Individual, social and environmental correlates of healthy and unhealthy eating

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The University of Western Australia Human Research Ethics Committee approved this study.

41 **Abstract**

42 **Background:** Few studies use comprehensive ecological approaches considering multi-level
43 factors, to understand correlates of healthy (and unhealthy) dietary intake. The aim of this
44 study was to examine the association between individual, social and environmental factors on
45 composite measures of healthy and unhealthy dietary intake in adults.

46

47 **Methods:** Participants (n=565) of the Australian RESIDential Environments project self-
48 reported dietary intake, home food availability and behavioral and perceived social and
49 physical environmental influences on food choices. A geographic information system (GIS)
50 measured proximity of supermarkets from each participant's home. 'Healthy' and 'unhealthy'
51 eating scores were computed based on adherence to dietary guidelines. Univariate and
52 multivariate models were constructed using linear regression.

53

54 **Results:** After full adjustment, 'healthy' eating (mean=6.25, SD=1.95) was significantly
55 associated with having confidence to prepare healthy meals (β=0.34; 95%CI=0.13, 0.55);
56 having more healthy (β=0.13; 95%CI=0.09, 0.16) and fewer unhealthy (β=-0.04; 95%CI=-
57 0.06, -0.02) foods available at home; and having a supermarket within 800m of home
58 (β=1.39; 95%CI=0.37, 2.404). 'Unhealthy' eating (mean=3.53, SD=2.06) was associated
59 with being male (β=0.39; 95%CI=0.02, 0.75), frequently eating take-away (β=0.33;
60 95%CI=0.21, 0.46) and cafe or restaurant meals (β=0.20; 95%CI=0.06, 0.33) and having
61 fewer healthy (β=-0.07; 95%CI=-0.10, -0.03) and more unhealthy (β=0.09; 95%CI=0.07,
62 0.10) foods available within the home.

63

64 **Conclusion:** Initiatives to improve adherence to dietary guidelines and reduce the
65 consumption of unhealthy foods needs to be multifaceted; addressing individual factors *and*

access to healthy food choices in both the home and neighborhood food environment. Ensuring proximity to local supermarkets, particularly in new suburban developments, appears to be an important strategy for facilitating healthy eating.

Keywords: diet, eating behavior, food environment, supermarkets, GIS

Introduction:

The high prevalence of nutrition-related health problems worldwide underscores growing concern surrounding eating patterns. Around 50% of the adult Australian and US population are at moderate-to-high risk of coronary heart disease due to elevated blood cholesterol levels (Dunstan et al., 2002; Roger et al., 2012), over half are overweight or obese (Australian Bureau of Statistics, 2012; Flegal, Carroll, Ogden, & Curtin, 2010), and around two-thirds of all cancer cases are linked to poor dietary and lifestyle habits (World Cancer Research Fund / American Institute for Cancer Research, 2007). To improve dietary intakes and reduce the prevalence of preventable nutrition-related health problems, a comprehensive understanding of the factors that influence healthy (and unhealthy) dietary intake is essential.

Research on the correlates of dietary intake has predominantly focused on socio-demographic, intrapersonal or interpersonal factors. For example, the ability of an individual to afford specific foods (related to income) is a primary determinant of food choice (Drewnowski & Darmon, 2005). Individuals who report being more involved in food purchasing and preparation or who cook more often, are more likely to meet dietary guidelines (Larson, Story, Eisenberg, & Neumark-Sztainer, 2006). Confidence in the ability to prepare healthy meals also appears to be a significant factor (Winkler & Turrell, 2010). Furthermore, the social context in which meals are consumed (i.e., alone, with family or friends) can affect the types of foods consumed and the total caloric intake of a meal (Herman, Roth, & Polivy, 2003). However, consistent with an ecological approach (Sallis, Owen, & Fisher, 2008), broader neighborhood-level influences on diet may also be important, but to date have rarely been considered alongside personal and interpersonal variables. The neighborhood food environment provides opportunity to purchase food for both immediate and later consumption. This has led to a new and growing body of research

investigating the relationship between availability of neighborhood food outlets and food choices.

The availability of neighborhood supermarkets is thought to be an indicator of access to healthy, nutritionally adequate and affordable food given that they generally provide better availability and selection, higher quality, and lower cost foods than smaller food stores (e.g., convenience stores) (Sallis, Nader, Rupp, Atkins, & Wilson, 1986). Studies examining whether the proximity or density of neighborhood supermarkets are associated with the healthfulness of residents' diets have largely focused on associations with fruit and vegetable consumption. Results have been mixed, with some studies reporting positive associations with increased supermarket proximity or density (Morland, Wing, & Diez Roux, 2002; Wrigley, Warm, & Margetts, 2003; Zenk et al., 2009), and others no association (Ball, Crawford, & Mishra, 2006; Pearson, Russell, Campbell, & Barker, 2005). Given that fruit and vegetable intake is only one component of a healthy diet, studies are required examining other foods that can be purchased from supermarkets.

The aim of this study is to use an ecological model to concurrently examine associations between individual, social, home and neighborhood environmental factors and dietary intake among adults.

Methods

Participants

This paper is based on cross-sectional data from 565 participants participating in the fourth survey (February 2011 – March 2012) of the RESIDential Environment (RESIDE) project. RESIDE is a quasi-experimental longitudinal study evaluating the impact of the Western

Australian government's new sub-division design code on walking, cycling, public transport use and sense of community. Details regarding the study design and sampling procedures appear elsewhere (Giles-Corti et al., 2008). Briefly, a cohort of people (n=1813) moving into 74 new housing developments in Perth, Western Australia were surveyed four times; prior to moving into their new home (baseline/T1), then at 12 (T2), 24 (T3) and 7-8 years (T4) after relocating. T4 was the only time point where participants self-reported dietary intake, home food availability and behavioural and perceived social and physical environmental influences on food choices. The University of Western Australia Human Research Ethics Committee approved the study.

Measures

Dietary intake

Participants self-reported frequency of intake of foods classified as 'healthy' (11 items, Table 1) and 'unhealthy' (11 items, Table 2). Reliability for these items was high with intra class correlations (ICCs) ranging from 0.79-0.95. A scoring system broadly based on adherence to Guidelines 2 and 3 of the Australian Dietary Guidelines was used to compute 'healthy' and 'unhealthy' diet quality scores respectively (National Health and Medical Research Council, 2013). Guideline 2 recommends that adults enjoy a wide variety of nutritious foods from the vegetable, fruit, grains, lean meats and dairy food groups each day. Guideline 3 recommends that adults limit intake of foods containing saturated fat, added salt, added sugars and alcohol. Both Guidelines provide recommendations for the optimal number of servings and serving sizes per day of foods. Items contributing to the 'healthy' eating score were coded from 0 to 2 ('2' indicating optimal intake/met recommendations, '1' indicating moderate adherence and '0' indicating low adherence to recommendations; see Table 1), and then summed (range 0-12). A higher 'healthy' eating score reflects greater compliance with the dietary guidelines.

Items comprising the 'unhealthy' eating score were reverse-coded (see Table 2), and summed (range of 0–18), with a higher score indicating lower compliance with the dietary guidelines.

Insert Tables 1 & 2 here

Individual factors

Socio-demographic factors

Self-report socio-demographic factors included: age; sex; marital status; education; work status; occupation; hours per week spent working; income; number of children <18 years in the household; number of adults in the household; and access to a motor vehicle for personal use.

Intrapersonal factors

Participants reported how confident they felt in their ability to prepare a healthy meal (not at all (1) to very confident (5)) (ICC 0.93), how much they like cooking (dislike a lot (1) to like a lot (5) (ICC 0.95) (Winkler & Turrell, 2010) and the frequency they eat meals bought from a canteen or take-away food shop (ICC 0.82) or from a restaurant or cafe (ICC 0.83) (most days (1) to never (7)) (Marks, Webb, Rutishauser, & Riley, 2001; New South Wales Health Department, 1994). Food insecurity was measured by, 'In the last 12 months have you ran out of food and couldn't afford to buy more?' (yes/no) (Australian Bureau of Statistics, 1997).

Social factors

Two items (7-point scale: 1=most days to 7=never) measured the context of meals eaten: 'How often do you eat meals together with other members of your household?' (ICC 0.71)

and ‘How often do you eat meals alone or when doing something else (e.g., watching TV or working)?’ (ICC 0.84).

Home food environment

Participants were asked how frequently 19 food items were available in their home (Fulkerson et al., 2008; Neumark-Sztainer, Wall, Perry, & Story, 2003) (Never (0); some of the time (1); about half the time (2); most of the time (3); and always (4)). All items had good test-retest reliability (ICC 0.67-0.96). Seven items were summed to create a ‘healthy’ home food inventory score (range 0-28): fresh fruit; fresh, tinned or frozen vegetables; wholemeal or wholegrain bread; porridge oats, muesli, cereals labelled ‘wholegrain’ or ‘high fibre’; lean meat, chicken or fish (fresh or tinned); reduced fat milk; reduced fat yoghurt or reduced fat cheese. Similarly, 12 food items were summed to create the ‘unhealthy’ home food inventory score (range 0–48): white bread or rolls; meat or chicken with visible fat; processed meats, salami or sausages; full cream milk; full fat cheeses; potato chips, corn chips, cheese snacks; chocolate or chocolate bars; sweets lollies or other confectionary; sweet biscuits, sweet pastries or puddings; cakes or sweet muffins; pizzas, hamburgers, meat pies, sausage rolls or pastries; and regular or sugar sweetened soft drink or flavoured mineral water. Higher values on each home inventory score reflected greater availability of these items within the home.

Neighborhood environment

Participants were asked how much they agreed with two statements (Saelens, Sallis, Black, & Chen, 2003): ‘I can do most of my day-to-day shopping in my local area’; ‘There are many shops within easy walking distance of my home’ (5-point scale: 1=strongly disagree to 5=strongly agree). Objective measures of supermarket availability included three separate variables; the presence of ≥1 supermarket within a) 800m (referent = no), 2) 1600m (referent

= no) and 3200m (referent = no), from home by road, measured with a geographic information system (GIS). Supermarket (major and minor chains, independent supermarkets) locations were obtained from an electronic telephone directory database in 2007 and the West Australian Health Department in 2009. Distances ≤1600m were chosen to represent the local neighborhood (i.e., the average distance a participant could walk at a moderate pace within a 30 minute round trip (Giles-Corti, Timperio, Bull, & Pikora, 2005)). The additional distance of 3200m was examined as supermarket trips taken by car may include supermarkets that are further away.

Statistical analysis

Descriptive statistics were computed for socio-demographic, intrapersonal, social, home and neighborhood food environment variables. Of the 565 RESIDE participants surveyed, 558 provided complete dietary data for the 'healthy' and 556 had complete data for the 'unhealthy' eating score. Each independent variable was checked for effects of multicollinearity. Each intrapersonal, interpersonal, home environment and neighborhood environment factor was separately entered into a linear regression model adjusting for socio-demographic factors (gender, age, education, income, children living at home, number of registered motor vehicles in the household) and clustering by estate only. Models were run twice; once for the 'healthy' eating score and then again for the 'unhealthy' eating score Intrapersonal, interpersonal, home environment and neighborhood environment factors found to be significant ($p < 0.05$) were included in a multiple regression model to examine their multivariate association with the a) 'healthy' and b) 'unhealthy' eating scores. All regression analyses controlled for socio-demographic variables that correlated with the dependent variables (defined as $r \geq 0.1$, $p < 0.05$) and clustering by estate. SPSS version 20.0 was used for the data analysis (2013).

Results

The mean age of participants was 48 years (range 25-80) (Table 3). Over half (65%) had greater than secondary school education, with 30% having a bachelor degree or higher. Three in four participants (78%) were employed; 35% worked full time. The 'healthy' eating score had a mean of 6.25 and standard deviation of 1.95 (range1-12) whilst the 'unhealthy' eating score had a mean of 3.53 and standard deviation of 2.06 (range 0-12).

Compared with participants lost to follow-up from baseline, participants in this sample were significantly less likely ($p<0.05$) to be male, younger in age, single, have no children living at home, work 60+hours per week and be a manager or blue collar worker. Drop-out was not found to be significantly related to education level, household income, and work status (results not shown).

INSERT TABLE 3 HERE

In univariate analyses, confidence in preparing healthy meals, enjoyment of cooking, frequency of meals bought from a take-away food shop, home availability of healthy (positive) and unhealthy (negative) foods and having a supermarket within 800m were associated with the 'healthy' eating score (all $p < 0.05$) and were included in the fully adjusted multivariate analyses (Table 4). After full adjustment, being confident in healthy meal preparation, having more 'healthy' foods available in the home and having a supermarket within 800m of home were significantly positively associated with the healthy eating score, while unhealthy food availability in the home was significantly negatively

associated. Notably, having one or more neighborhood supermarkets present within 800m of home had the largest effect size.

INSERT TABLE 4 HERE

Three intrapersonal factors, one social factor and home availability of healthy and unhealthy foods were significantly (all $p < 0.05$) associated with the 'unhealthy' eating score in univariate analyses (Table 4). In the final fully adjusted model, being male (β=0.39; 95%CI=0.02, 0.75), frequency of meals bought from a take-away, cafe or restaurant and having more unhealthy foods available within the home were significantly positively associated with the 'unhealthy' eating score (Table 4). Conversely, having healthy foods available within the home was significantly negatively associated with the 'unhealthy' eating score.

Discussion

This study used an ecological model to concurrently examine associations between individual, social, home and both perceived and objectively assessed neighborhood environment factors and dietary intake among Australian adults. 'Healthy' dietary intake was associated with having confidence to prepare healthy meals; having healthy foods and fewer unhealthy foods available within the home; and having a supermarket within 800m of home. 'Unhealthy' dietary intake was associated with being male, frequently eating meals bought from a take-away food shop, café or restaurant; and having fewer healthy foods and more unhealthy foods available within the home.

Consistent with previous research, having the confidence to prepare healthy meals was associated with healthy eating (Michaud, Condrasky, & Griffin, 2007; Winkler & Turrell, 2010). Cooking skills and the confidence to use them are important for a number of reasons. Foods prepared at home can be more nutritious than foods purchased pre-prepared (Porter & Patterson, 1994), and healthier dietary variety can be achieved by people who regularly cook from fresh or raw ingredients (Caraher, Dixon, Lang, & Carr-Hill, 1999). Furthermore, cooking skills may form a part of a positive general health outlook, empowering people to prepare their own nutritious foods and assisting them to make sound purchasing decisions (Caraher et al., 1999). Cooking skills are thought to be declining or devalued due to the rise in convenience foods and the demise of school home economics curricula (Begley & Gallegos, 2010; Short, 2003). Yet paradoxically, cooking-related television shows, celebrity chef personas, food magazines and cookbooks are enjoying unprecedented popularity amongst diverse audiences (de Solier, 2005). However, television chefs' meals typically do not comply with World Health Organisation nutritional guidelines (Howard, Adams, & White, 2012). Given the popularity of television chef programs, there is an opportunity to promote healthy eating through this medium. However, improving people's confidence and ability to prepare nutritionally sound meals may require television programs to actively promote healthy food options that are simple to prepare and complemented by school and community programs focused on translating nutrition concepts and healthy cooking techniques (Condrasky & Hegler, 2010).

Frequent eating of meals bought from a take-away, cafe or restaurant was associated with unhealthy dietary intake. This is not surprising given the observed positive associations between frequency of restaurant food/fast-food consumption and total energy intake, percentage energy from fat, body mass index (BMI) and body fatness (French, Story,

Neumark-Sztainer, Fulkerson, & Hannan, 2001; McCrory et al., 1999). Whilst there has been some effort by large fast food chains to improve the nutritional profile of their menus, fast-food meals are generally high in total fat, saturated fat and total energy and low in vitamins, minerals and dietary fibre (Antoniolli, Atkinson, & Palmer, 2013; Kirkpatrick et al., 2013). Therefore, dietary interventions targeting eating at fast-food restaurants may be of considerable benefit to improving dietary quality.

Consistent with previous research (Campbell et al., 2007; Kratt, Reynolds, & Shewchuk, 2000; Raynor, Polley, Wing, & Jeffery, 2004), availability of foods within the home was significantly associated with dietary intake. This suggests that encouraging people to limit the availability of unhealthy foods within the home (e.g., soft drinks, sweet biscuits and pastries), and increasing the availability of healthy foods (e.g., fruit and vegetables, fish, low-fat dairy) would reduce cues to eat unhealthy foods and increase cues to eat healthy food options. The choice of foods available is affected by weekly shopping choices and supporting better and thoughtful choices at the point of decision in supermarkets should be encouraged. Accessibility of healthy foods within the home helps to create a supportive home food environment. For example, placement of healthy foods in locations that facilitate consumption, such as fruit on the bench, have been shown to support healthful dietary intake in youth (Cullen et al., 2003; van der Horst et al., 2007). Furthermore, Neumark-Stzainer and colleagues (Neumark-Sztainer et al., 2003) found that even when taste preferences for fruits and vegetables were low, if fruits and vegetables were available in the home, intakes were higher. Around 68-87% of total energy consumed is from foods prepared within the home (Burns, Jackson, Gibbons, & Stoney, 2002; McLennan & Podger, 1997), yet there have been relatively few home-based interventions to improve dietary intake other than interventions around what to buy in the supermarket (Flynn et al., 2006). Future research should focus on

318 understanding influences on food purchasing behavior along with environmental
319 interventions targeting the home environment.
320
321 This study found that residing within walking distance (i.e., 800m or less) of a supermarket
322 was positively associated with healthy (but not unhealthy) dietary intake. These findings
323 support previous studies reporting a positive association between supermarket access and
324 adult fruit and vegetable consumption (Morland, Wing, & Diez Roux, 2002; Wrigley et al.,
325 2003; Zenk et al., 2009), however other studies have reported no association (Ball et al.,
326 2006; Pearson et al., 2005). Discrepancies in findings may relate to the differences in
327 defining availability (i.e., proximity to the nearest store versus store density), the fact that
328 fruits and vegetables can be brought from other places (e.g., green grocers, markets) and that
329 other determinants of food choices weren't assessed. Nevertheless, in this study, the largest
330 effect on healthy dietary intake was proximity to supermarkets. This highlights the
331 importance of the urban planning decisions that determine the geographical location of food
332 outlets. Planning for local shopping centres may facilitate better food choices than planning
333 for large 'big box' regional shopping centres with large catchment areas. This is particularly
334 important for groups with less mobility (e.g., older and younger adults; and those with lower
335 incomes) and less access to private motor vehicles for food shopping and, often, poorer
336 access to public transport. Ensuring equitable access to a range of affordable healthy foods is
337 especially critical for lower socio-economic groups (Morland, Wing, & Roux, 2002; Turrell,
338 1996). For example, evidence from the US and Australia suggests that the distribution of food
339 stores may be inequitable, with less advantaged areas having greater access to fast food
340 outlets and more advantaged areas greater access to supermarkets (Burns & Inglis, 2007;
341 Larson & Story, 2009). Designing communities to facilitate equitable local food access is an
342 issue that developers, planners and urban designers can positively influence (Donovan,

343 Larsen, & McWhinnie, 2011). Policy interventions aimed at improving the healthfulness of
344 neighborhood food environments as well as access to healthy food outlets may be promising
345 targets for large-scale public health interventions addressing healthy eating.
346
347 A strength of this study was its use of an ecological model to examine socio-demographic,
348 intrapersonal, social *and* home and neighborhood food environment influences on composite
349 measures of dietary intake concurrently. To date, few studies have examined food intake
350 from an ecological perspective, incorporated both perceived and objective environmental
351 measures and assessed dietary intake beyond just a measure of fruit and vegetable intake.
352 Future studies replicating our findings are warranted. This study also objectively assessed
353 access to supermarkets, where the majority of the foods in ourcomposite measure are usually
354 purchased. However, the role of availability and proximity to a range of other food stores
355 should be considered in future studies, particularly given the abundance of different types of
356 stores where food can be purchased and that participants may not have shopped at their
357 closest supermarket. Other important accessibility factors (e.g., opening hours, parking and
358 public transport availability) and in-store environments (e.g., availability, quality or cost of
359 foods) should also be considered. Further, in this study supermarket locations were collected
360 in 2007-09 and it is possible that these may have changed by the time this survey was
361 completed in 2011-12. The self-report dietary intake data may have been subject to random
362 and systematic bias, underreporting and social desirability bias (Armstrong, White, &
363 Saracci, 1992). The lack of portion size data on dietary intake is also a limitation of this
364 study. Future research should also include a wider variety of intrapersonal, interpersonal and
365 environmental variables. Results should be interpreted with caution as some measures and
366 items were newly developed and without evidence of validity. Nevertheless, these items were
367 based on existing validated questionnaire items developed for use in Australian populations

and a one week test-retest of all items found their reliability to be high. The cross-sectional design is also a limitation of this study. The fourth RESIDE survey (T4) is the only time point when participants self-reported dietary intake, home food availability and behavioural and perceived social and physical environmental influences on food choices. Thus, longitudinal analyses were not possible. Finally, these findings may not be generalizable given that participants were building new homes at the time of recruitment and thus, the socio-economic status of the sample may be higher than average. Replication of our results in other cohorts would help to address this.

Implications for policy and practice

Initiatives to improve adherence to dietary guidelines and reduce the consumption of unhealthy foods need to be multifaceted and address individual factors *and* access to healthy food choices in both the home and neighborhood food environment. There is a need for interventions targeting cooking and food purchasing skills, healthier away-from-home food choices as well as access to supermarkets. These findings highlight the importance of the local food environment and the role that planning plays in increasing access to local supermarkets. The findings also underscore the importance of including characteristics of individuals' neighborhood food environments into future studies to gain a better understanding of barriers and facilitators to healthy eating and the role of planning in facilitating access to local food choices. Ensuring proximity to local supermarkets, particularly in new suburban developments, appears to be an important strategy for facilitating healthy eating.

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555 Table 1: 'Healthy' eating score based on adherence to Guideline 2[a] of the Australian Dietary Guidelines (ADG) (National Health and Medical
556 Research Council, 2013).

			Score		
Guideline 1	Questionnaire item	Item reliability (ICC)b	0	1	2
Vegetables	How many serves of vegetables do you usually eat each day?(Australian Bureau of Statistics, 2003)		≤ 1 serve	2-4 serves	≥5 serves
Fruit	How many serves of fruit do you usually eat each day (including fresh, dried, frozen and tinned fruit)? (Australian Bureau of Statistics, 2003)		Do not eat	1 serve or less	≥2 serves
Dairy[c]	About how much milk (in total) do you usually have in a day? (Riley, Rutishauser, & Webb, 2001)	0.79	<150ml/day	150-300ml/day	301-600ml/day
	How often do you eat cheese (including ricotta, cottage processed, cream cheese hard and soft cheeses)? (Riley et al., 2001)	0.89	≤1-2 times/week	3-5 times/week	6-7 times/week
Red meat & poultry	How often do you eat red meat (beef, lamb and kidney but not pork or ham)? Include all minimally processed forms of red meat such as chops, steaks, roasts, rissoles, mince, stir-fries and casseroles? (Riley et al., 2001)	0.95	6-7 times/week or if never/rarely/sometimes trims off fat	3-5 times/week and usually trims off fat	≤2-3 times/week and usually trims off fat
	How often is the meat you eat trimmed of fat either before or after cooking? (Australian Bureau of Statistics, 1997)	0.93			
Fish	How often do you eat fish?	0.86	≤ 1 time/month	2-3 times/month	≥1-2 times/week
Wholegrains & pasta*	How often do you eat bread (including bread rolls, flat breads, crumpets, bagels, English or bread type muffins)? (Riley et al., 2001)	0.87	<3 times/week or eats white bread	3-5 times/week if multigrain or wholemeal or rye	6-7 times/week if multigrain or wholemeal or rye
	What type of bread do you usually eat? (Baghurst & Record, 1984)	0.94			
	How often do you eat pasta, rice, noodles or other	0.82	<3 times/week	3-5 times/week	6-7 times/week

	cooked cereals? (Riley et al., 2001)

[a]ADG Guideline 2: Enjoy a wide variety of nutritious foods from these 5 food groups everyday: vegetables, fruit, grains, lean meats and dairy (National Health and Medical Research Council, 2013).

[b]ICC = Intraclass Correlation; one week test-retest reliability of these items was high (defined as ICC >0.6(Landis & Koch, 1977)).

[c]Food group consisted of two items and was converted to a single score using the following criteria: 0 and 0=0; 1 and 1=1; 2 and 2=2; 0 and 1=0; 0 and 2=1; 2 and 1=2.

563 Table 2: 'Unhealthy' eating score based on Guideline 3[a] of the Australian Dietary Guidelines (ADG) (National Health and Medical Research
564 Council, 2013).

			Score		
Guideline 2	Questionnaire item	Item reliability (ICC)	0	1	2
Saturated fat	How often do you eat chips, French fries, wedges, fried potatoes or crisps? (Riley et al., 2001)	0.90	≤2-3 times/month	1-5 times/week	6-7 times/week
	How often do you eat biscuits, cakes, desserts, pastries, lollies and/or chocolate? (Rutishauser, Webb, Abraham, & Allsop, 2001)	0.87	≤2-3 times/month	1-5 times/week	6-7 times/week
	How often do you eat meat products such as sausages, frankfurter, polony, salami, meat pies, bacon or ham? (Riley et al., 2001)	0.89	≤2-3 times/month	1-5 times/week	6-7 times/week
	How often do you eat meat pies, sausage rolls or other savoury pastries? (Riley et al., 2001)	0.88	≤2-3 times/month	1-5 times/week	6-7 times/week
	How often do you eat fried, roast or BBQ chicken, pizza, burgers, or fish and chips? (Rutishauser et al., 2001)		≤2-3 times/month	1-5 times/week	6-7 times/week
	How often is the meat you eat trimmed of fat either before or after cooking? (Australian Bureau of Statistics, 1997)	0.93	Never or rarely	Sometimes	Usually
Salt	How often do you add salt to your food after it is cooked? (Australian Bureau of Statistics, 1997)	0.85	Must be both never or rarely	If any 'sometimes'	If any 'usually'
	How often is salt added to our food during cooking? (Australian Bureau of Statistics, 1997)	0.89			
Sugar	How many cups of regular or sugar sweetened soft drinks, cordial or sports drinks do you drink in a day? (Nelson & Lytle, 2009)	0.85	≤1 cup/day	1-2 cups/day	≥2 cups
Alcohol	On how many days of the week do you usually drink alcohol? (Department of Health of Western Australia,		M: ≤4 standard drinks/day	M: 4-6 standard drinks /day	M: >6 standard drinks /day

	2011) On a day when you drink alcohol, how many standard drinks do you usually have? (Department of Health of Western Australia, 2011)	F: ≤2 standard drinks/day	F: 2-4 standard drinks/day	F: >4 standard drinks/day

M = male; F = female; ICC = Intraclass Correlation; one week test-retest reliability of these items was high (defined as ICC>0.6 (Landis & Koch, 1977)).

[a]ADG Guideline 3: Limit intake of foods containing saturated fat, added salt, added sugars and alcohol (National Health and Medical Research Council, 2013).

Table 3: Socio-demographic characteristics of RESIDE study participants, Perth, Western Australia (n=565)

Characteristic	n	% or mean (SD)
Gender		
Male	215	37.9
Age (years)	565	47.85 (11.88)
Marital status		
Married/defacto	481	85.1
Separated, divorced, widowed or single	75	13.3
Education		
Secondary or less	189	34.7
Trade, apprentice, certificate	194	35.6
Bachelor or higher	163	29.7
Hours paid or unpaid work/week		
Not in workforce	119	21.6
<Half time	89	16.2
Half time- 38hrs	151	27.4
38 hrs-60hrs	193	31.8
>60 hrs	17	3.1
Income		
<$50,000	84	15.9
$50,000-$69,000	50	9.5
$70,000-$89,000	77	14.6
>$90,000	317	60.0
Children < 18 years at home	315	57.2
Number of adults in household	565	2.18 (0.78)
Registered motor vehicles in household		
One or less	107	19.3
Two	326	59.0
Three or more	120	21.7

SD = standard deviation

Table 4: Intrapersonal, social and environmental variable descriptive information and their association with the 'Healthy' and 'Unhealthy' eating score

		Univariate[a]		Multivariate[b]	
		'Healthy' eating score	'Unhealthy' eating score	'Healthy' eating score	'Unhealthy' eating score
Variables	Mean (SD)	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)
Intrapersonal factors					
Confidence in preparing healthy meals[c]	3.95 (0.84)	0.57 (0.37, 0.77)***	-0.46 (-0.66, -0.25)***	0.34 (0.13, 0.55)**	-0.12 (-0.31, 0.68)
Likes cooking[d]	3.64 (0.97)	0.24 (0.07, 0.42)**	-0.06 (-0.25, 0.11)	0.12 (-0.06, 0.29)	
Frequency eats meals bought from a take-away food shop[e]	4.57 (1.47)	-0.14 (-2.69, 0.06)*	0.52 (0.40, 0.64)***	-0.01 (-0.13, 0.11)	0.33 (0.21, 0.46)***
Frequency eats meals bought from a cafe or restaurant[e]	4.72 (1.24)	0.06 (-0.09, 0.20)	0.35 (0.21, 0.50)***		0.20 (0.06, 0.33)**
Food insecurity (%)	3.20	-0.56 (-1.61, 0.49)	-0.38 (-1.44, 0.68)		
Social factors					
Frequency eats meals alone or when doing something else (e.g., watching TV or working)[c]	1.46 (1.07)	0.14 (-0.10, 0.69)	0.12 (-0.04, 0.20)**		0.05 (-0.02, 0.13)
Frequency eats meals together with other members of the household[e]	4.10 (2.09)	0.15 (-0.03, 0.31)	0.09 (-0.08, 0.25)		
Home food environment					
Healthy home food inventory[f]	22.61 (4.50)	0.14 (0.10, 0.18)***	-0.07 (-0.11, -0.04)***	0.13 (0.09, 0.16)***	-0.07 (-0.10, -0.03)***
Unhealthy home food inventory[g]	20.70 (8.32)	-0.04 (-0.07, 0.02)***	0.10 (0.07, 0.12)***	-0.04 (-0.06, -0.02)***	0.09 (0.07, 0.10)***
Neighborhood food environment					
I can do most of my day to day shopping in my local area[h]	3.60 (0.14)	0.02 (-0.14, 0.11)	-0.08 (-0.19, 0.07)		
There are many shops within easy walking distance of my home[h]	2.87 (1.34)	0.11 (-0.03, 0.24)	0.05 (-0.08, 0.18)		
≥1 supermarket within 800m (%) (referent=no)	2.5	1.59 (0.49, 2.69)**	-0.01 (-1.14, 1.12)	1.39 (0.37, 2.40)**	
≥1 Supermarkets within 1600m (%) (referent=no)	19.3	0.24 (-0.22, 0.69)	-0.01 (-0.46, 0.44)		
≥1 Supermarkets within 3200m (%) (referent=no)	51.2	0.16 (-0.22, 0.55)	0.19 (-0.17, 0.56)		

***p=<0.001, **p=<0.01, *p=<0.05

[a]Each intrapersonal, interpersonal, home environment and neighborhood environment factor was separately entered into a linear regression model adjusting for socio-demographic factors (gender, age, education, income, children living at home, number of registered motor vehicles in the household) and clustering by estate only.

[b]Analyses adjusted for all other variables in the model, socio-demographics (gender, age, education, income, children living at home, number of registered motor vehicles in the household) and clustering by estate.

[c] 1=not confident, 5= very confident

[d] 1=I dislike it a lot, 5=I like it a lot

[e] 1=never, 7=6-7 times/week

[f] range = 4 to 28, the higher the healthier

[g] range = 1 to 48, the higher the unhealthier

[h] 1=strongly disagree, 5= strongly agree