

DISCUSSION PAPER

Rethinking food and nutrition science

The food environment

Theo Murphy High Flyers Think Tank 2017

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Executive summary

Transformation of the food system to improve population diets for the betterment of population health, health inequities and the health of our planet is urgently required. Ultimately this means shifting the balance of food consumption from mainly discretionary, highly processed foods towards healthier and more sustainable 'core food' alternatives. In this report, in the context of promoting the three pillars of health, equity and environmental sustainability, we identify three key control points for shifting the balance of food consumption. These are:

- reducing the profitability of discretionary and unsustainable foods
- increasing the profitability of core foods
- improving the availability of core foods.

We identify actions to achieve these control points and explain the rationale and benefits of such measures. Actions include:

- restricting the marketing of discretionary foods and beverages to children
- applying a health levy on sugar-sweetened beverages
- implementing fiscal food policies to reduce consumption of environmentally unsustainable (and unhealthy) foods
- banning industrially produced trans fatty acids
- legislating standards to ensure the healthiness of publicly procured foods
- introducing regulations to control food composition
- implementing urban planning laws to promote healthy food choices
- supporting grassroots action to promote healthy food environments.

While these options are not exhaustive, they represent what we consider to be most critical to rebalance our food systems to a healthier, more equitable, more sustainable model. Some existing government and non-government initiatives are in place to try to improve food supply and consumption. However, we believe the reach of these are limited and that more aggressive, disruptive action is required to achieve real change.

Recognising the importance of community-led action to drive the policy changes required, we set out recommendations that, if implemented, monitored and evaluated effectively, could have the

potential to transform our food system, leading to a healthier, more equitable and more sustainable food environment for all Australians.

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Vision Statement for discussion paper

To transform the food environment towards a sustainable and healthy food system for all Australians.

Key terminology

Core foods: Foods that promote health and wellbeing including vegetables and legumes, fruit, grain (cereal) foods, lean meats and poultry, fish, eggs, tofu, nuts and seeds, and legumes milk, yoghurt, cheese and/or their alternatives.

Discretionary foods: foods deemed unnecessary for a healthy diet because they are high in saturated fat and/or added sugars and added salt, and low in fibre. Includes alcohol.

Food environment: The physical environment that influences an individual's diet through the availability, affordability, accessibility and acceptability of foods and beverages.

Food security: Reliable access to a sufficient quantity of nutritious and affordable food.

Food systems: The course that food takes from producer to table to disposal, including producing, processing, distributing, preparing, marketing, accessing, consuming and disposing (Neff et al., 2009)

Context and scope

Improving population diets for the betterment of population health, health inequities and the health of our planet is one of the most significant public health challenges of our time.

Our food systems critically influence population diets by shaping the food environment, and thus the availability, accessibility, affordability and acceptability of foods (Figure 1). But our food system is under unprecedented and unsustainable pressure as it struggles to deliver healthy, nutritious and environmentally sustainable food in an equitable manner (Dangour et al. 2017). Serious investment to rebalance this system to favour healthy, equitable and sustainable food choices is urgently required. This will require action at all levels across the food system, from field to fork. The three pillars of health, equity and environmental sustainability are interrelated and therefore require interrelated goals and actions. Mutual and reinforcing goals must be identified and pursued. This forms the scope of the current discussion paper.

Pillar 1 Health

A sub-optimal diet is the leading risk factor for death and disability in Australia. More than one in three premature deaths are preventable, with diet being the single most important modifiable risk factor for these deaths (National Public Health Partnership 2001). Overweight and obesity—direct consequences of poor dietary intake—together cost Australia more than \$58 billion per year (Access Economics 2008).

Pillar 2 Equity

Despite this, collectively we are now healthier and live longer than ever before. However, inequalities in health, whether measured by education, income, employment or ethnicity, are widening. One in 20 people in Australia suffer food insecurity with lower socioeconomic groups at substantially higher risk (Booth and Smith, 2001). In addition, those with greater socioeconomic

disadvantage are more likely to consume poor diets and less likely to meet recommendations for core food groups (Backholer et al. 2016b). The reasons for this are complex, but include an interaction between greater exposure to unhealthy food environments and less social and economic resources to support healthy dietary choices for more disadvantaged individuals.

Pillar 3 Environmental sustainability

The food we eat also has a substantial impact on the environment. The environment in turn greatly influences the quality, availability and price of our foods. Agriculture alone accounts for approximately one-third of greenhouse gas emissions (Thornton. P 2012). The environmental impacts of an increasing reliance on highly processed, animal-based convenience foods, combined with a rapidly growing and increasingly urban population, is simply unsustainable. Climate change affects the quality, availability and price of our foods. Simultaneously, food waste represents a major global issue as food is lost across the food system from production, harvest, post-harvest handling, storage, distribution and processing through to the wastage that occurs after food reaches the consumer. Figuring out how to rechannel this biomass back into the global human food supply, in a way that is safe and preserves nutritional value, is a momentous contemporary challenge which is currently being addressed by CSIRO (Hawley 2017).



Black – Food environment; Red – Food system; Blue – Influencing factors with examples; Green - Pillars of a well functioning food system and food environment



Focus of this paper

The objective of this discussion paper is to identify critical control points for influencing the food system towards one that is more healthy, equitable and environmentally sustainable. Ultimately this means shifting the balance of food consumption from mainly discretionary, highly processed foods towards healthier core food alternatives. Discretionary foods are pre-packaged and highly processed, and perceived to be convenient and cheap. As a result they contribute significantly to

unhealthy and inequitable population diets and environmental degradation. Conversely, foods belonging to the core food groups—including fruit, vegetables, cereals, legumes, nuts and seeds, dairy and unprocessed meats—not only promote health and wellbeing but also support efforts to improve environmental sustainability.

With this in mind, healthy, equitable and sustainable nutrition action must strive to:

- reduce population intake of discretionary foods
- increase intake of core foods
- improve the overall quality of population diets
- reduce waste of food and its packaging
- enable a greater contribution of plant-based foods to population diets.

These goals may not always align with the interests of food producers and manufacturers whose primary goal is profit. Owing to their long shelf life and the cheaper and more easily sourced and quality controlled ingredients, the profitability of discretionary foods far outweighs that of perishable fresh foods. For this reason discretionary foods are heavily advertised and are ubiquitously available.

Achieving healthy, equitable and sustainable nutrition goals relies on actions to implement three key control points within the food system.

KEY CONTROL POINTS

- Reduce the profitability of discretionary and unsustainable foods
- Increase the profitability of core foods
- Improve the availability of core foods

Actions to achieve nutrition goals can all sit within the food system with an aim to ultimately improve our food environment and shift population diets to favour the three pillars of health, equity and environmental sustainability. For example, given most discretionary foods are pre-packaged, reducing the profitability of these foods would reduce their ubiquitous presence, thereby reducing demand and consumption. In turn this would result in a reduction food-related packaging waste, improving both health and the environmental sustainability of the food environment.

In this paper we present a range of options for specific actions that ultimately aim to address one or more key control points. Our options are not exhaustive but represent what we consider to be most critical for rebalancing our food system to a healthier, more equitable and more sustainable model. It is important that the actions must not be considered in isolation. Intervening with one action alone will not address the impact that food and nutrition has on population health, equity and the health of our planet. Positive changes to the food system will require comprehensive and cohesive action within and outside the food system.

Most of the ideas presented here build on previous reviews and programs established to advocate for better food environments. The Public Health Association of Australia's policy on food and health advocates for 'safe, affordable, secure and environmentally sustainable food system accessible to all Australians for health, wellbeing and prosperity now and into the future'. **INFORMAS** (International Network for Food and Obesity / non-communicable Diseases Research, Monitoring and Action Support) is a global network of public-interest organisations and researchers that aims to 'monitor,

benchmark and support public and private sector actions **t**o create healthy food environments and reduce obesity and non-communicable diseases (NCDs) and their related inequalities'. The Australian government's Healthy Food Partnership (www.health.gov.au/internet/main/publishing.nsf/Content/Healthy-Food-Partnership-Home) aims to 'improve the dietary habits of Australians by making healthier food choices easier and more accessible' including by 'supporting industry to reformulate their foods and supporting consumers to eat appropriate levels of core foods such as fruit, vegetables, whole grains, meat, fish and dairy'. However the current reach of these initiatives is limited and progress by the government in tackling dietary challenges at both state and federal levels is patchy at best.

Transforming the food environment with regulatory and grassroots actions

In this section we discuss and recommend potential actions to shift the Australian food system towards one that is more healthy, equitable and environmentally sustainable. Actions are organised according to the key control points. The first two control points, i) reducing the profitability of discretionary and unsustainable foods and ii) increasing the profitability of core foods, are directly related, so they are addressed together. Key control point iii) improving the availability of core foods is addressed individually. Our recommendations begin with regulatory measures, however, acknowledging that regulatory options are typically politically complex, involve multiple stakeholder interests and are laboured by civil libertarian arguments, for each action we also include ways in which grassroots action may pursue a similar goal. Not only can grassroots action have significant impact on health but can also increase political pressure for top-down action. Either way, grassroots leadership is crucial and to ensure meaningful and sustainable change it is essential that community leaders and health promotion champions are supported and their achievements celebrated.

We expect that comprehensive action across these recommendations will ultimately reduce population-level consumption of discretionay foods and beverages and increase consumption of core foods and beverages, leading to an improvement in population health, health equity and environmental sustainability. As action is implemented worldwide (whether led and implemented by governments or communities), researchers must be ready and armed with the appropriate data and resources to evaluate the impacts. Evaluations should be embedded within a complex systems model that recognises the many interdependent elements that may be influenced by policy or intervention implementation (Rutter et al. 2017). Evaluations of this type are in their infancy and methodological advancements will evolve as the evidence builds.

Control points 1 & 2: Reduce the profitability of discretionary and unsustainable foods and increase the profitability of core foods

Potential solution 1: Restricting the marketing of discretionary foods and beverages to children

Mandatory restrictions should be placed on the marketing of discretionary foods and beverages to children across all mediums. This could start with television and public open spaces and then extend to online and mobile mediums. Mandatory restrictions should be monitored and enforced to ensure compliance.

Worldwide, children are inundated with the marketing and advertising of food and beverages, designed to shape food preferences, purchase requests and diet quality. The majority of this

marketing is for discretionary food and beverage products and children with a lower socioeconomic position, or who belong to ethnic minority groups, are more exposed to this type of marketing (Klepp et al. 2007). A 2010 resolution from the World Health Assembly stated that governments should take action to restrict the marketing of unhealthy food products to children, stating 'settings where children gather should be free from all forms of marketing of foods high in saturated fats, trans-fatty acids, free sugars, or salt'.

In Australia, voluntary self-regulation by the food and beverage industry largely controls marketing practices. However, this self-regulation has proven to be wholly ineffective. Television advertising of both non-core groceries and fast food have remained unchanged since the 2009 industry pledge to 'reduce advertising and marketing communications to children for food and beverage products that do not represent healthier choices' (Watson et al. 2017, King et al. 2013). Mobile phone applications, websites and social media platforms are increasingly being exploited by food and beverage companies to market unhealthy food and beverages to children and adolescents (Boelsen-Robinson et al. 2016).

This year, Ireland became the first country to announce a new code of practice on marketing, product placement and sponsorship of high fat, salt and sugar foods to children and adults. While the code of practice has not yet been released by Ireland's Department of Health, it is expected to cover online, outdoor, print and cinema marketing, as well as commercial sponsorship and retail product placement. A push for a 9 pm watershed on the advertising of high fat, salt and sugar products on TV and radio has also been proposed (Irish Department of Health 2017). The code will be voluntary but monitored by a body designated by the Irish Minister of Health.

In Australia, from a grassroots perspective, local sports clubs and venues may restrict sponsorship from companies that sell discretionary food and beverage products. Public health organsiations may lead advocacy efforts to remove junk food advertising in elite sport, and potentially (where feasible) buy out this type of sponsorship and replace it with advertisements that promote healthy and nutritious food. Within the school environment, children should be protected from all forms of marketing relating to discretionary foods and beverages and only core foods and beverages should be promoted and sold.

Potential solution 2: Health levy on sugar-sweetened beverages

A health-related levy on sugar-sweetened beverages (SSBs) of at least 20% should be implemented with the revenue hypothecated for population nutrition science and interventions to improve population diets and health inequalities, such as fruit and vegetable subsidies for low-income households.

Strong scientific evidence demonstrates regular sugar-sweetened beverage (SSB) consumption with increased risk of excess weight gain (Te Morenga et al. 2012) and tooth decay (Moynihan and Kelly 2014) for both children and adults. In the 2011–12 National Health Survey, approximately one third of Australians over the age of two years reported consuming SSBs within the 24 hours prior to the survey (Australian Bureau of Statistics 2016). This was as high as two thirds for adolescent males. For these reasons, a large number of authoritative health bodies, such as the World Health Organization and the Australian Medical Association, have called for government action to mandate a levy on SSBs.

More than 30 countries and jurisdictions worldwide have now implemented, or have imminent plans to implement, a levy on SSBs for health-related reasons (Backholer et al. 2016a). Evaluations of these policies have returned positive results, the most notable evaluation being for the Mexican SSB tax which revealed an average 12% decline in SSB purchases 12 months following policy implementation compared to pre-policy trends. To date there is little evidence that SSB taxes have reduced obesity prevalence or reduced the incidence of obesity-related health conditions, primarily due to the relatively recent implementation of these taxes.

Sixty nine percent of Australians support a levy on SSBs if the revenue is reinvested back into health (Morley et al. 2012). Concerns of financial regressivity (whereby low income earners would pay a greater proportion of their income in additional tax) have been refuted by greater policy responsiveness (an average decline of 17% in SSB purchases for low income households in Mexico compared to 7% for high income households) and the potential for progressive health gains and progressive long-term savings in individual healthcare expenditure (Lal et al. 2017). For example, a recent modelling study has suggested a 20% tax on SSBs in Australia would raise approximately \$643 million annually and lead to estimated net gains of 175,300 health-adjusted life years and healthcare cost savings of \$1.7 billion dollars over the lifetime of the population. Almost half these gains were estimated to be in the lowest two quintiles of socioeconomic disadvantage (Lal et al. 2017).

Other fiscal recommendations include extending the health levy on SSBs to energy-dense, nutrientpoor, pre-packaged foods, with revenue to subsidise healthier minimally processed foods and meals and ensuring that fruits and vegetables remain GST-free. Given the ubiquity of price promotions and their relative dominance on energy-dense nutrient-poor foods and beverages compared to core food products (Pollock et al. 2009) restrictions on the price promotion of energy-dense nutrientpoor foods and beverages are also recommended.

From a grassroots perspective, retailers may provide economic incentives to promote the purchase of healthy foods and beverages. This may range from reducing the price of healthy items, increasing the price of unhealthy items, promotional deals, loyalty programs or a combination of these strategies. For example, in Victoria, Alfred Health recently participated in a trial to increase the price of non-diet soft drinks and energy drinks by 20% and saw a 27% reduction in the sale of these sugary drinks over the intervention period (Blake et al. 2017). Going one step further, the Western District Health Service and 12 other Health Services across South West Victoria, incorporating hospitals and health facilities, recently removed all SSBs for sale from its facilities. NSW Health has also recently announced (June 2017) it will remove all SSBs for sale from all hospital and health facilities. Other examples of retailer-led pricing policies to promote healthy choices have been successfully implemented and evaluated in remote Aboriginal stores (Brimblecombe et al. 2013).

Potential solution 3: Fiscal food policy to reduce consumption of environmentally unsustainable (and unhealthy) foods

An environmental levy should be placed on emissions-intensive food commodities, such as red meats, beef and lamb.

Many studies into healthy and sustainable diets identify particular foods that have significant environmental impacts involved in their production (Auestad and Fulgoni 2015, Hallström et al. 2015, McMichael et al. 2007). Red meats, such as beef and lamb, have carbon intensities that are between 5 to 7 times higher than white meats such as pork and chicken, and over 40 times higher

than plant-based sources of protein such as lentils (Clune et al. 2017). Beef production also has a significant land footprint (almost 1500 m² per kilogram) and dairy products have a substantial water footprint (around 775 litres of water per litre of milk produced) (Sheridan 2016).

These foods are also unhealthy if eaten at current high levels, due to their high saturated fat content. According to Friel et al. (2013), a priority dietary behaviour change required to shift the population's current consumption towards a healthy and sustainable pattern is to consume less animal- and more plant-derived foods to deliver both health and environmental benefits. In light of recent modelling showing the potential consequences of the current unhealthy Australian diet on population health, but also on the economy, the environment and future food availability (Turner et al. 2017), there is an opportunity to achieve benefits across multiple policy objectives by introducing measures to reduce the consumption of unsustainable foods.

Recent studies have used modelling techniques to quantify the impacts of taxes on emissionsintensive food commodities on the environment and health. Springmann et al. (2017) used a coupled agriculture and health modelling framework to show that the global climate change mitigation potential of emissions pricing of food commodities could be substantial. Globally it was estimated that emissions could be reduced by 919 MtCO2eq (more than the current emissions of global aviation (International Energy Agency 2015)) and over 500,000 deaths could be avoided. A UK study has also estimated the effect on UK non-communicable disease mortality and greenhouse gas emissions (GHGEs) of internalising the social cost of carbon into the price of food (Briggs et al. 2016). Two scenarios were created to explore the impact of different taxation options on consumption. In Scenario A, a GHGE tax of ± 2.86 /tonne of CO₂ equivalents (tCO₂e)/100 g product was implemented on all products with emissions greater than the mean across all food groups (0.36 kgCO₂e/100 g). It was found that beef consumption decreased by 21% and lamb by 17%, and pork and poultry consumption increased by 12% and 10% respectively, leading to 300 deaths being delayed or averted, 18,900 ktCO2e fewer GHGEs and £3 billion in tax revenue. In Scenario B the same tax rate was applied but subsidies for foods that generated less than the average greenhouse gas emissions were added such that the effect was revenue neutral. The same drop in beef and lamb consumption and increase in pork and poultry consumption occurred, but were accompanied by increases of 3%, 2% and 3% of fruit, cheese and egg consumption leading to 90 deaths delayed or averted and 17,100 ktCO2e fewer GHGEs. Additional studies in Spain (García-Muros et al. 2017), Denmark (Edjabou and Smed 2013) and France (Caillavet et al. 2016) also found beneficial synergies between environmental and health impacts of taxing unsustainable foods.

The main concerns that have been raised related to the implementation of taxes on unsustainable foods centre around whether the potential benefits to the environment would outweigh the financial burden it could impose on low-income consumers. The taxation approach has been described as a 'blunt instrument' that would be less effective than a method that took a deeper look at why consumers make specific purchasing choices and that tried to develop a more targeted approach to changing dietary choices (Heikkinen 2016). In terms of financial burden, the UK study found that the introduction of a tax would increase weekly costs by around £2.50, roughly equivalent to the cost of a take-away coffee, and the French study found that it would actually modestly reduce at-home food costs by 0.4%, which suggest that the potential impact would be small. Nonetheless, sparing food groups known to be beneficial for health from taxation, selectively compensating for income losses associated with tax-related price increases, and using a portion of

tax revenues for health promotion are recommended in multiple studies as potential policy options that could help avert most of the negative health impacts experienced by vulnerable groups, while still promoting changes towards diets that are more environmentally sustainable.

Global grassroots advocacy movements to promote the consumption of less meat have steadily grown in recent years for example, 'Meat Free Monday's' (https://www.meatfreemondays.com) and 'Happy Cow' (https://www.happycow.net). The pursuit of such efforts will be essential to build the momentum for both awareness of the environmental implications of what we eat (beyond the middle-class citizen) and to sustain political pressure for leadership in this area.

Potential solution 4: Ban on industrially produced trans fatty acids

Labelling of the trans fatty acid content of all foods should be mandated in the first instance and then an upper mandatory limit on the amount of industrially produced trans fatty acids that can be contained within any given food product should be established and enforced.

Compelling evidence relates the intake of industrially produced trans fatty acids to an increased risk of coronary heart disease and it is widely agreed that their use in food should be minimised (Kaur et al. 2012, Dietz and Scanlon 2012, Lichtenstein 2012). Industrially produced trans fats are generally found in discretionary foods, consumption of which is greater among those with greater disadvantage (Hendrie et al. 2008, Wardle et al. 2000). Indeed, it has been estimated that almost 500 deaths per year from coronary heart disease can be attributed to trans fatty acid intake, with one in seven Australian adults in the lowest income and education quintile consuming >1% energy from trans fatty acids (exceeding World Health Organization recommendations for trans fatty acid intake) (Wu et al. 2017),

Currently in Australia, labelling of trans fatty acid content on pre-packaged foods is only required when a health claim is made. Mandatory labelling of trans fatty acids would enable consumers to make an informed decision about purchasing products with excessive levels of trans fatty acids. However, research has demonstrated that people who have healthier diets and who are from higher socioeconomic backgrounds are more likely to guide purchasing decisions by seeking out and using food labels (Hess et al. 2012). Replacing industrially produced trans fatty acids with healthier alternatives, at minimal expense, has been demonstrated in jurisdictions such as Denmark and New York City. Here mandatory limits on the total amount of trans fatty acids have been enforced for all food products. Evaluation of this policy in New York City has demonstrated a significant reduction in restaurant food products without a consequent increase in saturated fats (Angell et al. 2012). Importantly, this effect was similar for high- and low-income neighbourhoods.

Control point 3: Increase availability of core foods

Potential solution 5: Legislation to ensure healthiness of publicly procured foods

Mandatory (legislated) public procurement programs should be implemented, enforced and effectively monitored.

Many people, particularly those in lower socioeconomic groups, rely on food from public sector institutions such as schools, hospitals or workplaces such as government offices that provide food. The food served in these institutions is increasingly provided by large commercial catering organisations driven by profit and as such does not always provide healthy, nutritionally balanced

food options. Public sector catering or public procurement initiatives to improve diets are supported by the World Health Organization and are increasingly being implemented by regional governments in many countries. These public sector catering or procurement policies stipulate that foods or meals provided must meet certain standards. These standards can be based on overall nutrient profiles of food, energy or portion size.

Widespread implementation of healthy public procurement policies would not only increase the availability of healthier, core foods to the general public, but may increase overall demand for healthy products as well as driving the reformulation of foods by food manufacturers (Geaney et al. 2011, Ellison et al. 1989, He et al. 2014a, Lee 2012). A 2014 systematic review (Niebylski et al. 2014) identified 19 studies in schools, 6 studies in workplaces and 6 further studies in hospitals and care settings and concluded that the nearly all the public procurement policies led to improved availability of healthy foods and decreased availability of unhealthy foods. Importantly, a number of studies reviewed also demonstrated beneficial effects on attitudes towards healthy eating as well as surrogate health markers such as BMI and blood pressure. Taken together, this evidence directly supports the implementation of healthy public procurement policies in all settings.

In Australia, some state health departments promote healthy public procurement through guidelines or standards. For example The Victorian Government has developed the Healthy Choices Guidelines to help make sure that healthy foods and drinks are offered and promoted in places like hospitals, health services, sport and recreation centres, parks and workplaces. Earlier this year, the New South Wales government launched a new Healthy Schools Canteen strategy to increase the provision of fresh foods in schools. Other states and territories also have programs in place but few programs are legislated and there is no systematic program for monitoring so the extent to which they are implemented effectively or have an impact is unclear.

Grassroots actions may include voluntary procurement of only healthy foods and beverages within retail outlets, schools, workplaces and other organisations. State specific guidelines, such as the Victorian Healthy Choices Guidelines (Services 2010), may be used to support healthy food provision, with assistance from the Healthy Eating Advisory Service (heas.health.vic.gov.au), if required. NGOs and consumer organisations can monitor implementation of voluntary standards or guidelines and help to highlight food practices with a view to supporting more consistent implementation.

Potential solution 6: Regulations to control food composition

Targets to reduce levels of salt, fat and sugar should be established for specific categories of foods

Similar to the way that public procurement policies can ensure that foods and meals served in institutions meet certain nutritional standards, governments can establish targets or standards that food manufactures and/or caterers must meet for all funded food and meals. This means that the food industry would be required to reformulate foods and meals to ensure that levels of salt, fat and sugar are reduced towards the government targets or standards. The World Health Organization promotes the reformulation of foods and meals towards healthier products as part of its Global Action Plan for the Prevention and Control of Noncommunicable Diseases (World Health Organization 2013) and increasingly governments are establishing programs to engage the industry through food reformulation programs (Webster et al. 2014). While programs exist relating to salt, fat (including trans fats) and sugar, salt is the most widespread and has the most evidence of effectiveness. The UK government implemented a comprehensive salt reduction strategy, including a

program of work to get the food industry to take salt out of foods, in 2003. In 2015 it reported that it had reduced salt by around 10%, which was estimated to be saving around 9000 lives a year as a result of reductions in blood pressure (He et al. 2014b). A recent review (unpublished) identified 76 examples of initiatives to influence food composition through targets and standards (Crino et al. 2017).

One of the key questions pertaining to food reformulation initiatives is whether they should be voluntary or mandatory (Charlton et al. 2014). Modelling work has shown that targets for sodium levels in foods are potentially the most cost-effective intervention in terms of reducing population salt intake (Bibbins-Domingo et al. 2010). However, a separate study estimated mandatory targets would be approximately twenty times more effective than the voluntary (Wilson et al. 2016).

The Australian Government's Healthy Food Partnership's food reformulation working group is currently identifying categories and targets to support voluntary food reformulation efforts in Australia.

Grassroots demand for healthier food and beverage reformulation would also increase pressure for food industry to make voluntary changes to the composition of the products they produce. For example, the Victorian salt reduction partnership (which includes VicHealth, the Heart Foundation and the George Institute for Global Health) is currently raising awareness of the importance of salt reduction, including undertaking regular surveys of salt levels in foods to highlight where progress on reformulation has been made and where further change is needed (unpackthesalt.com.au/2017/10/03/australian-ready-meals-are-saltier-than-ever-study/).

Potential solution 7: Urban planning laws to promote healthy food choices

Regulations should be established to ensure that urban planning and development projects support the provision of healthy food choices.

The UCL (University College London) Lancet Commission on Healthy Cities recognised that cities are complex systems, with many interacting sections (Rydin et al. 2012). It is difficult to make changes in some sections without having unwanted consequences in others. The commission recommended five key points to create and maintain healthy cities (Rydin et al. 2012). These included:

- the need to engage with a wide range of stakeholders
- attention to health inequalities
- action taken at the urban level
- an understanding by policy makers of the complexities of the decisions as well as overlapping and unintended consequences
- that progress will be made through local experimentation with evaluation and mutual learning

The food retail environment can be highly dynamic, with food stores opening and closing over short periods of time (Filomena et al. 2013). This type of environment can be a potential opportunity to effect change and promote the opening of healthy food stores over short period of time, but may not be a consistent influence due to short times in which these stores operate. Studies suggest that the relative numbers of healthy and unhealthy food stores can influence purchase of fruit and vegetables, and policies which aim to increase the ratio of healthy to unhealthy food stores can increase consumption of a broader range of fruit and vegetables (Casey et al. 2012). It can also

impact on levels of chronic disease that are related to overweight and obesity. One contributing factor is the accessibility to shops selling fruit and vegetables. Limited access to fruit and vegetables can adversely affect the weight status of those with lower socioeconomic backgrounds, especially in conjunction to reduced access to safe places for physical activity (Casey et al. 2012). Alternatively, increases in density of fast food outlets has been shown to increase adverse cardiovascular events and rates of overweight and obesity in adults, particularly in the absence of mixed land use that includes residential, commercial and public institutions (Li et al. 2008, Chum and O'Campo 2015).

Planning laws and food retail environments should take account of the ratio of healthy to unhealthy food stores, particularly in areas frequented by young people (i.e. around schools) and in areas of socioeconomic disadvantage, or disadvantaged populations.

The use of non-mainstream or alternative methods to access food has increased in popularity in recent years. Alternative food networks are defined as non-conventional groups of producers, consumers and others involved in the standardised, conventional or industrialised mode of food supply (Murdoch. J 2000). In addition to mainstream access food supply via supermarkets and grocery stores, the emergence of alternative food retail outlets include farmers' markets located on a range of premises including schools, universities and hospitals, online ordering and delivery services, and increased access to farm specialty stores and community-supported agriculture. Studies have shown that improved access to supermarkets relative to fast-food outlets and convenience stores can improve the diets of residents (Wegener and Hanning 2010). Alternative food retail outlets can further assist in improving diets by providing additional sources and options for healthy foods where there are barriers in access and availability, such as commercial zoning restrictions. The outlets do not necessarily require a change of zoning, can be constructed rapidly, need not necessarily be permanent fixtures and can be developed inexpensively and quickly via partnerships between local government and community planning authorities (Wegener and Hanning 2010). Some drawbacks include the limited hours of operation, particularly in the case of farmers' markets, and a tendency to be located in areas that are not limited in terms of access and availability of food outlets (Wegener and Hanning 2010).

Encouraging the use of local schools to host alternative food retail outlets may be one method to address this and to ensure greater accessibility to those who are not located in urban centres (Wegener and Hanning 2010). Similarly, the creation of local food hubs via urban planning policies can improve access to healthy food and increase active transport, as access to healthy food can be restricted without access to a car (Burns and Inglis 2007).Community gardens for urban agriculture can also provide a range of benefits including addressing 'food deserts' (locations with limited access to fresh fruit, vegetables and other whole foods), improving access to healthy food, and a hub for education on food and nutrition (Lovell 2010). Studies have shown that people who participate in school or community gardens also had a higher rate of fruit and vegetable consumption (Alaimo. K et al. 2008, Parmer et al. 2009).

It is recommended that areas be identified and promoted within each local government area (LGA) that may be suitable for alternative food retail outlets.

As some health and nutrition-based policies are going to be more feasible than others to implement and evaluate for success, prospective policies need to be carefully evaluated to ensure the most impact is gained for effort incurred (Johnson et al. 2013). Research into nutrition-based policies has shown that while proposed polices may have been viewed as being able to make a positive impact, and viable for implementation by governments if made policy, challenges lay in turning a proposed policy into accepted policy (Johnson et al. 2013). Many factors and arguments have been used in relation to successful (and unsuccessful) health and nutrition-based proposed policies that relate to local influences and how the policy is viewed (Nixon et al. 2015). However, it is clear that in-depth consultations, deliberation and debate with all stakeholders, which include vulnerable groups, is necessary if health equity due to urban planning and design is to be achieved (Rydin et al. 2012).

At the same time, community action that achieves similar goals to those mentioned above should be supported and celebrated. Schools and community halls are generally locations that can be accessed by a majority of local residents, lending themselves to pop-up farmers' markets and festivals that celebrate local produce and healthy food culture. Individual citizens, representative community groups and other local interest groups could be encouraged to engage with local council strategic plans and zoning applications to ensure their views on the food environment are voiced. Other options that may be achieved at the grassroots or community level may include instigating community gardens, particularly in 'food desert' areas, and approaching parent and citizen committees to support and encourage the growing of fruit and vegetables in local schools and community centres.

Outside the box

Fortification of nutrients in plants-based foods

It is now recognised that rising CO₂, as a result of global warming, is a key threat to food production. However, a relatively understudied area is the impact of rising CO₂ on the nutrient content of plants. Globally, deficiencies in iron and zinc are major public health problems (Tulchinsky. T. H 2010). In 2014, a landmark study in *Nature* examined key crops grown in Japan, Australia and the United States and discovered rising CO₂ resulted in a reduction of protein, iron and zinc (Myers et al. 2014). In the same year, a study of almost 130 varieties of plants and more than 15,000 samples confirmed that rising CO₂ levels led to an 8% overall reduction in plant concentrations of calcium, magnesium, potassium, zinc and iron, which increased the ratio of carbohydrates to minerals (Loladze 2014). Whether a reduction in the nutrient content of plant-based foods of this magnitude will have a meaningful impact on population health is questionable, but should be subjected to further examination.

Funding for communities to build their own healthy food environments

Government grants could be distributed to local communities to develop their own healthy food environments. This would allow community organisations to take risks and experiment with different ways in which changes could be made without being fearful of the negative impacts for business. These grants would need to be linked to a formal support structures (e.g. the Healthy Eating Advisory Service and those with expertise working with communities to develop healthy food environments) and embedded in robust evaluative frameworks.

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About the 2017 Theo Murphy High Flyers Think Tank: Rethinking food and nutrition science

The Australian Academy of Science has been hosting annual High Flyers Think Tanks on nationally important topics since 2002. These two-day events bring together outstanding early- and mid-career researchers with expertise in a broad range of disciplines to discuss novel applications of science and technology, and to identify gaps in knowledge that need to be addressed.

The 2017 Think Tank, *Rethinking food and nutrition science*, was held in Perth on 26-28 July with participants examining the field from four perspectives:

- Critical evaluation of nutrition science
- Key control points for healthy, equitable and sustainable food and nutrition
- Essential goals for achieving effective solutions
- Tools for change

Following the event, participants continued to work together to develop a series of discussion papers, of which this is one. The discussion papers are designed to create a productive dialogue and contribute to the consultation process during the development of a decadal plan for the discipline of nutrition.

The 2017 Think Tank was generously supported by the Theo Murphy (Australia) Fund, which is administered by the UK Royal Society.

The Think Tank and the subsequent drafting of discussion papers was overseen by the National Committee for Nutrition, The Theo Murphy High Flyers Think Tank Steering Committee and the following experts:

Professor Jennie Brand-Miller AM, University of Sydney Professor Frank Dunshea, University of Melbourne Professor Mike Gidley, Centre for Nutrition and Food Sciences, University of Queensland Professor Paul Griffiths, University of Sydney Professor Anne-Marie Grisogono, Flinders University Dr Brooke Harcourt, Murdoch Childrens Research Institute Professor Ian Hume AO FAA, University of Sydney Professor David Le Couteur, University of Sydney Professor Amanda Lee, Australian Prevention Partnership Centre, Sax Institute Professor Manny Noakes, CSIRO Professor David Raubenheimer, Charles Perkins Centre, University of Sydney Dr Gyorgy Scrinis, University of Melbourne Professor Stephen Simpson AC FAA FRS, Charles Perkins Centre, University of Sydney Professor Helen Truby, Monash University