classifying foods into 'everyday' and 'sometimes' foods (*food-based system*). International best practice food-based or nutrient-based standards or guidelines may be used as well to classify foods into 'healthy' and 'unhealthy' to allow for international comparisons.

Measures of inequalities

Schools are classified into deciles according to socioeconomic criteria and these will be analysed as tertiles:

low=deciles 1–3, mid=deciles 4–7, high=deciles 8–10. The area measure of socioeconomic status will be the New Zealand Deprivation Index (NZDep). NZDep2013 will be released by June 2014 (replacing NZDep2006) and tertiles will be used (least deprived=1–3, average deprived=4–7, most deprived=8–10). The NZDep2006³⁸ has eight dimensions of deprivation (income, owned home, support, employment, qualifications, living space, communication and transport). For substudy 2, density/proximity measures will also be analysed by tertiles of proportion of Maori or Pacific residents.

Substudy 1 ('food products'): composition, health-related labels and promotional characters

This substudy uses an existing food database developed by the Global Food Monitoring Group^{39 40} and established in New Zealand as *Nutritrack*. It currently contains the nutritional content of more than 16 000 packaged and fast foods (from major fast food outlets with ≥ 20 stores nationwide).^{41 42} From 2013, photographs of foods are being collected, and recently, a smartphone application, *FoodSwitch*, was launched to help consumers make healthier food choices, but also allowing them to contribute new products to the database. The app has been downloaded more than 28 000 times and users crowd-sourced more than 5000 new products. Volume data can be added to the *Nutritrack* database by linking with the electronic scanner food purchasing data from Nielsen Homescan (n=2500 households)^{43 44} to derive consumption per capita estimates. In this project, the salt, fat, saturated fat and sugar content of major food groups, subgroups and key foods will be presented, including consumption per capita estimates. One of the major benefits of tracking the composition of foods is to evaluate the impact of industry reformulation and public health policies on food composition and labelling.

INFORMAS developed a new taxonomy²⁶ of health-related food labelling, classifying nutrition information into: nutrient declarations, supplementary nutrition information (eg, percentage of guideline daily amounts), ingredient list and other information (eg, origin). Claims are classified into health-related ingredient claims, nutrient content claims, nutrient comparative claims, general health claims, nutrient and other function claims, reduction of disease risk claims and other claims (eg, organic). Nutrition information and claims present on food packages (using photographs in the *Nutritrack* database) will be classified according to the above taxonomy for a random sample of 20% of the total number of *Nutritrack* products and for the total number of products in some key food groups (eg, breakfast cereals).

Indicators, such as the number of food products in certain categories carrying a claim while being classified as 'unhealthy', will be used to characterise this aspect of the food environment. The *Nutritrack* food pictures will also be used to assess the presence and power of promotional characters on food packages for 20% of the total

number of *Nutritrack* products. These will be classified into the following categories according to an approach previously used in Australia⁴⁵: cartoons, company owned characters, licenced characters, sports-persons, celebrities and movie tie-ins. In addition, the thematic content will be categorised into promotional characters or premiums.

Substudy 2 ('food swamps and deserts'): density of 'healthy' and 'unhealthy' food outlets

In this substudy, potential food 'swamps' (areas with a particularly high density of unhealthy food outlets) and food 'deserts' (areas with a particularly low density of healthy food outlets) will be identified. As the potential power to use zoning laws to influence the density of 'healthy' and 'unhealthy' food outlets sits with the councils, measures for each TA in New Zealand are needed. The lists of all registered food outlets will be requested from all councils. These lists will be supplemented with food outlet data from the yellow pages, *zenbu* and *koordinates* websites. The types of food outlets included are major fast food chains, superette/dairy shops, supermarkets, sushi places, bakeries, ice-cream/gelato shops, natural food shops, fish and chips outlets, pie/donut/cake shops, farmers markets, fruit and vegetable shops, sandwich shops, salad bars, petrol stations and juice bars. To check the accuracy of the food outlet data, a random proportion of outlets (5%) for all council lists will be validated through online website searches, telephone calls and using 'street view' in Google maps. In addition, for the 22 selected TAs, 5% of the mesh blocks (aggregated as Census Area Units) will be randomly selected and all the streets will be directly observed by fieldworkers to evaluate whether any outlets were missed or any outlets captured are closed.

Food outlets will be rated on a 'healthy' to 'unhealthy' scale (+10 to -10) by an expert group and weighted by their likely contribution to healthy/unhealthy eating practices, as performed in Australia.⁴⁶ These weightings will be taken into account when assessing densities/proximities of food outlets. The food outlets and all school locations will be geocoded in ArcGIS.⁴⁷ The presence/absence of several types of food outlets within pre-defined distances of mesh block centres/schools, density of several types of food outlets (as a TA or population average \pm SD, within a specified buffer around mesh block centres and schools or using Kernel density methods⁴⁸) and relative density of 'healthy' versus 'unhealthy' food outlets around mesh block centres and schools will be assessed. Proximity to outlets will be assessed by road network distance to mesh block centres/schools and expressed as numbers of outlets within specified distances from mesh block centres/schools. In addition, spatial scan statistics (windows of various shapes and sizes moving systematically across the map)⁴⁷ will be used to identify potential food swamps or deserts.

Substudy 3 ('food stores'): prices, shelf space and placement of foods

INFORMAS aims to assess the costs and affordability of 'healthy' versus 'less healthy' diets, meals and foods. Developmental work is being undertaken for the diet comparison to be used internationally by creating a 'global reference healthy diet' modelled on recommended daily intakes which can be applied across countries and cuisines. This New Zealand substudy will start with the comparisons of prices of 'healthy' versus 'less healthy' foods (eg, low fat vs full-fat milk) and meals (eg, home cooked vs takeaway chicken dinner) and the diet comparisons will be carried out later in the project after some methods development. The 'less healthy' diet will be defined as the nutrient composition of the current diet derived from the latest adult national nutrition survey 2008/2009 (including separate analyses for Maori and Pacific population diets), while the 'healthy' diet will be the nutrient composition based on the nutrient reference values used to create the Dietary Guidelines. Both the healthy and the current diet will be converted into menu plans using commonly consumed foods through modelling for intakes for a 'standard household' (5 people of specified age and gender) for a fortnight. The menus will be converted into shopping lists and then standard food basket surveys will be conducted in selected supermarkets.

The types of outlets included will depend on where people predominantly get their foods from. A list of all supermarkets and other types of outlets included (see substudy 2) in the 22 selected TAs will be used as a sampling frame. In each TA, supermarkets will be stratified by NZDep2013 tertiles and chain (6 major chains accounting for 90% of the New Zealand supermarket share), and a 30% random sample of supermarkets within each stratum will be selected, such as done in other studies.⁴⁹ In addition to assessing these price differentials, the proportion of the food costs which are taxes will give a policy-relevant estimate of the scope for food fiscal policies. This, for example, will highlight the difference in the costs of fruit and vegetables in New Zealand (where they attract GST) versus Australia (where they do not). The costs of healthy and current diets will also be adjusted by mean household income to create complementary affordability measures.

In addition, during the supermarket visits, the shelf space and placement of designated indicators of 'healthy' (eg, fruits and vegetables) and 'unhealthy' (eg, biscuits, confectionary, potato chips, soft drinks) foods will be measured. The nine product placement locations (including check-out lines, aisle end-caps) and their weightings are derived from the validated GroPromo tool.⁵⁰ Locations are weighted (low, medium, high) according to their perceived importance based on a customer's average exposure to them derived from literature.⁵⁰ The linear and cumulative shelf space will be captured using a measuring wheel along the floor directly below the item. Supermarket size will be

determined by the number of cash registers and the total interior floor space. Shelf space measures can be combined with retail food outlet densities (see substudy 2) to assess food availability in communities.⁵¹

Substudy 4 ('Schools/ECE services'): foods in schools/ECE services and proximal outdoor food promotion

The *minimal* approach to data collection for the food provision module is a food policy and environment questionnaire and this will be sent (posted) to a stratified random sample of schools and ECE services. The questionnaire will be based on previous food environment surveys in schools conducted by ourselves in 1999⁵² and the Ministry of Health in 2007 and 2009 (unpublished). Foods will be classified according to the Fuelled4Life classification system. Based on an estimated 50% of schools/ECE services meeting these guidelines (to give the most conservative sample size estimate), a 95% CI for the true proportion of schools/ECE services meeting the guidelines, and an absolute precision of 5%, the required sample size is 385. With an anticipated 60% response rate,⁵² this will give a sample size for mailing of about 650 schools and 650 ECE services. A roughly equal proportion of schools in each tertile of school decile ratings will be selected.

In addition, the *optimal* approach of direct observation of foods provided and sold, and policy implementation will be applied in a sample of schools and ECE services in the 22 selected TAs. This will help to validate the *minimal* approach, provide more in depth data for comparisons across decile levels and more detailed information on food policies and foods provided and sold. A sample of 96 will give a 10% precision. Therefore, a random sample of 100 schools (primary, secondary and composite included) each in low and high deciles (1–3 and 8–10), and a sample of 100 ECE services will be selected across the 22 TAs. Foods will be coded to capture their nutrient composition using the *Nutritrack* (packaged foods) and the New Zealand Food Composition Database and classified according to the FSANZ nutrient profiling system and Fuelled4Life classification system.

The results from the *minimal* and *optimal* approach will be compared to see whether the *minimal* approach is sufficient for future monitoring.

To investigate outdoor advertising around schools and ECE services, maps of each selected site will be developed, using Google maps, and a concentric circle indicating a perimeter of 250 m will be drawn onto the maps. Research assistants will directly view all streets in these areas and record the food advertisements observed (including taking photos and recording location using geopositioning systems). Non-food signage (symbols or words used mainly for store identification) will be excluded. For each advertisement the following information will be captured: distance from school, size, setting (food shop, road, bus shelter), type (poster, billboard),

product types depicted, brand name, food category and presence of promotional characters.

Substudy 5 ('TV'): food advertising on television

Some research on food advertising through TV has been performed across 18 different countries and these protocols will be used for this survey.⁵³ A research assistant will record programming for two week days and two weekend days between 6:00 and 22:00, for the three channels most watched by children (<16 years). Television Audience Measurement data will be purchased from AC Nielson to give details of viewership by age and channels. Coding criteria include the programme category in which the advertisement is shown, the advertised product type and the time of broadcast, including whether it was in designated children's programming slots or in children's peak viewing times as previously defined.⁵³ ⁵⁴ Foods advertised will be classified according to the Fuelled4Life classification system, international best practice guidelines and, if possible, the FSANZ nutrient profiling criteria. The overall amount of exposure during the defined time periods; frequency of food adverts relative to other products; frequency of 'unhealthy' food adverts relative to 'healthy' food adverts and the marketing techniques used within the advertisements will be captured. Results will be compared to other international studies and previous New Zealand studies.

Substudy 6 ('magazines'): food promotion through children's magazines

Titles from all children's magazines (targeted at children below 16 years) distributed in New Zealand will be identified and their popularity will be assessed based on readership data purchased from AC Nielson. At least 1 year of publications will be included for each of the top five magazine titles, using methods undertaken in other studies.⁵⁵ ⁵⁶

The magazines will be scanned for advertisements by a research assistant. The following indicators will be determined: frequency of overall advertisements; frequency of food versus non-food ads; frequency of 'unhealthy' food ads versus 'healthy' food ads; frequency of ads for food groups and indicator foods; types of promotion (eg, direct ad, in editorial material, games); print space for food and 'unhealthy' food ads (percentage of page).

Substudy 7 ('sponsorship'): food promotion through sports club sponsorships

The 10 most popular sports codes among children in New Zealand will be identified. Sponsorship arrangements of the national sports associations will be assessed through website analyses and telephone interviews with national association officials as used in a 2010 study in New Zealand.⁵⁷ In addition for those codes combined, a random sample of 100 local sports clubs from the 22 TAs will be selected and a telephone interview will be administered with a club official using the questionnaire

from a recent, similar Australian survey.⁵⁸ The food or beverage sponsors will be classified into mainly healthy or mainly unhealthy based on the nutrient profiles of their top selling products. This will help to validate the findings from the survey of national associations and will identify the level of reliance of local clubs on food and beverage company sponsorship.

Substudy 8 ('internet'): food promotion through internet and social media

The methods from an Australian study will be used.⁵⁹ Popular websites for children and adolescents will be identified based on net ratings data from AC Nielsen (food and non-food websites included). In addition, the websites from the food brands most frequently advertised on TV or through sport sponsorships in New Zealand will be investigated as well. Each site will be visited once in a defined time period. Advertisement data will be coded at the time of the site visit. Several indicators will be determined: Frequencies of overall ads, food versus non-food ads and 'unhealthy' versus 'healthy' food ads; frequency of ads for food groups and indicator foods; types of promotional techniques used (eg, kid's section, games, premium offers). In addition, an audit of the usage of new media in the marketing of foods to children and adolescents will be performed. Market research companies currently do not have data available on food marketing through social media. Socialbakers (<http://www.socialbakers.com>) has free traffic data for Facebook and Youtube (6-month repository). Several methods to monitor 'unhealthy' food ads over time through social media are currently being piloted (including surveys among Facebook users) and a decision, of which method will be used, will be made based on these pilot results.

Substudy 9 ('trade agreements'): the risks of trade/investment agreements on food environments

This substudy will involve an analysis of New Zealand's trade and investment agreements and an assessment of their risks and benefits for influencing the healthiness of New Zealand's food supply. This is a relatively new field of research which will develop tools based on health impact assessment methodologies.⁶⁰ We will assess these risks in existing trade agreements. While there is a well-recognised threat to institutions (like Pharmac) and a risk of governments being sued by tobacco companies, the risks to food and population nutrition have not been well analysed.⁶¹ For new agreements, since the negotiations are conducted in secret, only the processes that the government uses for assessing risks and protecting the ability of future governments to regulate for healthy food environments can be examined (this will be carried out as part of substudy 10). The potential food-related public health risks of the proposed Trans Pacific Partnership agreement (TPP) have recently been analysed,⁶² giving some directions about how such risks might be assessed. An analysis of

proactive measures taken by governments in relation to foreign investment (eg, the terms and reliance on exceptions) and the protection of the government's regulatory autonomy with respect to public health nutrition⁶¹ will be performed.

Substudy 10 ('Governments'): government policies and actions on food environments

A Government Healthy Food Environment Policy Index (Food-EPI)²³ has been developed, based on major authoritative evidence from expert committee reports on reducing obesity and NCDs from international agencies, national government agencies, global non-government organisations, professional societies and expert advisory groups. The Food-EPI comprises a 'policy' component with seven domains on specific aspects of food environments (ie, the impact modules of INFORMAS), and an 'infrastructure support' component with seven domains (governance, leadership, funding and resources, monitoring and intelligence, workforce development, platforms for interaction, health-in-all-policies) based on the WHO building blocks for strengthening health systems.⁶³ 'Good practice statements' have been developed for each domain and validation feedback from government officials has been received. Domains and good practice statements were revised through a week-long consultation process with international experts.

Where possible, good practice is defined through international best practice exemplars (eg, for the good practice statement 'Taxes on unhealthy foods (eg, sugar-sweetened beverages, foods high in nutrients of concern) are in place to discourage unhealthy food choices where possible, and these taxes are reinvested to improve population health', Mexico could be identified as a best practice exemplar since the Mexican legislature passed an excise duty of 1 peso (\$0.80) per litre on sugary drinks and an ad valorem excise duty of 8% to foods with high caloric density. The taxes entered into force on 1 January 2014. The aim is for the revenue to be reinvested in population health, namely providing safe drinking water in schools.

The focus is on the national government, but local levels are taken into account where needed (eg, for estimation of the total budget spent on population nutrition promotion).

The following process is used to assess government policies and actions against good practice: (1) context analysis, (2) collection of relevant policy documents and budgets (including through government officials and official information requests), (3) a 'policy scan' to retrieve evidence for the extent of government implementation of policies, (4) validation of evidence by government officials, (5) rating (on a scale from 1 to 5; 1=less than 20% implementation, 5=80–100% implementation) of the extent of implementation by non-government public health experts against international best practice, after presentation of the evidence and

discussion during a workshop, (6) weighting and aggregation of scores on good practice statements to create domain-specific and component-specific scores, (7) weighting and aggregation of component-specific scores to create the Food-EPI score and (8) use of the results for advocacy and action support. Approaches for priority setting and for weighting the different domains and statements are currently under development. The proposed 'good practice statements' will all evolve into benchmarks established by governments at the forefront of implementing food policies for good health (see objective 3).

Substudy 11 ('food companies'): food company actions and practices on food environments

The Access to Nutrition Index (ATNI) measures the nutrition-related commitments, performance and disclosure practices of food and beverage manufacturers.⁶⁴ The first ATNI results were of the 25 largest food companies (published in 2013) and they found that even the top performers had significant room for improvement with the highest score being 6.3 on a 10.0 point scale. The 15 biggest packaged food retailers (currently 61% of market share in New Zealand), the four biggest soft drink retailers (currently 81.5% of market share in New Zealand) and the four biggest fast food providers (currently 50% of market share in New Zealand) will be selected using EUROMONITOR market-share data. Applying the ATNI in New Zealand will be the core measurement of the actions and practices of private sector companies and this will involve a desk review and rating of publicly accessible actions from company websites and written requests to companies for copies of policies; assessing composition of foods of the brands related to the companies investigated, label information, health and nutrition claims and promotional characters present on foods through the New Zealand *Nutritrack*

database to evaluate publicly agreed commitments and policies.

In addition, other 'commercial-interest activities' such as lobbying, political donations, funding of industry 'front groups' will be documented wherever possible. These activities may have a powerful influence on public policy but they are difficult to measure. Methods are currently being developed for this component. They will include assessments through internet, twitter and other social media searches. Other potential methods could include crowdsourcing information, interviews with former company representatives and former politicians, political donation declarations, publicly available submissions to policy documents, sources of research funding and other forms of declarations.

Development of equity indicators for some of the modules

The public sector module includes equity indicators within the good practice statements of some domains (eg, the leadership domain assesses whether reducing health inequalities is a government priority and the monitoring domain assesses whether progress on reducing those is regularly monitored). Four impact modules (food provision, retail, prices and promotion) lend themselves to including 'environmental equity' indicators, as shown by some examples (non-exhaustive) in [table 1](#). This will allow the links between policies and equity outcomes to be analysed and this will be particularly relevant for Maori, Pacific and low-income populations in New Zealand.

To benchmark progress

Benchmarking will be carried out in several ways. As funding becomes available for other countries to run INFORMAS modules, examples of international best practice will emerge. Food composition databases like *Nutritrack* are already available in several countries. In

Table 1 Examples of 'environmental equity' indicators for the national study on food environments in New Zealand

Food provision	▶ Substudy 4 (<i>optimal</i> approach): Quality of nutrition policies implemented, % of foods meeting food-based or nutrient-based standards in high (8–10) versus low (1–3) decile schools
Food retail	▶ Substudy 2: Frequency of 'food deserts' and 'food swamps' in least (NZDep 1–3), average (NZDep 4–7), most deprived (NZDep 8–10) areas and areas with high versus low % of Maori and Pacific residents
	▶ Substudy 2: Relative density of 'unhealthy' food outlets in a buffer zone around high (8–10), mid (4–7) and low (1–3) decile schools
	▶ Substudy 3: Ratio of shelf space devoted to 'healthy' versus 'unhealthy' foods by NZDep2013 tertile (based on location supermarkets)
	▶ Substudy 3: Percentage of junk-food free check-outs by NZDep2013 tertile (based on location supermarkets)
Food prices	▶ Substudy 3: Price differentials between 'healthy' foods and meals and 'less healthy' foods and meals by NZDep2013 tertiles (based on location of supermarkets or other outlet types)
	▶ Substudy 3: Price differentials and affordability of healthy versus current diets for Maori, Pacific and NZ European adults (from national nutrition survey data)
Food promotion	▶ Substudy 4: The number of outdoor advertisements for unhealthy foods in a buffer zone of 500 m around low (1–3), mid (4–7) and high (8–10) decile schools

NZ, New Zealand; NZDep, New Zealand Deprivation Index.

addition, the World Cancer Research Fund⁶ is developing a repository of international best practice examples of nutrition policies for the purposes of benchmarking progress. This repository is expected to grow into sufficient numbers of examples to allow policy benchmarking for the Food-EPI.

DISCUSSION

Obesity and diet-related NCDs will continue to rise unless there is a major effort to reverse the obesogenicity of the food environments. INFORMAS aims to increase the accountability of governments and the private sector by providing, for the first time, the evidence on their levels of action/inaction and the state of healthiness of food environments. Findings will be fed directly back to the government and the private sector along with recognition for areas of strong performance and recommendations for improvements in other areas. This is a central feature of 'Strategic Science' which aims to be highly policy-relevant. Comparative data (over time for countries and between countries) will be presented to political leaders and CEOs as 'performance assessment dashboards' (eg, league tables, report cards). These are widely used to increase the accountability of decision-makers in many areas, such as breastfeeding,³³ alcohol³⁴ and tobacco³⁵ because this communication form has the highest chance of 'cut-through' to decision-makers.

With time series and cross-country comparisons, INFORMAS will become a critical data resource for analysing the determinants of changes in obesity and NCDs over time and also the impacts of national policies which are difficult to measure otherwise (they are rarely amenable to randomised controlled trials). It will tie in closely with, and contribute to, WHO monitoring efforts. The history of the GBD initiative is instructive in that it started in 1990 with very incomplete data for eight regions of the world using mortality data. Over 20+ years, it has grown into a massive and influential global initiative with ever-increasing granularity of data, including risk factors, and sophistication of analyses of disease determinants and trends.¹ INFORMAS aspires to be the 'solution-equivalent' of the GBD for the most difficult and important of prevention actions—improving population nutrition. This research is highly original due to the very 'upstream' approach being taken, right at the interface of where policies meet environments. Most research on obesity and NCDs has been at the individual level (eg, behavioural, metabolic, genetic) or more 'downstream' at the population level (eg, prevalence, school interventions), and the vast majority has been in the 'problem-oriented' paradigm rather than being 'solution-oriented'.⁶⁵

In conclusion, INFORMAS has been established to monitor and benchmark food environments globally and support actions to reduce obesity, NCDs and their related inequalities. INFORMAS will be fully

implemented in New Zealand as the first national survey of the healthiness of food environments and the degree of implementation of the policies that influence them.

In addition, for four key modules (food prices, provision, promotion and retail), 'environmental equity' indicators will be developed to assess progress towards reducing diet-related health inequalities. New Zealand food environments will be compared with those of other countries as a first step towards global benchmarking of food environments and their related policies. Effective policy responses will be identified to improve the healthiness of food environments, and this baseline INFORMAS database will ensure that the impact of future food and nutrition policies can be evaluated. The detailed protocols will be offered to and adapted for countries of varying size and income in order to establish INFORMAS globally as a new monitoring initiative to reduce obesity and diet-related NCDs.

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Contributors SV and BS designed the study and methods, SV drafted the manuscript, BS critically revised the manuscript, all authors read and approved the final manuscript. BS is professor of population nutrition and global health at the University of Auckland and SV is a research fellow in food policy at the University of Auckland. BS is coordinating the International Network for Food and Obesity/non-communicable diseases (NCDs) Research, Monitoring and Action Support (INFORMAS) globally.

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REFERENCES

1. Lim SS, Vos T, Flaxman AD, *et al*. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2013;380:2224–60.
2. Swinburn BA, Sacks G, Hall KD, *et al*. The global obesity pandemic: shaped by global drivers and local environments. *Lancet* 2011;378:804–14.

3. Scarborough P, Burg MR, Foster C, *et al.* Increased energy intake entirely accounts for increase in body weight in women but not in men in the UK between 1986 and 2000. *Br J Nutr* 2011;105:1399–404.
4. Swinburn BA, Sacks G, Lo SK, *et al.* Estimating the changes in energy flux that characterize the rise in obesity prevalence. *Am J Clin Nutr* 2009;89:1723–8.
5. Hawkes C, Jewell J, Allen K. A food policy package for healthy diets and the prevention of obesity and diet-related non-communicable diseases: the NOURISHING framework. *Obes Rev* 2013;14(Suppl 2):159–68.
6. World Cancer Research Fund. WCRF International Food Policy Framework for Healthy Diets: NOURISHING. Secondary WCRF International Food Policy Framework for Healthy Diets: NOURISHING 2013. http://www.wcrf.org/policy_public_affairs/nourishing_framework/#about
7. World Health Organisation. Draft comprehensive global monitoring framework and targets for the prevention and control of non-communicable diseases. Formal Meeting of Member States to conclude the work on the comprehensive global monitoring framework, including indicators, and a set of voluntary global targets for the prevention and control of non-communicable diseases. Report by the Director-General. Geneva: World Health Organisation, 2013.
8. World Health Organisation. *Global strategy on diet, physical activity and health*. Geneva: WHO, 2004.
9. Beaglehole R, Bonita R, Horton R, *et al.* Priority actions for the non-communicable disease crisis. *Lancet* 2011;377:1438–47.
10. World Cancer Research Fund/American Institute for Cancer Research. *Food, nutrition, physical activity, and the prevention of cancer: a global perspective, 2007*. Washington, DC: American Institute for Cancer Research, 2007.
11. Gortmaker SL, Swinburn BA, Levy D, *et al.* Changing the future of obesity: science, policy, and action. *Lancet* 2011;378:838–47.
12. Haby MM, Vos T, Carter R, *et al.* A new approach to assessing the health benefit from obesity interventions in children and adolescents: the assessing cost-effectiveness in obesity project. *Int J Obes (Lond)* 2006;30:1463–75.
13. Magnus A, Haby MM, Carter R, *et al.* The cost-effectiveness of removing television advertising of high-fat and/or high-sugar food and beverages to Australian children. *Int J Obes (Lond)* 2009;33:1094–102.
14. Cecchini M, Sassi F, Lauer JA, *et al.* Tackling of unhealthy diets, physical inactivity, and obesity: health effects and cost-effectiveness. *Lancet* 2010;376:1775–84.
15. Fraser B. Latin American countries crack down on junk food. *Lancet* 2013;382:385–6.
16. Moodie R, Stuckler D, Monteiro C, *et al.* Profits and pandemics: prevention of harmful effects of tobacco, alcohol and ultra-processed food and drink industries. *Lancet* 2013;381:670–9.
17. Stuckler D, McKee M, Ebrahim S, *et al.* Manufacturing epidemics: the role of global producers in increased consumption of unhealthy commodities including processed foods, alcohol, and tobacco. *PLoS Med* 2012;9:e1001235.
18. Swinburn B, Egger G, Raza F. Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. *Prev Med* 1999;29:563–70.
19. Story M, Kaphingst KM, Robinson-O'Brien R, *et al.* Creating healthy food and eating environments: policy and environmental approaches. *Annu Rev Public Health* 2008;29:253–72.
20. Glanz K, Sallis JF, Saelens BE, *et al.* Healthy nutrition environments: concepts and measures. *Am J Health Promot* 2005;19:330–3, ii.
21. Friel S, Labonte R, Sanders D. Measuring progress on diet-related NCDs: the need to address the causes of the causes. *Lancet* 2013;381:903–4.
22. Swinburn B, Sacks G, Vandevijvere S, *et al.* INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. *Obes Rev* 2013;14(Suppl 1):1–12.
23. Swinburn B, Vandevijvere S, Kraak V, *et al.* Monitoring and benchmarking government policies and actions to improve the healthiness of food environments: a proposed Government Healthy Food Environment Policy Index. *Obes Rev* 2013;14(Suppl 1):24–37.
24. Sacks G, Swinburn B, Kraak V, *et al.* A proposed approach to monitor private-sector policies and practices related to food environments, obesity and non-communicable disease prevention. *Obes Rev* 2013;14(Suppl 1):38–48.
25. Neal B, Sacks G, Swinburn B, *et al.* Monitoring the levels of important nutrients in the food supply. *Obes Rev* 2013;14(Suppl 1):49–58.
26. Rayner M, Wood A, Lawrence M, *et al.* Monitoring the health-related labelling of foods and non-alcoholic beverages in retail settings. *Obes Rev* 2013;14(Suppl 1):70–81.
27. Kelly B, King L, Baur L, *et al.* Monitoring food and non-alcoholic beverage promotions to children. *Obes Rev* 2013;14(Suppl 1):59–69.
28. Ni Mhurchu C, Vandevijvere S, Waterlander W, *et al.* Monitoring the availability of healthy and unhealthy foods and non-alcoholic beverages in community and consumer retail food environments globally. *Obes Rev* 2013;14(Suppl 1):108–19.
29. L'Abbe M, Schermer A, Minaker L, *et al.* Monitoring foods and beverages provided and sold in public sector settings. *Obes Rev* 2013;14(Suppl 1):96–107.
30. Lee A, Mhurchu CN, Sacks G, *et al.* Monitoring the price and affordability of foods and diets globally. *Obes Rev* 2013;14(Suppl 1):82–95.
31. Friel S, Hattersley L, Snowdon W, *et al.* Monitoring the impacts of trade agreements on food environments. *Obes Rev* 2013;14(Suppl 1):120–34.
32. Vandevijvere S, Monteiro C, Krebs-Smith SM, *et al.* Monitoring and benchmarking population diet quality globally: a step-wise approach. *Obes Rev* 2013;14(Suppl 1):135–49.
33. Save the children. Breastfeeding policy scorecard for developed countries. Secondary breastfeeding policy scorecard for developed countries 2012. <http://savethechildrenweb.org/SOWM2012Interactive/SOWM2012/files/assets/downloads/page0045.pdf>
34. World Health Organisation. *Global status report on alcohol and health*. Geneva: World Health Organisation, 2011.
35. Australian Council on Smoking and Health. National tobacco control scorecard. Secondary National tobacco control scorecard 2010. <http://www.acosh.org/law-and-policy/australian-best-practice/>
36. Food Standards Australia New Zealand. Consumer guide to the nutrient profiling scoring calculator secondary consumer guide to the nutrient profiling scoring calculator 2013. <http://www.foodstandards.gov.au/industry/labelling/Pages/Consumer-guide-to-NPSC.aspx>
37. Heart Foundation. Fuelled4Life. Secondary Fuelled4Life 2012. <http://www.fuelled4life.org.nz/>
38. Ministry of Health. *NZDep2006 Index of deprivation*. Wellington: Ministry of Health, 2007.
39. Dunford E, Webster J, Metzler AB, *et al.* International collaborative project to compare and monitor the nutritional composition of processed foods. *Eur J Prev Cardiol* 2012;19:1326–32.
40. Dunford E, Webster J, Woodward M, *et al.* The variability of reported salt levels in fast foods across six countries: opportunities for salt reduction. *CMAJ* 2012;184:1023–8.
41. Woodward E, Eyles H, Ni Mhurchu C. Key opportunities for sodium reduction in New Zealand processed foods. *Aust N Z J Public Health* 2012;36:84–9.
42. Chand A, Eyles H, Ni Mhurchu C. Availability and accessibility of healthier options and nutrition information at New Zealand fast food restaurants. *Appetite* 2012;58:227–33.
43. Hamilton S, Mhurchu CN, Priest P. Food and nutrient availability in New Zealand: an analysis of supermarket sales data. *Public Health Nutr* 2007;10:1448–55.
44. Eyles H, Jiang Y, Ni Mhurchu C. Use of household supermarket sales data to estimate nutrient intakes: a comparison with repeat 24-hour dietary recalls. *J Am Diet Assoc* 2010;110:106–10.
45. Hebden L, King L, Kelly B, *et al.* A menagerie of promotional characters: promoting food to children through food packaging. *J Nutr Educ Behav* 2011;43:349–55.
46. Thornton LE, Kavanagh AM. Association between fast food purchasing and the local food environment. *Nutr Diabetes* 2012;2:e53.
47. Charreire H, Casey R, Salze P, *et al.* Measuring the food environment using geographical information systems: a methodological review. *Public Health Nutr* 2010;13:1773–85.
48. Thornton LE, Pearce JR, Macdonald L, *et al.* Does the choice of neighbourhood supermarket access measure influence associations with individual-level fruit and vegetable consumption? A case study from Glasgow. *Int J Health Geogr* 2012;11:29.
49. Bodor JN, Hutchinson PL, Rose D. Car ownership and the association between fruit and vegetable availability and diet. *Prev Med* 2013;57:903–5.
50. Kerr J, Sallis JF, Bromby E, *et al.* Assessing reliability and validity of the GroPromo audit tool for evaluation of grocery store marketing and promotional environments. *J Nutr Educ Behav* 2012;44:597–603.



51. Rose D, Bodor JN, Hutchinson PL, *et al.* The importance of a multi-dimensional approach for studying the links between food access and consumption. *J Nutr* 2010;140:1170–74.
52. Carter M-A, Swinburn B. Measuring the 'obesogenic' food environment in New Zealand primary schools. *Health Promot Int* 2004;19:15–20.
53. Kelly B, Halford JCG, Boyland EJ, *et al.* Television food advertising to children: a global perspective. *Am J Public Health* 2010;100:1730–36.
54. Kelly B, Hattersley L, King L, *et al.* Persuasive food marketing to children: use of cartoons and competitions in Australian commercial television advertisements. *Health Promot Int* 2008;23:337–44.
55. Adams J, Simpson E, White M. Variations in food and drink advertising in UK monthly women's magazines according to season, magazine type and socio-economic profile of readers: a descriptive study of publications over 12 months. *BMC Public Health* 2011;11:368.
56. Jones SC, Gregory P, Kervin L. Branded food references in children's magazines: 'advertisements' are the tip of the iceberg. *Pediatr Obes* 2012;7:220–9.
57. Carter MA, Signal L, Edwards R, *et al.* Food, fizzy, and football: promoting unhealthy food and beverages through sport—a New Zealand case study. *BMC Public Health* 2013;13:126.
58. Kelly B, Baur LA, Bauman AE, *et al.* Food and drink sponsorship of children's sport in Australia: who pays? *Health Promot Int* 2011;26:188–95.
59. Kelly B, Bochynska K, Kornman K, *et al.* Internet food marketing on popular children's websites and food product websites in Australia. *Public Health Nutr* 2008;11:1180–7.
60. World Health Organisation. Health impact assessments: Toolkits, guides and overviews. Secondary health impact assessments: toolkits, guides and overviews. <http://www.who.int/hia/en/>
61. Thow AM, McGrady B. *Protecting policy space for public health nutrition in an era of international investment agreements*. Bull World Health Organ, 2013;92:139–45.
62. Friel S, Gleeson D, Thow AM, *et al.* A new generation of trade policy: potential risks to diet-related health from the trans pacific partnership agreement. *Global Health* 2013;9:46.
63. World Health Organisation. *Everybody business: strengthening health systems to improve health outcomes. WHO's framework for action*. Geneva: World Health Organisation, 2007.
64. Access to Nutrition Index. Access to Nutrition Index. Secondary access to Nutrition Index 2013. <http://www.accessnutrition.org/>
65. Robinson TN, Sirard JR. Preventing childhood obesity: a solution-oriented research paradigm. *Am J Prev Med* 2005;28(2 Suppl 2):194–201.