

Horticulture Innovation Australia

Final Report

A Strategy to Address Consumption of Vegetables in Children

Dr David Cox
CSIRO Preventative Health Flagship

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VG13090

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Increasing vegetable intake amongst children

A strategic investment plan for the Australian Vegetable
Industry

David N Cox, Atul Kacker, Gilly Hendrie, Danielle Baird, Haidee Lease, Jane Bowen, Astrid Poelman and Jos Mojet

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For the attention of Philippa Lorimer

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Food and Nutrition Flagship

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1 Executive summary

This document reports on a HIA commissioned project (VG13090) to develop a strategic investment plan (SIP) for increasing vegetable intake amongst children. It comprises a systematic review of worldwide initiatives on increasing vegetable consumption with a view to identifying initiatives that have been shown to be effective as well as to identify gaps and opportunities for new initiatives, a consultation with key stakeholders to get their input into the effectiveness of initiatives and opportunities for collaboration, and a strategic investment plan (SIP) to prioritise and recommend initiatives that have some evidence of effectiveness in increasing vegetable consumption in children. Setting good eating behaviours as a child is essential as it forms the basis for future eating behaviours for life. Results from the latest Australian Health Survey suggest children are a long way off meeting recommended vegetable intakes hence there is an opportunity for the vegetable industry to work with those pursuing public health goals. The vision of this SIP is:

“To grow demand for vegetables amongst children (and their families) in a way that it is profitable for the industry”.

This project has identified a number of strategic priority areas for investment as follows:

- A situation analysis (seeking evidence) derived recommendations for the design and implementation of initiatives
- Suggested R&D project funding - new science, and building evidence around existing promising initiatives currently being undertaken in Australia; scale up of initiatives that have been found to be successful
- Suggested establishment of Stakeholder Alliance - To form a Stakeholder Alliance with relevant public and private stakeholders to maximise leveraging ability of levy investment and maximise translation of scientific evidence into community adoption
- Suggested Policy Development - To influence the opinion and policies of government and key external bodies for the benefit of increasing vegetable intake by children

A component of the situation analysis undertook a narrative review of the acquisition of children’s food choices and identified behavioral and attitudinal change strategies, categorizing these into three sections, in order of importance:

- Exposure and Conditioning,
- Imitation and Modelling,
- Cognitive Knowledge Transfer (as only supportive of the previous two).

A systematic review of the published scientific literature identified potential strategies and initiatives to address consumption of vegetables in children. The focus was upon children 2-12 years because of the greater ability to influence this age group. Interventions exclusively in schools were excluded because most of these focus upon school lunch provision which is not typically available in Australia. This review concluded that priorities should be focused upon:

- Younger children (aged 2-6 years)
- Aiming the intervention messages at either children, parents or the family as a whole
- Using existing community groups and integrate elements of the home environment i.e. multi-component settings

- Targeting vegetables within the context of eating a varied and balanced diet and/or lifestyle
- Making contact with participants on a weekly basis
- Incorporating planning for social support and social change. For short term behaviour change, focus upon action planning, graded goal setting, role modelling, use of prompts and cues, and prompt practice. To ensure sustainable longer term behaviour change use techniques such as nutrition education about when and where to eat vegetables, provide staff training and community engagement (e.g. community gardens) to increase availability and accessibility.
- Evaluating using a high quality study design (randomised controlled trial) on a sample representative of the target population
- Measure vegetable intake using a validated tool and follow up at 6 months

A third component reviewed unpublished community initiatives undertaken in Australia. It was concluded that of all 36 community initiatives identified, including 5 that had been evaluated, none could provide strong evidence in being effective in increasing children's vegetable intake. However it is important to note that absence of evidence is not absence of effect. It is possible some community initiatives are effective but they have just not been evaluated. Recent cessation of government funding (attributed to absence of evidence of effectiveness) is a threat to the industry's interests. In summary, two clear recommendations for the industry are suggested: support or facilitate a registry of initiatives and, secondly, support outcome evaluation measures in order to provide evidence of effect.

This SIP recognizes a parallel project (VG13089), currently in progress, to develop a vegetable education kit for the school curriculum. It is recommended that future initiatives provide community and/or home based components to support this project.

A stakeholder workshop (October 2014) identified a disconnect between stakeholders but a strong desire for collaboration, particularly community health and public health academics wish to connect with the industry over common goals.

Gap analysis revealed a number of opportunities:

Early life

Conception – two years. Current advice to (would be) mothers does not specifically advise women that their ingestion of vegetables will facilitate acceptance of vegetables in their (unborn) child via exposure to flavour transferred through amniotic fluid and breast milk. The industry should seek to rectify this through revision of advice.

Similarly advice on complementary / weaning foods should be strengthened, based upon evidence that exposure and judicious use of contingent rewards (positive reinforcement) are effective in increasing infant's liking for vegetables.

Pre-school. Representing one of the largest opportunities, current national regulations (Australian Children's Education & Care Quality Authority) lack specific dietary advice. There is a growing body of evidence that exposure to vegetables at this age facilitates liking and consumption and the industry should seek to revise advice.

Research gaps

The precise use of appropriate rewards (regular, intermittent, random), in support of exposure, requires further testing to optimise the advice. Similarly parents ability to deal with refusal to taste needs further work.

The explicit labelling of vegetable consumption as part of 'healthy eating' and the instrumental message (eat this because it is good for you) are controversial approaches. There is a growing body of evidence to suggest that 'healthy' is associated with 'poor taste' hence there is value in eliminating this controversy through research design. Much of the food acceptance work avoids explicit reference to 'healthy' but the broader approach to diet (suggested above) locates vegetables within a 'healthy' diet and community health stakeholders explicitly promote 'health'. Implicit versus explicit framing of strategies promoting vegetable consumption need testing.

There is a need to improve measures of effect. Novel non-invasive alternatives to self-report and efficient and valid measures of long term follow up need to be developed.

There are several identifiable roles for industry

- 1) To host, support or facilitate a register of initiatives
- 2) To commission suppliers to create an accessible template of best practice designs for children's initiatives.
- 3) To investigate novel approaches for interventions
- 4) To facilitate or fund quantitative outcome evaluations (effectiveness) of existing initiatives that have currently not been scientifically validated, and, in turn, maintain a register of results (impact).
- 5) enhance exposure of these initiatives, to make salient to politicians and, simultaneously, to use measures of effectiveness to argue for health, environmental and economic benefits
- 6) To support community initiatives directly through the provision of vegetables and, secondly, grower involvement in communities.
- 7) To initiate a broad stakeholder alliance in order to facilitate collaboration and optimise the use of a range of skills and resources to design, evaluate and deliver impact.

The outcomes from the analysis of worldwide initiatives to increase vegetable intake in children, discussions at a stakeholder workshop and gap analysis have been incorporated into four key strategic priority areas. These priority areas form the basis of the SIP and will inform the investment of R&D.

Priority Area 1 - Collaboration

Establish a Stakeholder Alliance to include stakeholders within and outside the vegetable industry, notionally called Vegetable Intake Strategic Alliance (VISA).

Develop a joint agenda and activities with stakeholders within the VISA

Priority Area 2 - The right initiatives and impact

Publish and endorse best practice guidelines for the development and implementation of new (community) initiatives.

Priority Area 3 – Continued research into new initiatives

Initiatives that achieve larger impact (greater than typical ½ serve/day increase) through multi-setting (e.g. complementing School curriculum project with home interventions) or longitudinal studies tracking early exposure through to maturity using age appropriate strategies.

Initiatives focused at peri-natal, weaning and early childhood in order to underpin specific government/health advice to (would be) mothers and fathers.

Direct industry involvement in supplying vegetables to community and school initiatives in order to increase exposure to vegetables.

Priority Area 4 – Influencing Policy

There is a potential opportunity to increase intake of vegetables through influencing policy changes. HIA could encourage the adoption of specific maternal advice and lobby for food policy in pre-school and schools settings that encourage learning to like vegetables

2 Media Summary

HIA commissioned CSIRO to develop a strategic investment plan for increasing vegetable intake amongst children. It comprises of a systematic review of worldwide initiatives on increasing vegetable consumption with a view to identifying initiatives that have been shown to be effective as well as to identify gaps and opportunities for new initiatives, a consultation with key stakeholders to get their input into the effectiveness of initiatives and opportunities for collaboration, and a plan to prioritise and recommend initiatives that have evidence of effectiveness in increasing vegetable consumption in children. Setting good eating behaviours as a child is essential as it forms the basis for future eating behaviours for life. Results from the latest Australian Health Survey suggest children are a long way off meeting recommended vegetable intakes hence there is an opportunity for the vegetable industry to work with those pursuing public health goals. This project has identified a number of strategic priority areas for investment as follows:

Priority Area 1 - Collaboration

- Establish a Stakeholder Alliance to include stakeholders within and outside the vegetable industry, notionally called Vegetable Intake Strategic Alliance (VISA).
- Develop a joint agenda and activities with stakeholders within the VISA

Priority Area 2 - The right initiatives and impact

Publish and endorse best practice guidelines for the development and implementation of new (community) initiatives.

A systematic review concluded that priorities should be focused upon:

- Younger children (aged 2-6 years)
- Aiming the intervention messages at either children, parents or the family as a whole
- Using existing community groups and integrate elements of the home environment i.e. multi-component settings
- Targeting vegetables within the context of eating a varied and balanced diet and/or lifestyle
- Making contact with participants on a weekly basis
- Effectiveness was associated with: whole of diet approaches, action planning, graded goal setting, role modelling, use of prompts and cues, prompt practice, repeated exposure, vegetable consumption opportunities, staff training and wider community engagement.
- Evaluating using a high quality study design on representative target populations
- Measure vegetable intake using a validated tool and follow up at 6 months

Priority Area 3 – Continued research into new initiatives

- Initiatives that achieve larger impact (greater than typical ½ serve/day increase) through multi-setting (e.g. complementing a School curriculum project with home interventions) or longitudinal studies tracking early exposure through to maturity using age appropriate strategies.

- Initiatives focused at peri-natal, weaning and early childhood in order to underpin specific government/health advice to (would be) mothers and fathers.
- Direct industry involvement in supplying vegetables to community and school initiatives in order to increase exposure to vegetables.

Priority Area 4 – Influencing Policy

- There is a potential opportunity to increase intake of vegetables through influencing policy changes. HIA could encourage the adoption of specific maternal advice and lobby for specific food policy in pre-school and schools settings that encourages vegetable consumption

3 Introduction

3.1 Objective and outcomes

Objective

In 2012 AUSVEG, in partnership with Horticulture Australia Limited (HAL), developed a Strategic Investment Plan (vegetable industry SIP) for the Australian (leviable) vegetable industry. The vegetable industry SIP set out a 10 year vision for the industry and guidelines for investment of vegetable Research and Development (R&D) levy to achieve that vision.

Pursuant to the investment guidelines, HAL tendered for the development of a strategy to address consumption of vegetables in children. The tendered project comprised a systematic review of worldwide initiatives on increasing vegetable consumption with a view to identifying initiatives that have been shown to be effective as well as to identify gaps and opportunities for new initiatives, a consultation with key stakeholders to get their input into the effectiveness of initiatives and opportunities for collaboration, and a strategic investment plan (SIP) to prioritise and recommend initiatives that have some evidence of effectiveness in increasing vegetable consumption in children.

At the commencement of this project, HAL was not able to conduct marketing and promotion activities using the industry R&D levy. HAL has now been replaced by Horticulture Innovation Australia Limited (HIA) as the grower owned Research and Development Corporation (RDC) to look after the interests of Australia's \$9.5 billion horticulture industry and invest levies in research, development, extension and marketing programs¹ and services.

The SIP will explore a range of complementary initiatives that address consumption of vegetables in children, review the evidence on their effectiveness and outline a strategic plan to guide investment in this area. The SIP will also explore opportunities to leverage and enhance the impact of initiatives to increase vegetable consumption through partnerships outside the traditional horticulture supply chains. It is intended that the SIP is used as an input into strategic investment decision making within HIA on the allocation of funds into chosen initiatives and enable the development of detailed implementation plans for those initiatives.

Outcomes

A key outcome of the SIP is to facilitate and inform the future development and implementation of evidence based initiatives that create a long term and sustained increase in awareness and consumption of vegetable produce by children.

3.2 Background

The Australian Guide to Healthy Eating (National Health & Medical Research Council DoHA, 2013) recommends children between the ages of 2 and 18 years consume between 2.5 and 5.5 portions of vegetables (depending on age) with a portion defined as 75g (Australian Government Department of Health & Ageing, Go for 2 & 5).

¹ NB There is no marketing levy for the vegetable industry

Results from the Australian Health Survey 2011-13 (Australian Bureau of Statistics, 2013) reveal that children who participated in the National Nutrition and Physical Activity Survey reported an average intake of 102g of vegetable products and dishes for the day of interest. Vegetable intake in children increased stepwise with age group, from 67g for 2-3 year olds to 123g for 14-18 year olds. Children aged 2-3 years were more likely to meet the recommended usual intake of vegetables (49%), compared to children aged 4 to 18 years (<10%). This may be attributable to the steep increase in recommended intakes at age 4 from 2.5 portions to 4.5 portions (see figure 1).

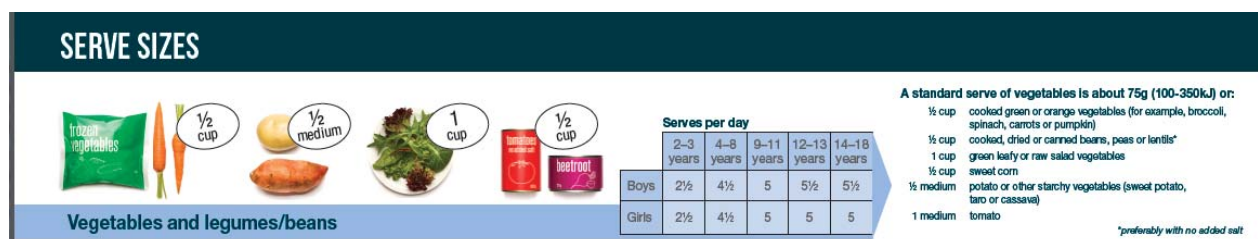


Figure 1. Guidelines for children’s vegetable intakes from eatforhealth.gov.au

Setting good eating behaviours as a child is essential as it forms the basis for future eating behaviours and relationships with food for the remainder of life (Friedl et al, 2014). Results from the latest Australian Health Survey suggest children are a long way off meeting recommended vegetable intakes. This provides the vegetable industry with an opportunity to develop initiatives that increase vegetable intake in children (& hence increase vegetable sales and profitability of growers) and help in shifting the intake of children towards those recommended by the Australian Guide to Healthy Eating.

HAL contracted CSIRO to review the effectiveness of community interventions and scientific studies in the literature and develop a strategy outlining initiatives to increase and sustain vegetable intake in children. The strategy would take into account:

- Community interventions with direct application, i.e. interventions that have been shown to be effective and those that can be implemented relatively quickly
- Scientific studies that have occurred in a natural context (i.e. studies done within a school, group or community) that may be rolled out on a larger scale
- Scientific studies of food preference development that can be translated into a community context and the ease or difficulty with which the initiatives can be implemented
- The level of involvement and ownership the vegetable industry can exert on the initiatives
 - Directly by the vegetable industry itself (e.g. levy payers)
 - Indirectly through immediate partners of the vegetable industry (e.g. supply and value chain partners)
 - Indirectly through new or stronger partnering with others (e.g. health and education departments of state governments; other RDCs e.g. MLA; public health organisations; health and parenting NGOs)

The outcomes of this Project would inform the strategic investment of levy funds into suitable initiatives in HIA’s Annual Operational Plan.

4 Vision

The overall vision of the Australian Vegetable Industry Strategic Investment Plan 2012 – 2017 is

“To be a cohesive, financially and environmentally sustainable, and highly efficient industry focused on growing demand profitably”.

This vision was formulated on the basis of industry analysis and the results of numerous interviews and focus groups, and was formulated from the perspective of the levy paying grower.

The vision “stresses that the industry is not only concerned with growth in vegetable production and value, but more importantly, growth in profitability to farmers. It also considers the necessity to improve the industry’s sustainability long into the future; keeping in mind the short-term and long-term threats and opportunities for the industry. Analysis of past programs in the industry have shown that these aspects can only be achieved through a more focused, structured and cohesive industry.” (Source: Australian Vegetable Industry Strategic Investment Plan 2012 – 2017, March 2012)

The Vegetable industry has recognised that creating demand amongst children is an opportunity for not only creating demand amongst this target group, but also creating future demand by establishment of lifelong healthy eating habits. There is strong evidence from the scientific literature to support the fact that children’s eating behaviours carry through to adulthood, and some evidence that children influence parental purchasing of vegetables, hence addressing children’s consumption may have immediate effects upon families of the children targeted and may have longer term effects throughout the child’s life.

In alignment with the overall vision of the Vegetable Industry, and taking the specific aim of the current Strategic Investment Plan into account, we propose the following vision:

“To grow demand for vegetables amongst children (and their families) in a way that it is profitable for the industry”.

5 Mission

5.1 Vegetable industry SIP

In March 2012 AUSVEG, in partnership with HAL, developed the Australian Vegetable Industry Strategic Investment Plan 2012 – 2017. The AUSVEG SIP outlined a vision for the industry “to be a cohesive, financially and environmentally sustainable, and highly efficient industry focused on growing demand profitably”.

The AUSVEG SIP also identified three key strategic priorities for the industry to achieve its vision.

1. Consumer alignment
2. Market and Value Chain Development
3. Farm Productivity, Resource Use and Management

The suggested spending allocation of R&D levy funding to these strategic priorities were:

- Consumer Alignment – 45%
- Market & Value Chain Development – 20%; and
- Farm Productivity, Resource Use and Management – 35%,

which was a strategic shift in taking a total value chain approach and including consumer and customer demands.

This Project falls under the first of the priority areas - Consumer Alignment. This priority area focuses on increasing consumer demand through research into understanding the needs and preferences of vegetable consumers and investing in projects across the value chain that deliver outcomes that meet consumer expectations. It is also focussed on strengthening the consumers’ perceptions of the value of Australian vegetable products. Research into understanding the needs of consumers is usually more than just a survey and may include research into changing consumer preferences and ways to enhance the value of vegetables in their preferences or research into the sensory attributes of vegetables and means of influencing consumer preferences towards those sensory attributes.

5.2 Children’s SIP

This project has identified a number of strategic priority areas for investment as follows:

- Design and implement initiatives
- R&D project funding - new science, and building evidence around existing promising initiatives currently being undertaken in Australia; scale up of initiatives that have been found to be successful
- Establishment of Stakeholder Alliance - To form a Stakeholder Alliance with relevant public and private stakeholders to maximise leveraging ability of levy investment and maximise translation of scientific evidence into community adoption
- Policy Development - To influence the opinion and policies of government and key external bodies for the benefit of increasing vegetable intake by children as an essential component of overall diet

6 Situation Analysis

6.1 Overview

A comprehensive understanding and analysis of the internal and external environment and the key issues now and into the future has been undertaken. The situation analysis is based upon:

- 1) A narrative review of the development of children's food preferences
- 2) A systematic review of published initiatives that sought to increase children's vegetable intakes
- 3) A review of unpublished (community) initiatives that sought to increase children's vegetable intakes
- 4) Stakeholder analysis
- 5) Dialogue from a stakeholder workshop

6.2 Narrative review of the development of children's food preferences

A review presented the theoretical background of food choice development from a behavioural perspective from pregnancy to children to 12 years of age. This development also specifically reviews literature on food preference development and food choice on vegetables in children from 2 to 12 years of age – an important window of opportunity in influencing children's food choices. Eating issues that are encountered in different age groups, and strategies and methods to overcome are presented in Table 1.

Behavioral and attitudinal change in children can be categorized into three sections:

- Conditioning,
- Imitation and Modelling, and
- Cognitive Knowledge Transfer.
- **Conditioning** in the form of mere exposure, and the resulting familiarisation with new and complex sensations are most effective when novel foods are introduced at an early age. Monotony in vegetable presentation should be avoided, variety over days and by the presentation of different vegetables in a meal helps.
- **Modelling** by and imitation of peers, older children and other role models can also play an important role in increasing vegetable consumption. Flavour-flavour conditioning (pairing liked and disliked flavours) can also contribute to the intake of new vegetables, but flavour-nutrient (adding high density components to vegetables) does not. Conviviality in food-related activities such as meals, communal vegetable gardening and joint cooking are recommended intervention strategies.
- **Cognitive knowledge** transfer alone is not very effective, but it may have a consolidating influence on the positive effects obtained by mere exposure and other methods.

Contrary to common belief, the inappropriate use of rewards (e.g. eat your vegetables and you can have dessert) has often adverse effects of children's intrinsic motivation. Nevertheless, small incentives that encourage trying (positive reinforcement) have been found to be effective (Corsini, Slater, Harrison, Cooke & Cox, 2013; Cooke 2011b). See gaps below, Section 4.9.

In many cases combination of methods has proven to be successful in achieving the goal of healthier food intake and increased vegetable consumption.

Period 0-2 years ²	Situation	Issues	Strategies	Methods
Pregnancy phase	Last 4 months before birth	Monotony in maternal vegetable eating habits	Achieving postnatal food acceptance via varied food intake by pregnant women	Promoting mother's prenatal intake of a large variety of vegetables
Milk feeding phase	Home	Breast feeding: depends on maternal feeding pattern	Achieving varied food acceptance via maternal food habits	Continued varied vegetable intake both over and within days by carers
	Daycare	Formula feeding: may lead to little variation in taste		
Weaning phase	Home	Transition to solid food (e.g. vegetables)	Achieving a varied food acceptance of flavour and texture via maternal food habits	Repeated exposure (RE), flavour-flavour (FF) & flavour nutrient (FN) conditioning, pairing with like food
	Daycare	Novel flavour and texture		
Period approx 2-5 years	Situation	Issues	Strategies	Methods
Preschool refusal phase	Home	Rejection of novel foods (neophobia)	Achieving acceptance of novel foods through single and multi-component approaches	<ul style="list-style-type: none"> - RE, Conditioning FF & FN - Restriction or limitation - positive reinforcement - Conviviality (i.e. eating the same food/meal together) - Panic avoidance/acceptance of refusal
	Daycare	Reactions of parents and care providers		
	Preschool			
Period 5-7 years	Situation	Issues	Strategies	Methods
Primary school perceptual phase	Home & school	<p>Acceptance of novel foods</p> <hr/> <p>Eating habits/manners (behaviour, finishing plate, utensil use etc)</p>	Achieving acceptance of novel foods through single or multi-component approaches	<ul style="list-style-type: none"> - Exposure +/- reward, variety & choice - Sensory education/cooking classes - Joint preparation and eating - Exemplary behaviour of parents, peers & caretakers - Interactive shared reading
Period 7-12 years	Situation	Issues	Strategies	Methods
Primary school reflective phase	Home & school	<p>Lack of knowledge about vegetable context (e.g. health, growing, preparation, culture)</p> <hr/> <p>Self-regulation of food intake</p>	Achieving acceptance of novel foods through single or multi-component approaches	<ul style="list-style-type: none"> - Continued RE - Continued sensory & food culture education - Common edible gardens, joint preparation & eating - Self efficacy (goal-setting & self-monitoring) - Modelling

Table 1. Schematic overview of the different phases in young children's food choice development

² Timespan suggests key opportunities within this time but does not suggest that weaning may occur up till 2 years.

6.3 Previous reviews of published studies

The majority of previous reviews report both fruit and vegetable intakes combined and/or focus upon school initiatives to change lunch provision. These approaches were of limited value with regard to vegetable intakes in the context of Australian public schools. There is currently no opportunity to intervene in school lunches as there is often limited or no lunch provision. In Australia, school canteen, tuck shop and lunch box guidelines are merely guidelines and require medium to long term understanding and action in the policy arena.

The most recent comprehensive review of initiatives on increasing fruit and vegetable intake amongst primary school children suggest that intensive, focused, controlled trials can increase (self-reported) intakes by + 0.3 – 0.99 servings but that the majority of this modest increase is derived from fruit not vegetables (Knai et al, 2006). Further support for this assertion comes from a recent review of school based fruit and vegetable interventions who found small effects upon self-reported fruit intake (0.24 servings) but minimal effects upon vegetable consumption (0.07 servings) (Evans et al, 2012). Clearly there is a need to improve our understanding of what current interventions and community initiatives are doing and their impact on vegetable intake.

Furthermore previous reviews tend to focus on effectiveness and do not describe 'how' initiatives were undertaken. With these issues in mind a new review was undertaken.

6.4 Systematic review of published studies

CSIRO undertook a systematic review of the scientific literature, to identify potential strategies and initiatives to address consumption of vegetables in children.

The main search was conducted in June 2014 and included the following databases: PubMed, PsychINFO and CABabstracts. Unpublished work was not included as part of this review of scientific literature (see below 4.5 for grey literature search).

Types of participants

Children of primary school age or less were included. In this Australian context, primary school aged children was considered to include children aged 12 years or less. Infants and toddlers less than 2 years of age were also excluded from this review.

Types of studies

Prospective studies of any duration that evaluated the effectiveness of an intervention, with or without a traditional comparison group, were included. Interventions were included if they focused specifically on vegetable consumption, on healthy eating or healthy lifestyles in general.

Initiatives solely within schools were not included (but those that had multiple settings that included schools were) because of previous reviews already conducted in this area (Evans et al 2012) but more importantly because of the lack of provision of school lunches in Australian public schools.³ This is a major limitation to influencing children's consumption of vegetables (see 4.2 above). This age group was agreed with a HAL consultative committee, subsequent to evidence suggesting that there were more opportunities to influence children of this age group. It should be noted that there is some evidence that peri-natal *in utero* (Menella et al, 2001) and early infancy (Maier et al, 2008) are also viable opportunities for influencing the acceptance of vegetables and see 4.2 above.

³ Refer to project VG13089 for an initiative in Australian schools and section 5.6 below

Types of outcomes

Studies were included if they provided an objective measure of vegetable consumption in children, reported at an individual or group level. Vegetable consumption needed to be reported separately to fruit intake and broadly represent an amount consumed. For example, this amount could be reported as amount consumed (grams, servings), frequency of consumption (times per day, week, month), number of vegetables included in lunch box, or purchase habits (shopping receipts).

A systematic search strategy was undertaken and Figure 2 describes the scale of the search task.

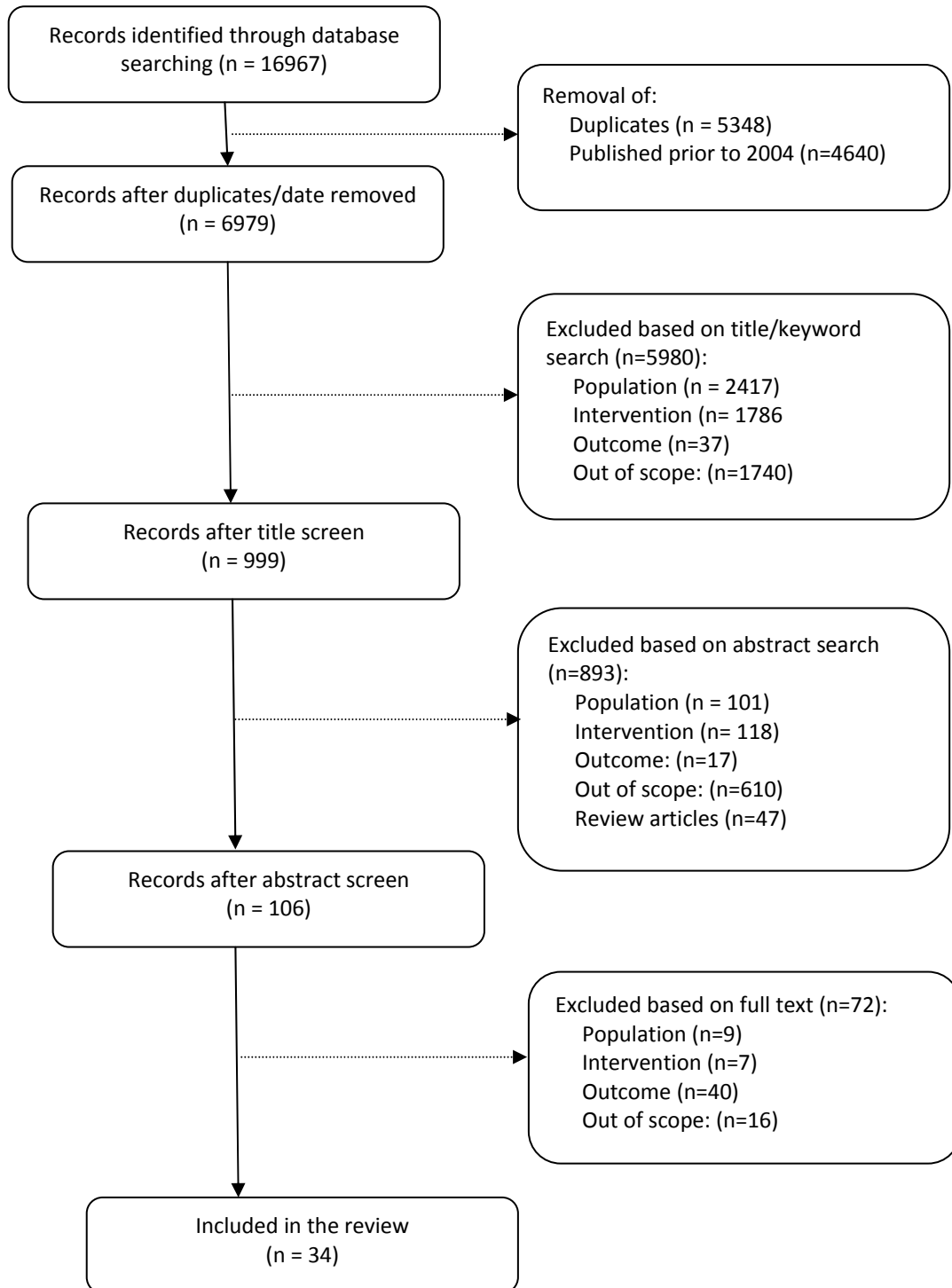


Figure 2: PRIMA flow diagram for inclusion of studies into the systematic review of scientific literature.

Results

Of the 34 papers included in the review, 25 (73%) significantly increased children's vegetable consumption (were effective in the short term immediately post intervention). Twelve studies measured longer term effectiveness, and of these seven (58%) reported a sustained increase in children's vegetable intake at 6 months or more. Overall impact of these interventions was small, equating to about a quarter to half of one serve of vegetables.

The majority of interventions were conducted in the USA (n=24), eight in Europe and two in Australia. Only three interventions specifically targeted children's vegetable intake, while the others targeted both fruit and vegetables (n=12), healthy eating principles including vegetables (n=10), healthy eating and lifestyle more generally (n=9).

Twenty-six studies (76%) declared their funding sources and most were funded by research grants or from charities, philanthropies or foundations. Five programs received financial support from Government Departments/Agencies, while the remaining received funding from Universities and industry.

The home environment was the most commonly used setting. However, all the interventions delivered in the community were effective in increasing children's vegetable intake. Most interventions delivered through preschools/childcare centres were effective and after-school programs were also predominantly effective.

Intervention design and delivery	
Target group	Children aged 2-6 years Intervention messages can target children, parent or the family as a whole.
Setting	Using community groups and educational institutions, with integration into the home environment.
Intervention target	Whole of diet: Vegetables within the context of a prudent diet
Level of contact	High frequency of contact but can be lower intensity such as group based activities and newsletters.
Intervention content: Behaviour change techniques	
Definitely include:	Plan social support and/or social change
Have potential for short term behaviour change:	Action planning Set graded tasks Teach to use prompts and cues Use of animal stories as role modelling (if age appropriate) Prompt practice
Useful for longer term behaviour change:	Provide staff training Provide information or training on when and where to eat vegetables Change availability and accessibility
Commonly used but evidence not well established :	Use of exposure techniques Provision of information on the consequences of behaviour in general and to the individual Provide instruction on how to perform the behaviour Goal setting Provision of resources
Intervention evaluation	
Design of evaluation	Randomised controlled trial in individuals representative of the target population
Measurement of outcome	Need for validated and comprehensive measure of vegetable intake, with long term follow up (6 months or more)

Table 2 Summary results of techniques associated with effective initiatives

<p>1: Provide information on consequences of behaviour in general (non-tailored or personalised)</p> <ul style="list-style-type: none"> • “.....weekly 90-minute sessions on physical activity, nutrition education” (Wright et al, 2012) • Children were given the message “eat them up to be big and strong” (Horne et al, 2011) • “The intervention emphasised the need for an increase in nutrient-rich foods, but also included limited information on reducing savoury snacks and confectionary” (Evans et al, 2010)
<p>2: Provide information on consequences of behaviour to the individual (tailored/ personalised information)</p> <ul style="list-style-type: none"> • “.....the cooking and nutrition workshops were offered in Spanish and specifically targeted toward the Hispanic families in the program.....workshops provided families with useful information and resources related to making healthy food choices” (Castro et al, 2013) • Targeted information offered to parents including “information on energy content of fruit , vegetables and energy dense snacks offered to children” (Bayer et al, 2009) –this was targeted and aimed at the diet of the kids and the food parents offered them
<p>5: Goal setting (behaviour)</p> <ul style="list-style-type: none"> • “The first log on was to participate in the behaviour change program and set behaviour change goals that gradually increased the number of FV servings to consume.....” (Latif et al, 2011) • “Children, with guidance from instructors, set realistic, measureable goals for bringing healthful snacks to school and sporting activities, and for preparing them at home” (Freedman & Nickell, 2010)
<p>7: Action planning</p> <ul style="list-style-type: none"> • “The goals identified specific foods, meals and days, times and days on which the goal would be attained..” (Latif et al, 2011)
<p>9: Set graded tasks</p> <ul style="list-style-type: none"> • “Children were challenged to choose achievable, small changes in consumption of targeted food items” (Freedman & Nickell, 2010)
<p>21: Provide instruction on how to perform the behaviour</p> <ul style="list-style-type: none"> • “Practical advice specific to each feeding habit (ways to increase fruit and veg intakes, ideas for healthy snacking, ways to promote drinking water or milk” were provided (McGowan et al, 2013) • “Standardized instructions were provided in a booklet which included a flowchart with suggestions about how to respond to a child who refused to taste” (Corsini et al, 2013)
<p>22: Model/demonstrate the behaviour</p> <ul style="list-style-type: none"> • “Demonstration of snack preparations” (Somerville et al, 2012) • Participants watch a nine-part DVD series that “depicted the lives of a family trying to make healthy dietary changes” (Horton et al, 2013)
<p>23: Teach to use prompts/cues</p> <ul style="list-style-type: none"> • Educational sessions “helped parents recognize inconsistencies between actual and desired behaviours and learn skills to reduce this dissonance” (Martinez-Andrade et al, 2014) • One of the modules included “helping children listen to their own body’s signs of hunger and fullness” (McGowan et al, 2013)
<p>26: Prompt practice</p> <ul style="list-style-type: none"> • “Work sessions gave families the opportunity to practice gardening skills” (Castro et al, 2013) • “The snack was eaten in a family-style manner, together at a table, with a table cloth and non-disposable plates and silverware” (Davis et al, 2011) • “Intervention activities consisted of familiarizing with different food types and preparation methods as well as cooking and eating meals together in groups of children, teachers and parents” (De Bock et al, 2012)
<p>29: Plan social support/social change</p> <ul style="list-style-type: none"> • “The behavioural skills component consisted of instruction in various self-management and self-regulatory skills (e.g., recruiting social support)” (Annesi et al, 2009) • “The intervention included strategies for parents to solicit support from all family members to routinely self-monitor to anticipate future barriers or difficult situations” (Wolfenden et al, 2014)

Table 3 Examples of how Behaviour Change Techniques are described in the interventions

Conclusions from the review of published literature – Interventions to increase children’s vegetable intake would have the following key characteristics:

- Target younger children (aged 2-6 years)
- Aim the intervention messages at either children, parents or the family as a whole
- Use existing community groups and integrate elements of the home environment i.e. multi-component settings
- Target vegetables within the context of eating a varied and balanced diet and/or lifestyle
- Make contact with participants on a weekly basis
- Incorporate planning for social support and social change. For short term behaviour change, focus upon action planning, graded goal setting, role modelling, use of prompts and cues, and prompt practice. To ensure sustainable longer term behaviour change use techniques such as nutrition education about when and where to eat vegetables, provide staff training and community engagement (e.g. community gardens) to increase availability and accessibility.
- Evaluate using a high quality study design (randomised controlled trial) on a sample representative of the target population
- Measure vegetable intake using a validated tool and follow up at 6 months

6.5 Unpublished Australian community initiatives

In addition a search of unpublished Australian community initiatives was undertaken.

Of the 36 programs identified, just over half conducted some form of evaluation. Seven of these were considered to be process evaluation and 14 were outcome evaluations. Five of the 14 programs with outcome measures reported changes in vegetable consumption.

While three campaigns reported positive trends towards increased vegetable intake, namely FOODcents®, Eat Well Be Active and CRUNCH&SIP®, the increase in intake was not statistically significant (Eat Well Be Active) or not reported (FOODcents®, CRUNCH&SIP®).

The studies that did not report on vegetable intake, evaluated their programs in terms of change in vegetable related knowledge, attitudes, awareness and/or intention from baseline. Therefore, it was concluded that of all 36 community initiatives, including the 5 that had been evaluated, none could provide strong evidence in being effective in increasing children’s vegetable intake. However it is important to note that absence of evidence is not absence of effect. It is possible some community initiatives are effective but they have just not been evaluated. Hence they remain an untapped potential vehicle for vegetable promotion that the industry could use.

The cuts to ‘health promotion’ that have recently occurred, for example nationally with the cessation of the Commonwealth’s National Partnership Agreement on Preventative Health and in South Australia subsequent to the McCann report (2012) and more recent Federal cuts to health budget are a warning that the industry cannot continue to rely on state and community promotion of vegetable consumption. Other States’ funding is also under threat although this may vary. All initiatives suffer from lack of, or poor, outcome evaluations. Without the ability to prove effect (and flow on to health care cost savings or other benefits) many more initiatives could be cut if a slowdown in the economy and/or government policies limit spending on health promotion, including the consumption of vegetables amongst children.

6.6 Classroom based education (extract from VG13089 Vegetable Education Kit)

We have noted above that there are limited opportunities to directly influence the food supply in Australian schools (in contrast to Europe and North America); however, a parallel project seeks to influence vegetable intake through a scientific curriculum package for teachers use.

Project VG13089 aims to develop a Vegetable Education Kit for use in Australian classrooms. The project is a collaboration between CSIRO Food and Nutrition Flagship and CSIRO Education. To determine feasibility and best-practice approach, as part of this project a literature review was undertaken of several programs that used a classroom based approach and were relevant to the goals of the Vegetable Education Kit project.

A summary of the outcomes of this review is included here, because of its relevance to the development of an overall Strategic Investment Plan for Children. The programs reviewed included programs in The Netherlands (Smaaklessen), France (Lessons du Gout), Finland (Sapere), several other European countries (mostly adaptations of the French program), and the USA (Veggiecation). These programs aimed to increase healthy eating habits and/or vegetable consumption. An Australian program, the Stephanie Alexander Kitchen Garden Program, which aims to increase vegetable consumption by setting up a garden and kitchen in schools, was also included in the literature review, although strictly speaking this was not a classroom based program. The programs were selected because they had a potentially good fit with the aims of the Vegetable Education Kit, had been developed over a considerable amount of time, were well described in terms of contents, and research into their effectiveness had occurred. It does not imply that there may not be other programs that would fit this category, but we worked from the perspective that in-depth analysis of a few programs would provide better insights and applicability for development of an Australian Vegetable Education Kit than a global analysis of many. The review of these projects included contents and delivery of the program, scientific evidence, curriculum alignment, funding and outreach and additional activities. In addition, key features of several other programs aimed at increasing vegetable consumption through classroom education were mapped.

Common elements across reviewed programs were enjoyment, fun and tasting of products to increase appreciation of foods towards healthier eating habits and/or vegetable consumption. Effectiveness evaluations of these programs have shown that changes in children's behaviour consistent with several aims of these programs were achieved. Measures of effectiveness included increases in knowledge, attitude and willingness to taste new foods, and only in few programs measures of actual consumption were included. Programs were focusing their efforts on primary schools, with stronger effects found among younger age groups. The wider mapping of classroom based educational programs aimed to increase vegetable consumption around the world found that most programs targeted children at primary schools. The reasons are that primary school-age children are more likely to be malleable, a staged long term approach is facilitated by starting at a younger age and that establishing acceptance at a young age is likely to carry through to older age. In contrast, teenagers possibly present 'too late' and assert independence and other food choice challenges. There is a need to establish a 'cohort' of younger children. Furthermore the implementation of such program is facilitated by more flexibility in the classrooms and primary level curriculum.

Even within primary schools, several programs (France, Netherlands and Finland) found greater effects with younger children than with older children. These results are supported by scientific evidence that children's preferences develop early and that children are more receptive to change in acceptance at a younger age (Birch, 1998; Köster & Mojet, 2007).

Most programs have continuity in learning; they are built up over the years, whereby the children's knowledge and attitudes are reinforced and expanded over time. The Dutch program has shown this continuity to be a critical success factor. The need for a cumulative learning effect and the greater effect

when focusing upon younger (primary) children suggests a 'cohort' needs to be started now at the primary level.

Combining the two findings above, from a theoretical viewpoint of achieving change, it seems recommended to focus attention on primary school and develop a comprehensive unit of work across stages.

Many programs found that children had developed an increased willingness to taste new foods, which is a decreased 'food neophobia'. Food neophobia has been shown to be related to vegetable acceptance, vegetable intake and dietary variety (Galloway, Lee, & Birch, 2003; Nicklaus, Boggio, Chabanet, & Issanchou, 2005). Thus, reduction of food neophobia will benefit vegetable acceptance and intake. This is all the more important, as vegetables are the least liked food category amongst children (Nicklaus, Boggio, & Issanchou, 2005).

The programs have emphasised fun, experiential learning, and tastings are an important part of the program. The mere exposure theory predicts that with increased familiarity (repeated tasting) an increase in acceptance will be achieved (Zajonc, 1968). Many studies have found that repeated exposure is successful in increasing children's acceptance and intake of vegetables (Anzman-Frasca, Savage, Marini, Fisher, & Birch, 2012; Corsini, Slater, Harrison, Cooke, & Cox, 2013; Lakkakula, Geaghan, Zanovec, Pierce, & Tuuri, 2010; Wardle et al., 2003). The school environment provides an excellent opportunity to expose children to vegetables, especially for children whose vegetable consumption is low because their parents do not buy and serve many vegetables themselves. The school environment provides opportunities for both explicit and implicit (as part of another activity) exposure to vegetables, and therefore there are several opportunities to increase acceptance. French research has further shown that a classroom based program is more effective than a school canteen based program.

In the Netherlands, the health component of the program was found to have a negative impact on emotion. There is a growing scientific literature on the assertion that locating or framing children's food choices within a 'healthy' food or health domain may be counter-productive. Secondly that taste must be addressed first and independently of health.

Early work by Baranowski et al (1993) found that amongst 4th and 5th grade students there appeared to be a predominant belief that "if a food tastes good, it must not be good for me; and if a food tastes bad, it is probably good for me." Further work by this group (Kirby et al, 1995) supported this assertion and found that the most frequent comment was that "veggies taste nasty". Another qualitative study (Ross, 1994) found that food choice amongst UK pre-schoolers was not determined by the health attributes of food but by preference, play, socialisation and convenience. Another UK study (McKinley et al, 2005) found that amongst school-age children taste was by far the biggest impediment to healthy diets, as healthy food was not positively associated with taste. The children even presumed 'healthy' food they had not tried would not be nice. Indeed a European review (Brug et al, 2008) identified taste preferences and liking as being the most important for children's food choices with availability driving such preferences and liking through cultural practices and exposure.

Specific studies on health and taste include experimental work by Wardle & Huon (2000) demonstrating that simply labelling a beverage as healthy decreased children's liking due to the association with poor taste. Testing of the unhealthy = tasty hypothesis used both implicit and explicit measures (Raghunathan et al, 2006) and found, in a series of experiments, that unconsciously (implicitly) students and adults associated healthy foods (including vegetables) with poor taste. Such a relationship held true amongst people who explicitly believed that healthy = not tasty and those that did not believe this. More recent evidence (Maimaran & Fishbach, 2014) shows that simply giving children 'instrumental' information (eat this because....) decreased liking for a range of beverages and foods including a vegetable.

In summary there is reasonable evidence that locating children's vegetable consumption within an explicit health framework is likely to evoke beliefs that healthy is unpalatable and, given that we know that children are driven by the hedonic and sensory attributes of foods, it is likely that explicit framing of vegetable consumption within the health domain may decrease liking for and consumption of vegetables.

Most of these programs did not just have a classroom focused education approach, rather were multi-component interventions in which the classroom educational resource was the core, and other activities had later been added. Notably, activities included components to keep continued involvement of schools, involve parents and/or supply of vegetables. Examples of activities involving parents are newsletters, websites and an interactive online community space. Supply of vegetables was particularly strong in one program, by linking to another program, the European Union funded ‘Schoolgruiten’, which is somewhat comparable to the WA and NSW Crunch & Sip Program. This EU project sponsors free fruit and veg delivery to schools for a limited period.

6.7 Stakeholder engagement workshop

6.7.1 BACKGROUND

The absence of a vegetable marketing levy negating a generic marketing campaign and the widespread interests, particularly amongst the health sector, of increasing vegetable intake strongly suggests collaboration with a wide range of stakeholders. In effect the health sector has been a collaborator, with varying degrees of informality, for decades. A workshop was held October 2014 in Adelaide SA. HAL provided funding for inter-state participants travel and accommodation. CSIRO provided the venue and support services in-kind.

6.7.2 INVITED STAKEHOLDERS

Consultation was undertaken with HAL, key informants, web searches and the authors’ knowledge of those in the field to identify stakeholders. Table 4 shows sectors invited and those agreeing to participate.

Stakeholder	Invited	Participated
Vegetable Industry (growers, levy payers)	yes	yes
Vegetable processors	yes	No
Supply chain	yes	No
Markets	Yes	Yes
Retailers	yes	No
Industry Organisation	yes	yes
Community Health	yes	yes
Govt. Health Departments	yes	yes
Academic/ researchers	yes	yes
CSIRO	yes	yes
Non-Government Organisations	yes	yes
Consultant/ supplier to HAL	yes	yes
Parents groups	yes	yes
Govt. Education Departments	yes	No
Parents	yes	yes
Children	no	no

Table 4 Stakeholder representatives who were invited and participated

Excluding the hosts CSIRO (n 8) and HAL (n 2), 29 participants attended the stakeholder workshop. Most sectors were well represented (Appendix 1). The majority (77%) of participants were women. There was a wide geographical spread with all States represented but not the Territories.

Appreciative Stakeholder Analysis

6.7.3 PURPOSE AND RESPONSE

In preparation for a stakeholder workshop (see Milestone report 104), a Pre-workshop exercise, Appreciative stakeholder analysis (ASA), was undertaken with all invited participants. ASA was designed to help participants think about how (if) their organisation addresses the issue of children’s vegetable intake, how they might like to see it change and how their organisation could collaborate with others. It also asked about their relationship to the vegetable industry and what the industry’s role could be.

In summary, 26 participants (90% of those external to CSIRO and HAL) responded. Of these roughly a quarter were from NGOs and a further quarter from academia; one fifth from industry organisations and one fifth from the government health sector. A poll suggested level of interest in the issue was almost universally high (96%) suggesting invitees were the ‘right’ stakeholder participants.

Appendix 2 reports responses in detail.

6.7.4 CURRENT AND DESIRED RELATIONSHIP WITH INDUSTRY

Almost two-thirds (59%) reported weak or non-existent relationships with industry; however, 86% reported a desire for a strong relationship. The vast majority (94%) of people who indicated their current relationship was either weak or non-existent were from government/health departments, NGOs or Academia.

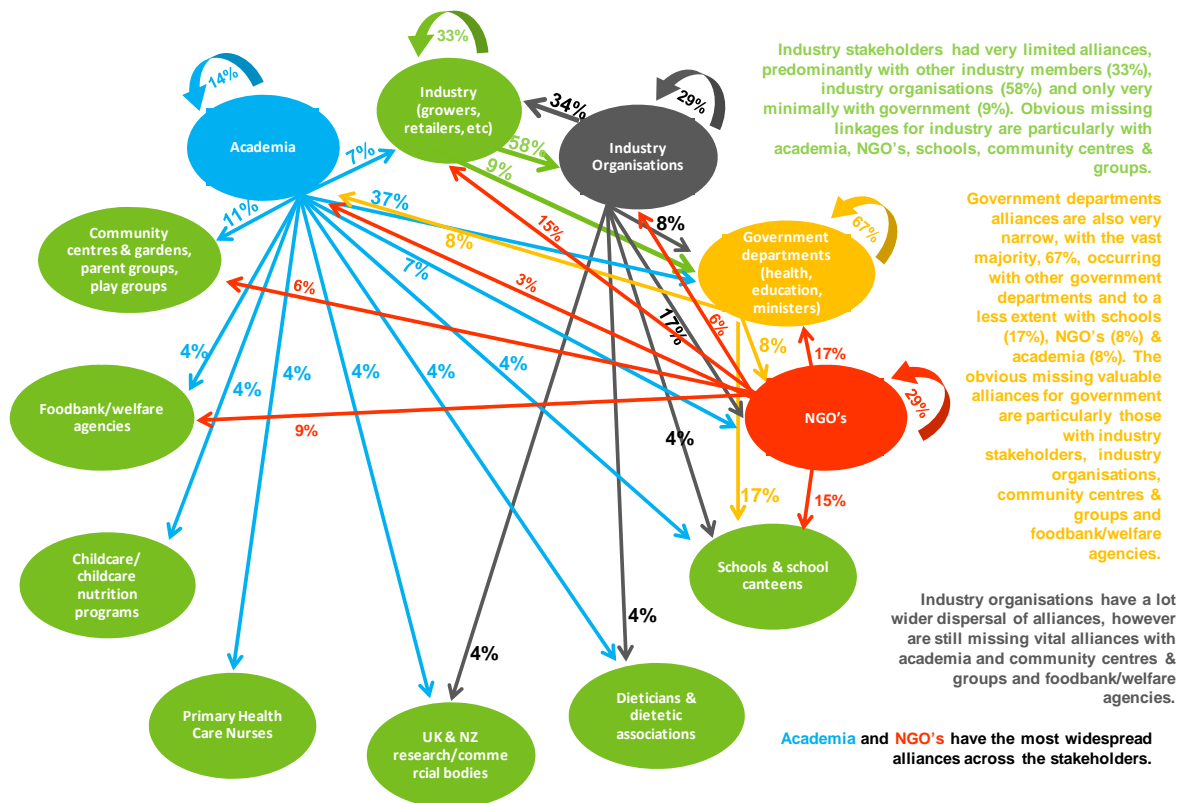


Figure 3 Connections between stakeholders sampled (n 26) at Adelaide workshop (excludes CSIRO) October 2014.

6.7.5 SPECIFIC STAKEHOLDER INTERESTS AND CONTRIBUTIONS

The most frequent (38%) specific interest was in relation to healthy eating and subsequent weight status and co-morbidities, followed by linkages between stakeholders (including absent government education departments and retailers) to improve consumption and demand. The third most frequent was growing the industry. There would appear to be no conflict between these differing specific interests, although the explicit framing of vegetable consumption within 'healthy eating' needs careful consideration. Whilst healthy eating may be the ultimate goal for these stakeholders, alternative paradigms to the promotion of vegetables as 'healthy' may be required, for example the sensory learning and food involvement adopted by VG13089 Curriculum project. This approach is in alignment with the review on food preference development

Almost all participants (96%) reported high interest in the objective suggesting the correct stakeholders were identified and that they are highly motivated. When asked what each stakeholder could contribute, almost half (46%) offered capability in implementation of community initiatives / programs.

6.7.6 PERCEPTIONS OF INDUSTRY'S ROLE

The industry's role was seen to be diverse but many wanted it to play a role in funding effective, evaluated initiatives and leading initiatives through collaboration. Lobbying government to improve food choices was also reported, as was, to a lesser extent, developing innovative products.

6.8 Workshop activities

6.8.1 FINDING COMMON GROUND: DILEMMA FRAMING TOOL

Background

A task sought to enable stakeholders to think about their own perspectives and how stakeholders' interests could be combined towards solving a common dilemma.

Methods

Small group tasks (6 participants by 6 groups) were undertaken with workshop participants whereby participants assumed four stakeholder positions for each group and agreed a common dilemma statement – a common objective, for example, "How to get children to eat more vegetables". Next they stated how solving the dilemma would benefit them as a stakeholder and what they needed to do to solve the dilemma.

Results

Results are reported in Table 5

Dilemma Statement:	This project is about how to get children to eat more veg, parents to provide their families more veg, community/society to desire and prioritise veg and for industry and all relevant stakeholders to collaborate towards this shared goal.					
Stakeholder:	Government	NGO	Industry	Parents	Schools/Education	Health Practitioners
How solving this will benefit you as stakeholder	<ul style="list-style-type: none"> - Improved population health, decreased diet related, obesity, chronic and mental health diseases - Reduced healthcare costs (keeping people out of hospital) - Increased national & local economy and grower productivity, increased sustainability 	<ul style="list-style-type: none"> - Increased food literacy & access - Increased community health & wellbeing, improvements in chronic disease risk factors, overweight & obesity levels and increase in kids' veg consumption - Economic & sustainability benefits 	<ul style="list-style-type: none"> - More demand, increased volumes, sales & profits, economic growth, job increase - Increased food security, sustainability, reinvestment back into industry, new commodities and succession planning (who is going to run the farm in next generations) - Increased knowledge & awareness 	<ul style="list-style-type: none"> - Strategies & skills making parenting easier - Improve own health as parents - Knowledge that you are investing in your children's future health 	<ul style="list-style-type: none"> - Supplying of veg to kids - Better learning outcomes & increased understanding, confidence and food literacy - Vocational opportunities 	<ul style="list-style-type: none"> - Improve partnerships & communications between dietitians and GPs, improved professional standards - Greater job satisfaction promoting preventative health rather than treating ill health - Empowering parents
How do we do this, what do you need in order to solve this?	<ul style="list-style-type: none"> - Multi-strategic collaborative approach, Listen to people/collaborate, engagement with industry, stakeholder partnerships, government support - Invest in, commit to and update policy - Curriculum changes & education - Evaluation, monitoring and delivery on outcomes. 	<ul style="list-style-type: none"> - Effective collaboration and communication, to understand each other's roles and shared goals - Need funding and goals as measures of success - Direction from and implementation of policy - Engaging communities through targeted/tailored education programs, experiential programs integrated into the classroom 	<ul style="list-style-type: none"> - Shared vision & goals, collaboration, effective/efficient communication - Funding & strategic investments - Marketing levy and access to marketing consumer demands, promotion - Supply of quality produce and sustainability of industry 	<ul style="list-style-type: none"> - Easy access to affordable, quality veg - Create supportive environment and ways to deal with peer pressure and social norms of modern life 	<ul style="list-style-type: none"> - Change in curriculum - Collaboration with industry - Kids visit farmers to get first hand education 	<ul style="list-style-type: none"> - Communication opportunities between health practitioners and stakeholders - Access to affordable, quality veg & recipes

Dilemma Statement:	This project is about how to get children to eat more veg, parents to provide their families more veg, community/society to desire and prioritise veg and for industry and all relevant stakeholders to collaborate towards this shared goal.	
Stakeholder:	Industry Org	Researcher
How solving this will benefit you as stakeholder	<ul style="list-style-type: none"> - Increased sales/profits across supply chain and strength/sustainability of the industry, grower & industry advocacy - Increased viability of independent retailers - Increased employment and innovation opportunities 	<ul style="list-style-type: none"> - Impact/translation of your research, making a difference - Grants & publications & funding to drive innovation
How do we do this, what do you need in order to solve this?	<ul style="list-style-type: none"> - Marketing campaigns & promotion, education programs - Communicate/collaborate and understand each other's roles and shared goals - Lobby government 	<ul style="list-style-type: none"> - Evaluation of strategies using validated tools & testing new ideas - Understanding & fundamental knowledge of sensory factors, norms, behaviour change & barriers - Stakeholder collaboration to guide key research questions

Table 5 Summary results of the Dilemma Framing task

6.8.2 STAKEHOLDER COMMENTS ON RECOMMENDATIONS FOR FUTURE INITIATIVES (FROM SYSTEMATIC REVIEW)

Age group focus

- Children aged 2-6 years lack motor skills for participatory / experiential learning through growing and cooking. Older children are an important agent of change (through cooking / gardening) and can take the message home.
- Younger children (aged 2 – 6) are more malleable.
- Hence needs a dual approach
- Comments on school approaches suggested that by not including schools (beyond curriculum, VG13089) vital avenues of change were being missed. Hence need to lobby for change in school food policy.

Small impact of published studies

- Focus on whole meals and snacks. Vegetable as snacks need to be normalised (i.e. move away from energy dense salty/sweet) at all occasions (provision at meetings, pre-schools, after-school; community events, schools (“brain break” could be vegetables not fruit)
- Avoid explicit ‘health’ message.
- Small effects upon children may have additional effects upon whole family hence the ¼ - ½ portion increase may extend to others in family / greater overall consumption (greater overall demand).
- Possible route is through promoting formal family meals. However, this is going ‘backwards’ and maybe need to acknowledge that food culture has changed?
- French have maintained the tradition of formal structured meals with conviviality. However this is not part of Australian culture.
- Asian influences could increase vegetable intake at breakfast in Australia

6.8.3 STAKEHOLDER COLLECTIVE EXPERIENCES / CRITICAL ELEMENTS

Participants voiced their experiences and concerns in an open discussion and the following dot points (transcribed from audio recordings) summarise that discussion:

- Need for a central point of contact (a role for HIA?)
- Better evaluations so that we learn from each other
- Need for a communication infrastructure (e.g. LinkedIn group to maintain contact) / electronic stakeholder alliance.
- Do not re-invent the wheel. (but do we know how to change intakes)
- Lobbying – make the case for economic and health benefits – use modelling data to demonstrate benefits and direct economic benefit to veg industry (tonnes)
- HIAL in partnership with academic rigour
- Need to identify gaps for new funding.
- Could also fund education of health professionals, policy makers, GPs, etc. (precedent from Nut Industry). But HIA may have new rules and will be working directly with growers.
- Connecting with existing State alliances (e.g. Vic Health / Vic Health promotion strategy board)

- Identifying a role for growers (direct benefit)
- Schools eating policy (Lobbying advocacy) – needs effective policy
- Involve parents (parents are thought to be disconnected from school policies especially around food). Parents want better eating at school. Parents as stakeholders.
- School Principals Associations – as stakeholders
- Can it be shown that increased vegetable intake leads to increased academic performance?
- Crunch n’ Sip (70% participation in NSW) planned evaluation next year (SPAN survey)
- Strong desire for collaboration from growers attending
- Food and Health dialogue (Heart Foundation links needed)
- Elephant in the room is the retail duopoly / how do we engage? Coy, secretive difficult to engage with. (Grower). Competition for a generic product allows buyers to dictate terms and change suppliers
- Nutrition Australia has links to Woolworths (“Healthier bites” aisle) with pre-packed vegetables deemed successful, but not an easy relationship.

6.8.4 INVESTMENT PLAN

Workshop participants were presented with questions for discussion, specifically:

- Do you believe you need many small interventions or should they be grouped into one large intervention?
- What role do you think state and commonwealth governments’ advocacy and policy play in changing consumption?
- Where does funding come from. What role do the growers play, who should be advocating, which organisations?

Key points from discussion

Some participants suggested

- A comprehensive approach needed
- Best approaches from past experiences
- HIA in partnership with academic rigour
- Undertake a gap-analysis to overlay what were the most successful elements from the literature review with an analysis of what is already being undertaken as community interventions in Australia
- One consistent campaign with all stakeholders participating
 - A need for economic analysis, including WHO modelling of Disability Adjusted Life Years Saved (DALYS) following increased vegetable consumption
- WCRF cancer risk reduction linked to weight loss (associated with increased vegetable consumption)
 - Prospective meta-analysis (Register trial)
- Taxation / subsidy – works for low SES
 - Industry should lobby

6.8.5 A REGISTRY OF INITIATIVES

A rationale for creating a registry of research initiatives undertaken in Australia to increase vegetable consumption in children includes

- Categorizing of efforts in this area
- Avoid “reinventing the wheel”
- Provides an opportunity to learning from others
- Access to information
- Potential to measure effectiveness

Finding existing (unpublished) initiatives and keeping track of numerous community initiatives is very challenging. Whilst AUSVEG/HIA has a searchable database of past projects its accessibility is limited to levy payers and suppliers, furthermore it does not include projects not funded by HIA. Other organisations have maintained registries of initiatives using software that facilitates a wide range of useful functions. An example is Quality Improvement Program Planning System (QIPPS) by Infoxchange.com.au that includes:

- a template enabling consistent planning, monitoring, evaluation and reporting of initiatives
- a central online repository or storing/retrieving work enabling internal and external partner collaboration
- Provides built-in help and learning tools including support information, definitions, research material, references, website links to assist in designing/evaluating programs
- Promotes information sharing to facilitate greater state, regional and local collaboration and engagement

We suggest a more accessible repository of information with a view to maintaining a comprehensive registry of initiatives. There was broad support from participants in the October stakeholder workshop. We recommend that HIA plays a central role in maintaining and promoting such a registry.

6.8.6 WORKSHOP EVALUATION

A graphical report is available in Appendix 3

6.9 Gap analysis

6.9.1 OVERVIEW

The focus of the current project was to identify strategies and initiatives to increase consumption of vegetables in children aged 2-12 years. This age bracket was decided upon given the vast differences between research and intervention strategies aimed at increasing vegetable intake in mum's to be and infants aged up to 2 years compared to children who have progressed beyond the weaning phase at around 2 years. Therefore research and current initiatives (such as NOURISH and INFANT (Daniels et al, 2009; Hesketh et al, 2013) that address pre and post-natal (up to 2 years of age) influences on maternal and children's vegetable intake was beyond the scope of the current brief. This is an extensive and distinct area of research requiring a separate systematic review to explore the topic fully and comprehensively. So saying, the following is a gap analysis and brief review of the principles that come into play in the acquisition and development of food preferences up until the age of 2, taking into account the pregnancy, milk-feeding, and weaning phases.

6.9.2 GAP ANALYSIS & REVIEW (CONCEPTION-2 YEARS)

Pregnancy phase

The Australian Dietary Guidelines (National Health & Medical Research Council, Department of Health & Ageing^a) on healthy eating during pregnancy suggests eating plenty of vegetables of different colours and type, fruit, wholegrain breads and cereals, legumes, lean meat, fish, dairy and choosing foods low in saturated fat, salt and sugar to ensure mum and baby's nutritional needs are met. However, what is not stressed is the evidence that eating a wide variety of foods, particularly vegetables, influences vegetable preferences and liking in infants and furthermore, that foods which are more familiar to an infant through early (in utero) exposure are more likely to be accepted, willingly consumed and influence later childhood food and vegetable preferences. The vegetable industry should seek to amend and test the effectiveness of advice. **There is a need to understand, monitor and seek to influence advice given to mothers.** Delivering information to pregnant women (in co-operation with general practitioners and midwives), possibly using adaptations of the EU Habeat project materials, (www.habeat.eu) directed at education regarding the consequences of vegetable intake of pregnant women for the later development of vegetable acceptance of their unborn child would be an opportunity to promote and shape infants' vegetable habits and reduce conflict at the meal table.

Milk feeding phase

Current government advice from the Australian Infant Feeding Guidelines (National Health & Medical Research Council, Department of Health & Ageing^b) advises that breast milk provides all the nutrients a baby needs for the first 6 months and remains an important source beyond this and further can protect against infection, obesity and other chronic diseases such as diabetes in later life. However, the importance of breast milk as a foundation for developing an infant's taste palette and the establishment of food preferences (particularly vegetables) and dietary habits into childhood and beyond is not mentioned. Breast milk shares the same flavor profiles as foods eaten by the mother (Mennella & Trabulsi, 2012) and an infant will learn and develop a flavor palette from their mother's milk and will set them up for transition into the weaning phase. Babies of mothers who eat a range of differing flavours are more likely to accept new flavours themselves

when introduced to solid foods (Department of Health & Ageing, South Australia, 2014). However the significance of this not only to the introduction of solid foods but also to the establishment of healthy dietary patterns into further childhood and beyond needs to be further elaborated on so that breast feeding mothers fully understand the impact that their choices in food and variety can have not only now, but later on in the child's development and establishment of life long dietary habits. Seeking to strengthen information about breast feeding and formula feeding with regard to the positive influence of variation in vegetable intake by mothers of new-born children in co-operation with daycare personnel, general practitioners and concerned healthcare consultants and stakeholders of formula and vegetables companies is recommended.

Weaning phase (age 6-12 months)

The introduction of solid foods is of huge developmental significance because it can affect the acceptance of foods not only in infancy but in later childhood and beyond. The transition from an infant's diet based exclusively of breastmilk (or formula) to a mixed diet encompassing liquid and solid foods is facilitated by providing the infant with familiar tastes (such as those eaten by mum while pregnant and breast feeding) such that the infant experiences similar familiar flavours across the two feeding situations (Mennella & Trabulsi, 2012). Because of the additional exposure to a variety of flavors and tastes through the breast milk, breast fed infants in this way are at an advantage to their formula fed peers in the ease of acceptance of a wide variety of initial solid foods and are often less 'picky' with their feeding. The weaning phase is a critical period in develop and can have lasting effects well beyond infancy. Research has shown that infants who are delayed being introduced to solid foods (10 months or later) eat fewer solid foods of all kinds at 15 months. Even at follow up at 7 years of age, those same children were still found to eat less of all categories of fruit and veg and had significantly more feeding and 'picky eating' problems than those introduced earlier (around 6 months) (Northstone, Emmett & Nethersole, 2001; Coulthard, Harris & Emmett, 2009). Furthermore, research suggests that infants will eat more of a particular vegetable after being repeatedly exposed to it over 8-9 days (Mennella, Nicklaus, Jagolino & Yourshaw, 2008; Forestell & Mennella, 2007). However it was found that many parents were unaware of the changes in acceptance of repeated exposure and simply gave up too soon when introducing foods and particularly vegetables of bitter taste. It is recommended that parents continue to provide their infants with repeated opportunities to taste all types of vegetables in order to change their child's willingness to try and acceptance of new and unfamiliar foods and vegetables. Variety in flavor is associated with greater variance in the nutrient composition of foods that compose a diet, thus having preferences for a wide array of flavours should result in an increase the range of nutrients consumed and the chance of achieving a well-balanced nutritious diet (Mennella & Trabulsi, 2012). Parents need to be informed and educated about the importance of this phase and the potential flow on effects it can have in later childhood and beyond. It is recommended setting up more courses or initiatives (such as Australian initiatives, including NOURISH and INFANT) for parents and caretakers of infants, dealing with issues regarding the importance to encourage, motivate, reward, how to be a model, how to make variations in the meals, etc. with concerned healthcare consultants and concerned stakeholders. Please note that a large scale extension to the HAL funded study of exposure and reward (Corsini et al, 2013) by one of the authors (DNC) was proposed to HAL specifically on this approach, albeit directed at older children; however, funding was not available at that time.

Pre-school phase

It is recommended that information be provided about the advantages of both temporal (day to day) and simultaneous (at least two in a dish) variation of vegetables in meals to daycare and pre-school carers /centres. An opportunity exists within childcare, day care and pre-school setting as national regulations set by the Australian Children's Education & Care Quality Authority (ACECQA) currently only specify that 'food or beverages provided at the service must be nutritious and adequate in quantity and take into account dietary requirements appropriate to each child's growth and development needs, and any specific cultural, religious or health requirements. This does not apply to food and beverages provided by a family for their child'. Therefore it is up to each individual provider to devise their own nutrition policy for their centre and to define and specify what is considered 'nutritious' and 'adequate in quantity' for the children within their care. Thus an opportunity exists to work with the ACECQA to develop explicit guidelines around meal composition (including recommended vegetable servings) so that these can be included in each centre's policy. Across some states, various initiatives are attempting to provide support and advice to centre's regarding nutrition and dietary issues, however implementation appears to be uneven and poorly documented. A lot more could be done.

Research (individual, group, expert, health care, economic and ecological perspective)

Operant Conditioning

Behavior with a positive consequence has an increased chance of reoccurrence. It was rare for intervention studies (Corsini et al, 2013) to have positive reinforcement at the core of their method using this paradigm in the true behaviorists' sense. Positive reinforcement is the crucial element in operant conditioning and a golden rule in operant conditioning is contingency. There can be no delay between behavior and reward; they must be contingent. Nearly all intervention studies separate behavior and reward in time and thereby let the reward become an incentive and allow the behavior to become instrumental in getting at that incentive; an entirely different psychological mechanism and scenario than operant conditioning. Even those few studies that do connect behavior and reward in time fail to implement the most effective reinforcement scheme which is that of variable intervals.

- Rewarding every time works (Corsini et al, 2013).
- Rewarding every other time works better.
- Rewarding at unpredictable moments works best.

Although operant conditioning is by far the most powerful way of shaping behavior no intervention study has been designed along the best principles, intermittent or unpredictable rewards.

Supermarkets' customer loyalty cards

A valuable source of information on families' food habits plus the chance to directly address those families who would benefit most from an interventions lies in the domain of supermarkets' customer loyalty cards. There are examples in the UK where families with very poor dietary habits

were identified through loyalty card data. These families received offers to buy vegetables at reduced prices and they received free recipes on how to prepare attractive vegetables dishes.

Liaison between scientists and chefs

A Belgian group of scientists and chefs have developed a food item combination model that describes that components that are mainly responsible for the taste of a food item are strong indicators of easily accepted combinations with food items that contain (some of) these same components. Some obvious and well known combinations show up from this model but many new and unexpected combinations of food items that go together very well are described (such as Roquefort and pineapple). It would be worthwhile to investigate whether children will accept the combination of a vegetable that shares certain components with a food item they already like. (<https://www.foodpairing.com/en/home>)

Financial consequences of very low vegetable intake

Intervention studies in which providing information is the key method are usually restricted to issues close to “vegetables and behavior”. It should be considered whether information from a more remote point of view has effect such as the financial consequences of poor diet:

“On average families that enjoy varied and vegetable rich meals save \$xx,- per year on health care!” There are two opportunities in this:

- Investigating whether such families do in fact save on health care.
- Investigate whether this information has a positive effect on vegetable consumption in families and consequently on children.

6.9.3 DESIGN OF INITIATIVES

Identification of gaps in knowledge suggest that previous initiatives do not explicitly describe the theoretical under-pinning of the interventions, and future designs should draw upon such knowledge to target specific age groups.

The design of community initiatives may need improvement. In general it was difficult to identify ‘how’ the initiatives were undertaken (because of difficulty in accessing information). Some behavioural change techniques were identified (Milestone report 103) but there is room for drawing upon the published literature in order to design better community initiatives.

In general it was rare for industry to fund initiatives. Most initiatives were dependent upon competitive grants or government funding. We suggest it is in the vegetable industry’s interests to directly fund or partner in funding interventions so as to build a body of evidence that can be translated into public health advice and communication strategies for the industry.

There is a need for more initiatives in Australia as only two of the studies were conducted in Australia. At present we cannot be certain that the design of effective studies would work in an Australian context. So saying, both Australian studies (of which one was funded by HAL) were effective in the short term despite being of differing designs.

6.9.4 EXPLICIT REFERENCE TO HEALTH OR SENSORY APPRECIATION?

The explicit labelling of vegetable consumption a part of 'healthy eating' and the instrumental message (eat this because it is good for you) are controversial approaches. There is some evidence that both children and adults associate 'healthy' with an expectation of poor taste. Initiatives that avoid explicit health messages and focus upon sensory learning and product involvement are needed. Early work by Baranowski et al (1993) found that amongst 4th and 5th grade students there appeared to be a predominant belief that "if a food tastes good, it must not be good for me; and if a food tastes bad, it is probably good for me." Further qualitative work by this group (Kirby et al, 1995) supported this assertion and found that the most frequent comment was that "veggies taste nasty". Another qualitative study (Ross, 1994) found that food choice amongst UK pre-schoolers was not determined by the health attributes of food but by preference, play, socialisation and convenience. Another UK study (McKinley et al, 2005) found that amongst school-age children taste was by far the biggest impediment to healthy diets, as healthy food was not positively associated with taste. The children even presumed 'healthy' food they had not tried would not be nice. Indeed a European review (Brug et al, 2008) identified taste preferences and liking as being the most important for children's food choices with availability driving such preferences and liking through cultural practices and exposure.

Specific studies on health and taste include experimental work by Wardle & Huon (2000) demonstrating that simply labelling a beverage as healthy decreased children's liking due to the association with poor taste. Testing of the unhealthy = tasty hypothesis used both implicit and explicit measures (Raghunathan et al, 2006) and found, in a series of experiments, that unconsciously (implicitly) students and adults associated healthy foods (including vegetables) with poor taste. Such a relationship held true amongst people who explicitly believed that healthy = not tasty and those that did not believe this. More recent evidence (Maimaran & Fishbach, 2014) shows that simply giving children 'instrumental' information (eat this because....) decreased liking for a range of beverages and foods including a vegetable.

In summary there is reasonable evidence suggesting that locating vegetable consumption within a health framework is likely to evoke beliefs that healthy is unpalatable and, given that we know that children are driven by the hedonic and sensory attributes of foods, it is likely that explicit framing of vegetable consumption within the health domain may decrease liking for and consumption of vegetables.

6.9.5 MAGNITUDE OF EFFECT AND MEASUREMENT OF EFFECT

Interventions identified only have small effects and whilst these may accumulate over time, there is a need for more impactful initiatives.

All interventions rely on self-reported intake (consumption). This is prone to social desirability bias (giving answers to please); however, existing objective measures are invasive (serum) and unsuitable for children. Other non-invasive objective measures are required.

Follow up measures lacking, there is a need to develop, fund and apply long term follow-up measures of children's intakes after interventions.

6.9.6 ROLES FOR INDUSTRY

There are several identifiable roles for industry (see below, section 6 for more details) feasible within the R&D budget.

- 1) To host, support or facilitate a register of initiatives (for example, using the software QIPPS) and /or actively promote and publicise such a resource (including webinars summarising findings, roadshows etc.) with a clear definition of who is the target.
- 2) To commission suppliers to create an accessible template (on the HIA website) of best practice designs for children's initiatives. That those designs be freely available for community use.

- 3) To investigate novel approaches for interventions aimed to increase children’s vegetable consumption
- 4) to provide feedback and suggest enhancements to the existing programs based on our understanding of the latest research and other successful programs that we’ve encountered along the way
- 5) To facilitate or fund quantitative outcome evaluations (effectiveness) of existing (community) initiatives that have currently not been scientifically validated, and, in turn, maintain a register of results (impact). Applications for evaluation funding would have to utilise the ‘best practice’ guidelines (above) or demonstrate novel design that was theoretically sound. Suppliers skilled in understanding successful design features could assist.
- 6) Another possible role is for the industry to enhance exposure of these initiatives, to make salient to politicians and, simultaneously, to use measures of effectiveness to argue for health, environmental and economic benefits (see point below)
- 7) To support community initiatives directly through the provision of vegetables (possibly including seconds / ugly vegetables) for children’s consumption and, secondly, grower involvement in communities (incursions and excursions / field trips / visits to pre-schools; schools (see VG13089).

6.9.7 BROADER STAKEHOLDER INVOLVEMENT

Despite attempts to invite large retailers, independent retailers, the education sector, supply chain and vegetable processors, representatives from these sectors declined or were unable to attend a stakeholder’s workshop. Parenting organisations were also under-represented. Efforts should be directed to involving these stakeholders in the future. Some willing collaborators (for example, the Heart Foundation, Nutrition Australia and produce markets [personal communications]) have existing relationships with retailers that could be cultivated through the proposed stakeholder alliance.

Involvement of other RDCs and primary producer alliances (which was outside the scope of the October workshop) should be reviewed with regard to how such organisations could benefit the vegetable industry’s objectives.

Many important stakeholders, particularly those who actively promote vegetable consumption, are disconnected from the industry but have a strong desire to improve this relationship. A stakeholder alliance could provide a means for strengthening / making connections.

6.9.8 STAKEHOLDER CONTRIBUTIONS

Table 6 shows potential contributions each stakeholder group could make to activities suggested in the strategy.

Project component	Contributor
Vegetable supply to initiatives	Growers/markets/wholesalers
Evidence based design	research providers
quantitative outcome evaluation	research providers
Delivery	Community health / retailers /preschools / community
Funding/resources	Public (Govt) & private (grants, levy)
Broader impact (economic, social, environmental)	Govt. and industry org.
Lobbying	Ausveg / consultants / primary industries orgs

Table 6 Collaborators’ potential roles

7 Strategic Priorities for Investment

The outcomes from the analysis of worldwide initiatives to increase vegetable intake in children along with the discussions at a stakeholder workshop have been incorporated into four key strategic priority areas. These priority areas form the basis of the SIP and will inform the investment of R&D and marketing levy funds aligned with HIA's objectives - to increase demand, to increase production efficiency and to enable an effective operating environment. The HIA objectives are based on the premise that, at either farm or whole of industry level, the primary way to improve profitability of horticulture businesses is to increase demand for the products and/or to improve production efficiency. The first priority area of 'enable an effective operating environment' recognises that the industry cannot achieve increased demand alone (particularly in the absence of a marketing levy⁴) and underpins the other priorities by ensuring the industry has appropriate structures, processes and programs in place to create the best possible environment for the industry to develop profitably. The first and second priority areas are most relevant to this SIP for increasing vegetable demand in the short term. However evidence suggests that the impact from existing designs would be small, hence there is a need to improve initiatives through innovation and new projects (priority area 3). A longer term goal (priority area 4) is to influence policy and public health advice given in pregnancy and parenthood, particularly by making such advice explicit about flavour learning in order 'teach' a liking for vegetables. Additionally a long term stretch goal would be to lobby (with others from a stakeholder alliance) for an enforceable food policy in schools that would improve vegetable consumption.

The four key strategic priority areas identified in this SIP are:

Priority Area 1 - Collaboration

- 1) *Establish a Stakeholder Alliance* to include stakeholders within and outside the vegetable industry, notionally called Vegetable Intake Strategic Alliance (VISA). This project has identified that increasing vegetable intake in children will require the input and contribution of stakeholders outside of the horticulture industry supply chain. These would include state and commonwealth departments and agencies in the agriculture as well as health arenas, research organisations, retailers, parenting organisations and non-governmental organisations. The VISA would link into existing networks (e.g. Victorian Food Alliance between Vic Health and Deakin University), the Commonwealth Food and Health Dialogue etc. seeking to leverage funding as well as knowledge. The role of the Stakeholder Alliance would be to increase the remit of the network to positive whole foods and engage constructively with 'early years' governmental policy makers.
- 2) *Develop a joint agenda and activities with stakeholders within the VISA* to achieve their goals. Activities could include a yearly workshop to share research findings and initiatives. At current there is no forum where the wide range of stakeholders from the Vegetable Industry come together, and such a workshop may facilitate development of public/private partnerships in this area.

⁴ Even if a marketing levy were available this alone is unlikely to increase demand in the long term particularly in the face of much larger marketing budgets promoting innately preferred foods)

Priority Area 2 - The right initiatives and impact

This area focuses on developing and implementing initiatives designed to engage children and increase their vegetable consumption.

Evidence suggests that targeting children in the age group 2-6 years may provide the best opportunity to intervene, particularly as children are 'accessible' in childcare settings thus creating life-long vegetable consumption habits. This age group focus does not negate pregnancy and infancy; however, accessing women and infants is possibly best first addressed through policy engagement (see Priority area 4, below). Whilst past evidence suggests changes may be small, such small incremental increases in intake across each life stage should not be underestimated. It is also important for initiatives to be evaluated using an appropriate evaluation framework to ensure their impacts are captured and contribute to the growing body of evidence for such initiatives.

Suggested action focused objectives in this priority area are:

- 1) *Publish and endorse best practice guidelines for the development and implementation of new initiatives.* Based on the best available evidence, including but not limited to the synthesized findings of the three reviews conducted by CSIRO, a set of guidelines should be developed and published on the HIA website for researchers, community groups, and other interested stakeholders. Such guidelines would inform the development of new initiatives targeting children's vegetable intake. They would assist to improve the quality of future initiatives, encourage consistent evaluation approaches and promote HIA (the vegetable industry) as a key stakeholder supporting the development of new evidence for increasing vegetable intake.
- 2) *Establish a Registry of existing (& future) initiatives that seek to increase vegetable intake in children.* This project identified a large number of initiatives both in Australia as well as overseas that were attempting to increase vegetable intake in children but good information on these initiatives and their impact was not easily determined. The initiatives were often led by stakeholders from outside the vegetable industry with little input from the industry. Often the vegetable industry had little or no awareness of these initiatives and no chance to contribute to their success. Establishment of a Registry by HIA, and promoting its availability, would enable logging of initiatives and an opportunity for the vegetable industry to provide expertise and knowledge. Success of such a Registry would depend on the selection of the appropriate ICT solution and ongoing funding for its implementation and maintenance.
- 3) *Support the development and implementation of a validated evaluation tool to quantify the impact of initiatives.* Such a tool would support community based initiatives to evaluate their programs and demonstrate impact in terms of behaviour (which many aren't able to report on at present) as well as encourage consistent reporting of impacts across initiatives including community, academic and industry funded initiatives. This tool should be freely available but its implementation co-supported by HIA for those initiatives that follow HIA's best practice guidelines (objective 1) and that have registered their initiative with HIA (objective 2).
- 4) *Establish an Initiatives Working Group (IWG) - to develop and refine designs and measures of impact* in order to undertake community initiatives. The IWG may be a sub-group of the Stakeholder Alliance (see Priority Area 2). The IWG would:

- a. Review the outcomes of this project and test potentially efficacious design(s) in a range of Australian contexts with a focus upon 2-6 years through community and pre-school settings with linkages to home and parenting.
 - b. Establish desired design principles of initiatives
 - c. Commission initiatives
 - d. Measure impact and evaluate designs
 - e. Design templates (from refined designs, above) and promote through Registry and other portals
 - f. Encourage and facilitate collaboration and a roll out to stakeholders including community health (private/public partnerships), supply chain and retailers
- 5) *HIA to support local, state and nationwide initiatives* – Initiatives could be directly commissioned HIA initiatives or be HIA supported (financial or in-kind) initiatives commissioned by other stakeholders and included in the Registry. Inclusion of the initiative on the Registry would enable better HIA oversight as well as opportunity to leverage levy funds. HIA would develop a forward calendar of supported initiatives and include in their Annual Operating Plans.
- 6) *Measure impact nationwide* – HIA could support and/or access National Health / Nutrition Surveys or other measures (e.g. sales data) to determine and report on impact of initiatives undertaken from a social, economic and environmental impacts perspective. Specifically, HIA should commission a nationwide assessment (survey) of children’s vegetable intakes every five years and then commission research services suppliers to analyse trends against HIA objectives. If the Stakeholder Alliance is working well there would be good opportunity to leverage the national assessments undertaken by other stakeholders to include assessment of vegetable intakes at a significantly reduced investment level.

Priority Area 3 – Continued research into new initiatives

- 1) This project identified initiatives that led to an increase in vegetable intake in children, but there was a paucity of initiatives that increased intake by more than ½ serve of vegetables per day. HIA could fund novel research that aims to determine whether larger increases in vegetable intake could be achieved and sustained. Such investment, if successful, would grow demand of vegetables considerably. One potential area may be in investigating food preference development research. The review provides an overview of principles that have been found to work in food in general, with gaps identified where this has not been tested in vegetables. Any proposals would need to clearly demonstrate a rationale for expecting larger increases in intake than typically found.
- 2) Peri-natal food consumption, breastfeeding and introduction of weaning foods were found to be good routes to priming infants to accept a wide variety of foods and flavours. Community health nutrition advice and guidelines in pregnancy, breastfeeding and introduction of weaning foods do not currently promote vegetable consumption by mothers for the purposes of improving their (unborn) children’s acceptance of vegetables. HIA could commission research into revision and testing of new guidelines in existing community initiatives (e.g. health advice; mother groups, parenting support networks) to promote mothers’ vegetable consumption throughout pregnancy and breastfeeding. Longitudinal studies would be required.
- 3) HIA could undertake initiatives to become a more direct partner of supplying vegetables to schools or community initiatives. This could involve setting up a mechanism to supply vegetables to tuck

shops, and/or to ensure quality supply of vegetables to health initiatives in remote areas where vegetable supply is at current problematic

- 4) Long term research needed that, for example, tracks consumption of vegetables from early childhood through the lifetime by measuring at period intervals. Establishing a cohort trial and/or linking or 'buying in' to existing cohorts.

Priority Area 4 – Influencing Policy

- 1) There is a potential opportunity to increase intake of vegetables through influencing policy changes. HIA could lobby for specific maternal advice and effective food policy in pre-school and schools settings:
 - a. Appointment of suppliers to understand current policies and lobby for effective policy that promotes vegetable consumption,
 - i. Seek to amend advice to include evidence that pregnancy (peri-natal) and lactation are windows of opportunity to transfer flavours of vegetables via amniotic fluid and breast-milk from the mother to the foetus or infant thus facilitating acceptance of vegetable flavours by the child at weaning and later life.
 - ii. Seek short term impact upon 'early years' policies (by 2020); Align with childhood 'early years' policy (Federal Govt. policies) and lobby for 'early years' policy (e.g. National Quality Standards) / other childhood policies that have measurable impact
 - iii. Seek long term impact upon schools policies (by 2025). Lobby for schools policy change (specific guidelines or mandatory standards) to school lunch box or lunch provision that encourage exposure to vegetables, increase liking and ultimately vegetable consumption.
 - iv. Link to VG13089 School curriculum project by initiating action to support the exposure/involvement curriculum activities i.e. improve consumption of vegetables within the school (and home) environment.
 - b. Liaise with other stakeholders (see VISA) and others
 - i. For example, Parent's Jury (as parental lobby); NGOs (Heart Foundation; Cancer Council) and State health sector (e.g. Vic Health) and
 - ii. Create an opportunity with Education and Health departments (no connection at present).
 - iii. Seek evidence to argue that academic outcomes (Healthy eating -> wellbeing -> academic success (cognition) may result.
 - iv. Seek opportunities with other RDCs / Primary producer organisations and lobby governments (State and Federal) for effective policies / guidelines/advice in
 1. Pregnancy (short term)
 2. early years (short term) and
 3. schools (medium - long term)
- 2) Uptake of effective initiatives to support food policies in pre-school and other interactions with children's early years. Convince governments using impact upon vegetable intakes, children's wellbeing and cognition to support growth of industry and investment in children's wellbeing

8 Key Performance Evaluation/measures

INCREASING VEGETABLE INTAKE AMONGST CHILDREN

Overarching SIP Objective

“To grow demand for vegetables amongst children (and their families) in a way that is profitable for the industry”.

Strategies

Strategic Priority Area 1	Collaboration
Strategic Priority Area 2	The right initiatives and impact
Strategic Priority Area 3	Continued research into new initiatives
Strategic Priority Area 4	Influencing policy

Strategic Priority Area 1	Collaboration – within and outside the vegetable industry				
Rationale	Increasing vegetable intake will require the input and collaboration of multiple stakeholders including those outside the vegetable industry and effective partnerships need to be established.				
Suggested Actions	2015/16	2016/17	2017/18	2018/19	2019/20
Establish a Stakeholder Alliance: Vegetable Intake Strategic Alliance (VISA) – to include state and commonwealth departments and agencies, retailers, parenting organisations and NGOs					
Develop a joint agenda for ICVISA and establish programs					

Outputs	Stakeholder group to drive increase in vegetable intakes. New initiatives funded and driven through multiple channels.
Outcomes	Enhanced consumption of Australian vegetables. Viable partnerships established.
KPI's	ICVISA established to drive new initiatives. Multiple year program agenda established.

Strategic Priority Area 2	The right initiatives and impact – Develop and implement initiatives designed to engage children and increase vegetable consumption				
Rationale	Evidence suggests that targeting children in their early years may provide the best opportunity to create life-long vegetable consumption habits along with perhaps smaller incremental increases in intake across other life stages. Initiatives need to be evaluated using appropriate evaluation frameworks to ensure their impacts are captured and only effective initiatives are continued.				
Suggested Actions	2015/16	2016/17	2017/18	2018/19	2019/20
Publish and endorse best practice guidelines for the development and implementation of new initiatives					
Establish a registry of existing (& future) initiatives that seek to increase vegetable intake in children					
Support the development and implementation of a validated evaluation tool to quantify the impact of initiatives					
Establish an Initiatives Working Group (IWG) to develop and refine designs and measures of impact					
The vegetable industry to support local, state and nationwide initiatives					
Measure impact nationwide					

Outputs	New initiatives for increasing vegetable consumption in children and new evaluation frameworks and tools to measure the impact of the initiatives.
Outcomes	Enhanced consumption of Australian vegetables. Initiatives that are demonstrated to be effective can continue to be funded.
KPI's	Development of best practice guidelines for design of new initiatives. Establishment of registry of initiatives. Development of an evaluation tool to measure impact of initiatives. 3-5 initiatives commenced in the first five years.

Strategic Priority Area 3	Continued research into new initiatives – that show increase in vegetable consumption in children of more than ½ serve of vegetables per day				
Rationale	In an extensive review of initiatives worldwide there was a paucity of initiatives that increased intake by more than ½ serve of vegetables per day. The vegetable industry could fund novel research that develops and test new initiatives to increase and sustain vegetable consumption.				
Suggested Actions	2015/16	2016/17	2017/18	2018/19	2019/20
Investigate general food preference development research to identify initiative opportunities that demonstrate a rationale for expecting larger increases in intake					
Explore opportunities to increase vegetable intake during peri-natal, breastfeeding and weaning stages by commissioning research into revision and testing of new nutrition guidelines in existing community initiatives					
Explore partnerships to supply vegetables to school or community programs especially in remote and regional areas					
Establish (or partner with others) long term research into tracking consumption of vegetables from early childhood through the lifetime by periodic surveys					

Outputs	New research identifies novel opportunities for increased vegetable intake in children and in mothers before, during and after pregnancy. Enhanced supply of vegetables to school and community programs.
Outcomes	Enhanced consumption of Australian vegetables. Continual survey of vegetable consumption patterns to inform future directions.
KPI's	Review of research into new initiative opportunities completed. Opportunities for interventions in pre and post pregnancy mothers identified and tested. Regular data on vegetable consumption patterns.

Strategic Priority Area 4	Influencing policy – to increase vegetable intakes in pre-school and school settings				
Rationale	There is a potential opportunity to influence policy changes to promote vegetable consumption				
Suggested Actions	2015/16	2016/17	2017/18	2018/19	2019/20
Understand policy frameworks that govern intake of vegetables in both ‘early childhood’ and school settings – commonwealth policies, national quality standards and state school policies – and develop strategy for lobbying					
Link to VG13089 School Curriculum project by initiating action to support the exposure activities within schools (and home) environments					
Liaise with other stakeholders (through VISA) to enhance lobbying/influencing opportunities					
Demonstrate impact of effective initiatives to support food policies in parental (maternal) advice, pre-school and other early childhood year’s interactions.					

Outputs	Review of policy settings and frameworks that can be influenced through lobbying. Initiatives with stakeholders for enhanced lobbying efforts. Demonstration of impact of enhanced vegetable intake on wellbeing for further support of policy changes.
Outcomes	Enhanced consumption of Australian vegetables. Enhanced exposure of vegetable industry in early childhood and school settings.
KPI’s	Development of strategy to influence food and nutrition policies. Changes to policy settings achieved.

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CONTACT US

t 1300 363 400
+61 3 9545 2176
e enquiries@csiro.au
w www.csiro.au

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FOR FURTHER INFORMATION

Food and Nutrition Flagship

David Cox
t +61 8 8303 8800
e david.cox@csiro.au
w www.csiro.au/businessunit-flagshipname

Appendix 1: List of attendees

First Name	Last Name	Company	Title
Amy	Rossignoli	Nutrition Australia	Project Officer - Early Childhood Service
Julie-Anne	McWhinnie	SA Health	Chief Project Officer-Public Health Nutrition
Gail	Woods	Brismark	General Manager
Erin	Hart	PMA Australia and New Zealand	Marketing Manager
callum	howarth	AUSVEG	Scientific and ScECIAL Projects Officer
Sally	Fisher	ac.care	Community Foodies Coordinator
Andrea	Bravo	NSW Office Preventive Health	State Program Manager Schools (Crunch & Sip, Live Life Well at School)
Christine	Innes-Hughes	NSW Office Preventive Health	Manager, NSW Healthy Children Initiative
Tuesday	Udell	Heart Foundation SA	Acting Cardiovascular Health Director
Lucinda	Hancock	Nutrition Australia, Victoria Division	Executive Officer
Hazel	Mactavish-West	MacTavish West Pty	Director
Deana	Said	Fresh Select Pty ltd	Marketing Manager
Emma	Germano	levy payer	Marketing Manager
Nenita	Orsino	Eat Well Tasmania	Executive Officer
Patricia	Carter	SA Health	Principal Advisor, Public Health Nutrition
Jo	Gardner	Healthy Kids Association	Chief Executive Officer
Gie	Liem	Deakin University	Senior Lecturer
Mark	Williams	SA Health	
Margaret	Miller	Edith Cowan University	Senior Research Manager
Elizabeth	Denney-Wilson	University of Technology Sydney	Associate professor
Bec	Golley	University of South Australia	
Clare	Collins	The University of Newcastle	Co-Director Priority Research Centre in Physical Activity and Nutrition
Belinda	Adams	levy payer	Manager
Angus	Street	Horticulture Australia Limited	
Philippa	Lorimer	Horticulture Australia Limited	Portfolio Manager
Louisa	Matwiejczyk	Flinders University	
David	Park	Edelman	Senior Counsel
Sue	Moir	Department of Health & Human Services (TAS)	Program Manager, Move Well Eat Well
Lisa	Yates	Nuts For Life	Program Manager & Dietitian
Astrid	Poelman	CSIRO	Team Leader
Manny	Noakes	CSIRO	Research Director
Haidee	Lease	CSIRO	Research Projects Officer
Danielle	Baird	CSIRO	Research Projects Officer
Gilly	Hendrie	CSIRO	Research Scientist
Atul	Kacker	CSIRO	Business Development Manager
David	Cox	CSIRO	Team Leader
Jane	Bowen	CSIRO	Research Scientist
Julian	Carbone	Market Fresh SA	Marketing and Business Development Manager
Michelle	Jones	SA Health	

Appendix 2: Appreciative Stakeholder Analysis – summary results

Stakeholder:	Industry	Industry Organisation	Academia	Government	NGO
Interest in increasing children's intakes of veg	<ul style="list-style-type: none"> - Education: Increasing level of knowledge & engagement about where their food comes from (33%) - Improving health: 'The younger they are taught the healthier they will be in the future' (33%) - Increasing veg consumption (17%) - Increasing veg sales (17%) 	<ul style="list-style-type: none"> - Building/driving growth in vegetable sector, supporting local greengrocer (56%) - Increasing health of the nation (11%) - Benefiting/supporting growers (22%) - Providing education, content & resources about healthy eating to children and parents (11%) 	<ul style="list-style-type: none"> - Interventions/strategies to ensure PHC providers and others who support children (families/schools etc) are equipped/committed to encouraging veg intake (32%) - Development of early food preferences for veg for long term habits (17%) - Reducing children's intake of discretionary foods to 'create space' for veg intake (17%) - Sensory & psychological mechanisms of veg consumption to improve health outcomes in kids (17%) - Undertaking of projects which promote good nutrition, healthy growth & development of children and increase the mean daily servings of veg (17%) 	<ul style="list-style-type: none"> - Delivery of programs & building sustainable approaches in school, community, & sport settings to increase & promote veg consumption in children and reduce childhood obesity (60%) - Promotion of links between school and growers (20%) - Increasing the health of both children and adults (20%) 	<ul style="list-style-type: none"> - Implementing programs/initiatives & working with early childhood education services, schools & canteens to increase veg intake, overcome barriers & present new strategies - Delivery of healthy eating & gardening programs to children living in disadvantaged families - Promotion of healthy eating by delivery of community nutrition education programs that aim to increase veg consumption and food supply
Experience to contribute	<ul style="list-style-type: none"> - Experience with overseas markets (12.5%) - Nuffield scholar (12.5%) - Partnership in R&D projects (12.5%) - Grower representation & experience in Aust. veg industry (37.5%) - Education experience (12.5%) - Consumer alignment team member (12.5%) 	<ul style="list-style-type: none"> - Development of new F&V based food products (7%) - Work with/in overseas markets & insights from other countries (14%) - Development of campaign & education programs (eg Veggycation) to increase F&V (29%) - Knowledge of current state of veg consumption and barriers to growth / consumer interaction & reports (22%) - Publication of resources (books, recipes etc) to promote healthy eating (7%) - Healthy eating ambassador/role model (7%) - Dietetic experience (7%) - PR & marketing of produce (7%) 	<ul style="list-style-type: none"> - Experience developing, implementing, managing knowledge/behaviour interventions & projects (21%) - Dietetic experience (5%) - Child nutrition research, publications & theoretical knowledge regarding veg consumption trends, barriers, enablers, taste development, role of parents in kids food choice, repeated exposure, sensory testing methods etc (21%) - Experience working with families, early childhood education settings, schools to promote veg intake and developing nutrition education programs and no pressure preferences for veg (21%) - Experience in vegetable media campaigns & development of printed & online resources (11%) - Development of validated dietary intake tool & other validated research tools (16%) - Worldwide research collaborations (5%) 	<ul style="list-style-type: none"> - Experience in implementing/managing intervention program & initiatives in schools, communities and families (80%) - Research, collecting data and reporting on children's vegetable consumption habits (20%) 	<ul style="list-style-type: none"> - Provision of training, menu assessments & healthy eating policies for early childhood education services & canteens (7%) - Development of educational and classroom resources & programs teachings garden, kitchen & food literacy skills (22%) - Dietetic skills (14%) - Working in partnership with other stakeholders to increase community development, capacity building & health promotion in low SES & disadvantaged populations (14%) - Supporting govt campaigns through social media, policies and working with community (22%) - Delivery of the 'Healthy Eating Advisory Service' to early childhood education services, OSHC, primary/secondary schools, hospital food outlets and workplaces (7%) - Working with food industry to increase consumption & develop healthier policies/criteria (14%)

Stakeholder:	Industry	Industry Organisation	Academia	Government	NGO
What do you see the vegetable industry's role to be	<ul style="list-style-type: none"> - Education (14%) - Promotion / marketing to children (14%) - Growing (14%) - Ongoing support (29%) - Funding (29%) 	<ul style="list-style-type: none"> - Delivery of products (12.5%) - Delivery of messages, marketing, promotion of veg and 'healthy eating' (25%) - Be open to collaboration (12.5%) - Act for the collective 'greater good' as well as individual commercial interests (12.5%) - Provide support for education programs and encourage change within school curriculum (12.5%) - Provider of health/nutrition info on veg, recipes, tips, how to's (12.5%) - Increase demand by making F&V more fun and exciting (12.5%) 	<ul style="list-style-type: none"> - Support for interventions & funding (29%) - Partnerships with govt/non govt organisations to deliver solutions to increase veg intake (14%) - Leaders in innovation in area of product development & promotion (7%) - Facilitate the promotion of veg intake in children (7%) - Evaluation/monitoring of change & use of validated research & assessment tools and strategies (22%) - Delivery of information to professionals and public, education of parents (tasty ways to prepare & eat) and education of community about veg production & sustainability (14%) - Production of high quality produce (7%) 	<ul style="list-style-type: none"> - Develop local grower coops & networks (25%) - Develop relationships with schools (25%) - Advise/support strategies that increase veg supply/access & availability (50%) 	<ul style="list-style-type: none"> - Better connections, coordination & funding of programs to provide produce & increase veg accessibility to regional early childhood education services & schools & families who do not have access to produce (23%) - Funding to train food service staff in early childhood education settings & schools (6%) - Funding and partnerships with other key providers for nutrition education & development of education materials, programs & curriculum activities to build positive relationship with vegies & skill development (23%) - Lobbying government for tighter regulation of healthy eating policies in schools (6%) - Nutrition promotion through advocating for consumer nutritional issues and provision of information to support consumers (18%) - Working with suppliers (6%) - Advertising/marketing (12%) - Research (6%)

Appendix 3: Workshop Evaluation - graphical report

