

Supplementary Material for:

Associations between childhood to adulthood socioeconomic mobility and adult diet quality

Authors: Johanna E Wilson¹, Dipti Sugumar¹, Sarah A McNaughton², Seana L Gall¹, Terence Dwyer^{1,3,4}, Alison J Venn¹, Kylie J Smith^{1,*}

Affiliations:

¹ Menzies Institute for Medical Research, University of Tasmania, Hobart, 7000, Australia.

² Institute for Physical Activity and Nutrition Research (IPAN), School of Exercise and Nutrition Science, Deakin University, Geelong, 3220, Australia.

³ The George Institute for Global Health, University of Oxford, Oxford, OX1 3QX, UK.

⁴ Murdoch Children's Research Institute, Melbourne, 3052, Australia.

*Corresponding author:

Dr Kylie J Smith, Menzies Institute for Medical Research, University of Tasmania

Postal Address: Private Bag 23, Hobart. Tasmania, Australia, 7001.

Email: k.j.smith@utas.edu.au

Phone: +61 3 6226 7780

Fax: +61 3 6226 7704

Table S1. Dietary Guidelines Index scoring matrix for males and female 9-50 years of age, by age group, based on the 2013 Australian Dietary Guidelines

Dietary Guideline	Indicator and Description	Max score	Criteria for maximum score by sex and age in years								Criteria for minimum score	
			Boys			Girls			Men	Women		
			9-11	12-13	14-18	9-11	12-13	14-18	19-50	19-50		
Adequate intake												
1. Variety of nutritious foods.	1. Intake of foods from each of the five core food groups	10	Two points for a serving from each of the five core food groups. < 1 serving receives appropriate proportion of the 2 points.								0 serves from any of the core food groups	
2. Vegetables, including legumes/beans.	2. Servings of vegetables per day including legumes/beans, excluding fried potato.	10	≥ 5	≥ 5.5	≥ 5.5	≥ 5	≥ 5	≥ 5	≥ 6	≥ 5	0 servings	
3. Fruit.	3. Servings of fruit per day (max 125ml 100% fruit juice, one serving of dried/sweetened fruit)	10	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	0 servings	
4. Grain (cereal) foods, mostly wholegrain and/or high fibre.	4a. Servings of breads and cereals per day.	5	≥ 5	≥ 6	≥ 7	≥ 4	≥ 5	≥ 7	≥ 6	≥ 6	0 servings	
	4b. Servings of wholegrains as a proportion of total grains [†] .	5	100%	100%	100%	100%	100%	100%	100%	100%	0%	
5. Protein foods. Lean meat and poultry, fish, eggs, tofu, nuts and seeds, and legumes/beans.	5a. Servings of meats or alternatives per day	5	≥ 2.5	≥ 2.5	≥ 2.5	≥ 2.5	≥ 2.5	≥ 2.5	≥ 3	≥ 2.5	0 servings	
	5b. Proportion of lean meats/alternatives to total meat and alternatives	5	100%	100%	100%	100%	100%	100%	100%	100%	0%	
6. Dairy or alternatives. Milk, yoghurt, cheese or alternatives, mostly reduced fat.	6a. Servings per day of total dairy or alternatives.	5	≥ 2.5	≥ 3.5	≥ 3.5	≥ 3	≥ 3.5	≥ 3.5	≥ 2.5	≥ 2.5	0 servings	
	6b. Proportion of reduced fat dairy or alternatives to total dairy or alternatives	5	100%	100%	100%	100%	100%	100%	Skim, low, or reduced fat milk or alternatives	Child: 0%	Adult: Whole milk	

7. Drink plenty of water	7a. Servings per day of fluids, excluding alcohol.	5	≥ 6	≥ 6	≥ 7	≥ 5	≥ 5	≥ 6	≥ 10	≥ 8	0 servings	
	7b. Proportion of water to total fluid intake per day, excluding alcohol.	5	≥ 50%	≥ 50%	≥ 50%	≥ 50%	≥ 50%	≥ 50%	≥ 50%	≥ 50%	0%	
Limit intake												
8. Limit intake of saturated fat, added salt, added sugars and alcohol.	8. Servings per day of foods high in saturated fat, added sugars or salt †. Alcohol was included for adults.	20	≤ 1.5	≤ 1.5	≤ 2.5	≤ 1.5	≤ 1.25	≤ 1.25	≤ 1.5	≤ 1.25	Males 9-13/19-50: > 3; Males 14-18: > 5; Females 9-11: > 3; Females 12-50: > 2.5	
9. Replace saturated fats with unsaturated fats	Child: 9. kJ from healthy fats/oils as proportion of total fats/oils.	5	80% [§]	80%	80%	80%	80%	80%	Usually	Spreads low in saturated fat	Child: No un-saturated fats eaten	Adult: Never/rarely
	Adult: 9a. Trimming fat from meat.											Adult: 9b. Type of spread usually used.
Total:		100										

Reprinted from Nutrition Research, Vol 65, Wilson JE, Blizzard L, Gall SL, Magnussen CG, Oddy WH, Dwyer T, Venn AJ and Smith KJ, An age-and sex-specific dietary guidelines index is a valid measure of diet quality in an Australian cohort during youth and adulthood, Pages No. 43-53, Copyright (2019), with permission from Elsevier.

† Calculated for bread only as other cereal foods in the food frequency questionnaire (e.g. rice, pasta) did not specify wholegrain quality

‡ Servings of discretionary choices are only recommended for active, taller adults, or older children, and therefore, the number of servings for the maximum score for discretionary items is less than or equal to half the recommended servings for the age group and sex

§ 80% is used as the maximum, in recognition that eggs and cheese which contain saturated fat are included in recommended food groups

Table S2. Childhood characteristics of 1985 baseline eligible population and analysis population

	1985 Baseline population				Analysis population			
	Male		Female		Male		Female	
	%	n/N	%	n/N	%	n/N	%	n/N
Sex	51.2	2860/5589	48.8	2729/5589	45.7	678/1482	54.3	804/1482
Age (years)								
10	17.2	493/2860	18.2	497/2729	17.1	116/678	17.4	140/804
11	17.1	489/2860	17.7	484/2729	17.0	115/678	18.2	146/804
12	17.3	494/2860	17.9	489/2729	16.7	113/678	17.5	141/804
13	16.3	466/2860	16.0	438/2729	15.8	107/678	14.9	120/804
14	16.3	467/2860	15.0	408/2729	16.7	113/678	15.9	128/804
15	15.8	451/2860	15.1	413/2729	16.8	114/678	16.0	129/804
Language spoken at home [†]								
English	86.8	2404/2769	87.2	2331/2672	88.5	600/678	90.3	726/804
European language	10.4	287/2769	9.2	247/2672	9.7	66/678	7.1	57/804
Other language	2.8	78/2769	3.5	94/2672	1.8	12/678	2.6	21/804
Area-level SES quarter [‡]								
High	22.5	614/2733	23.9	628/2632	23.7	161/678	27.1	218/804
Medium-High	29.0	793/2733	29.0	762/2632	28.3	192/678	30.0	241/804
Medium-Low	38.7	1058/2733	38.5	1013/2632	40.1	272/678	36.3	292/804
Low	9.8	268/2733	8.7	229/2632	7.8	53/678	6.6	53/804
Academic performance [§]								
Excellent	6.8	180/2664	12.0	307/2560	8.4	53/633	15.5	117/753
Above average	23.5	625/2664	31.4	803/2560	33.3	211/633	36.7	276/753
Average	44.1	1176/2664	38.6	989/2560	43.1	273/633	38.4	289/753
Below average	19.2	512/2664	14.1	362/2560	12.6	80/633	8.1	61/753
Poor	6.4	171/2664	3.9	99/2560	2.5	16/633	1.3	10/753
School type								
State	75.1	2148/2860	74.6	2036/2729	71.5	485/678	75.4	606/804
Catholic	18.8	539/2860	20.9	570/2729	20.4	138/678	19.9	160/804
Independent	6.0	173/2860	4.5	123/2729	8.1	55/678	4.7	38/804

DGI score [¶] , mean(SD)	45.3 (12.2)	43.9 (11.9)	46.7 (12.2)	44.0 (11.7)
-----------------------------------	-------------	-------------	-------------	-------------

[†] Other languages were primarily Vietnamese, Chinese and Arabic.

[‡] Area-level SES quarter defined using the SEIFA index, a measure of area disadvantage.

[§] Reported by the school.

[¶] A higher score (potential range 0-100) indicates greater compliance with the 2013 Australian Dietary Guidelines. Baseline males: $n = 2,536$; baseline females: $n = 2,507$; study population males: $n = 678$; study population females: $n = 804$.

Table S3. Mean differences in the dietary guideline index score, by child and adult socio-demographic variables.

SES factor	Males (N = 678)				Females (N = 804)					
	n	Model 1 [†]		Model 2 [‡]		n	Model 1 [†]		Model 2 [‡]	
		β^{\S}	(95% CI)	β^{c}	(95% CI)		β^{\S}	(95% CI)	β^{c}	(95% CI)
Childhood variables										
Area level SES										
High	161		Reference		Reference	218		Reference		Reference
Medium-high	192	-2.6	(-5.0, -0.3)*	-1.3	(-3.6, 1.0)	241	-0.9	(-3.1, 1.2)	0.9	(-1.3, 3.0)
Medium-low	272	-2.6	(-4.7, -0.5)*	-0.8	(-2.9, 1.3)	292	-0.8	(-2.8, 1.2)	0.9	(-1.1, 2.9)
Low	53	-3.5	(-7.2, 0.3)	-0.3	(-3.8, 3.2)	53	-1.3	(-4.9, 2.3)	0.5	(-3.1, 4.1)
<i>Linear trend</i>			$p = 0.023$		$p = 0.779$			$p = 0.422$		$p = 0.580$
Parent's highest education [¶]										
University	171		Reference		Reference	192		Reference		Reference
Vocational	221	-1.9	(-4.3, 0.4)	-0.6	(-2.8, 1.6)	282	-2.4	(-4.6, -0.3)*	-0.8	(-3.0, 1.3)
School only	286	-4.3	(-6.4, -2.2)***	-1.6	(-3.9, 0.6)	330	-3.1	(-5.2, -1.1)**	-0.6	(-2.8, 1.6)
<i>Linear trend</i>			$p < 0.001$		$p = 0.137$			$p = 0.006$		$p = 0.691$
Parent's highest occupation [¶]										
Professional or manager	373		Reference		Reference	434		Reference		Reference
Non-manual	132	-2.3	(-4.4, -0.2)*	-1.8	(-3.8, 0.3)	155	-1.3	(-3.7, 1.0)	-1.2	(-3.5, 1.1)
Manual	170	-2.4	(-4.5, -0.4)*	-1.1	(-3.2, 1.0)	203	-1.1	(-3.2, 0.9)	-0.5	(-2.6, 1.7)
Not in the workforce	3	-2.3	(-3.6, -1.0)**	-2.7	(-5.8, 0.5)	12	3.8	(-3.0, 10.7)	4.9	(-0.9, 10.7)
<i>P-value</i>			$p = 0.012$		$p = 0.209$			$p = 0.456$		$p = 0.937$
Adult variables										
Area level SES										
High	222		Reference		Reference	269		Reference		Reference
Medium-high	190	-2.4	(-4.5, -0.2)*	-1.6	(-3.8, 0.5)	220	0.3	(-1.9, 2.5)	1.4	(-0.8, 3.5)
Medium-low	163	-2.2	(-4.3, -0.1)*	-1.4	(-3.4, 0.7)	199	-2.5	(-4.7, -0.4)*	-0.9	(-3.1, 1.2)
Low	103	-4.9	(-7.5, -2.2)***	-3.1	(-5.8, -0.5)*	116	-2.7	(-5.4, 0.0)*	-0.8	(-3.6, 2.0)
<i>Linear trend</i>			$p < 0.001$		$p = 0.022$			$p = 0.008$		$p = 0.291$

Education										
University	244		Reference		Reference	355	Reference	Reference		
Vocational	257	-5.1	(-7.0, -3.2)***	-4.8	(-6.7, -2.9)***	206	-2.0	(-4.0, -0.1)*	-2.2	(-4.2, -0.2)*
School only	177	-6.8	(-9.0, -4.6)***	-6.4	(-8.6, -4.1)***	243	-6.6	(-8.6, -4.7)***	-6.4	(-8.4, -4.4)***
<i>Linear trend</i>			<i>p</i> < 0.001		<i>p</i> < 0.001			<i>p</i> < 0.001		<i>p</i> < 0.001
Occupation										
Professional or manager	400		Reference		Reference	379		Reference		Reference
Non-manual	43	-3.0	(-6.4, 0.3)	-3.2	(-6.6, 0.3)	205	-3.2	(-5.2, -1.1)**	-2.7	(-4.8, -0.7)**
Manual	210	-4.2	(-6.0, -2.3)***	-3.9	(-5.8, -2.1)***	42	-2.9	(-7.2, 1.4)	-2.6	(-7.1, 2.0)
Not in the workforce	25	3.6	(-1.0, 8.3)	3.2	(-1.6, 8.0)	178	-2.2	(-4.4, 0.0)	-1.6	(-3.8, 0.7)
<i>P-value</i>			<i>p</i> = 0.002		<i>p</i> = 0.005			<i>p</i> = 0.041		<i>p</i> = 0.159

CI: confidence interval

* *p* < 0.05 ** *p* < 0.010 *** *p* < 0.001

† Model 1 – unadjusted.

‡ Model 2 – adjusted for language spoken at home in childhood, adult age, marital status, area of residence (major city, inner regional, outer regional/remote), physical activity (metabolic equivalents of task hours per week), BMI, usual daily energy intake, and adult SES factors as follows: Childhood area-level SES models adjusted for ASHFS DGI score, adult area-level SES and adult education level. Childhood parental education and occupation models adjusted for childhood DGI score and adult education and occupation respectively and for adult area-level SES. Adult area-level SES adjusted for adult education level. Adult education level and occupation adjusted for adult area-level SES. Area-level SES models did not also adjust for adult occupation due to collinearity between adult occupation and adult education.

§ The beta coefficients represent the difference in the Dietary Guideline Index (DGI) score compared to the reference group. The DGI was based on the 2013 Australian Dietary Guidelines. A higher score indicates greater adherence to the guidelines (potential range 0-100).

|| SES quarter defined using the SEIFA index, a measure of area disadvantage.

¶ Data collected retrospectively in adulthood – participants were asked to report their mother and father's education and main occupation up until they were 12 years old.

Table S4. Participant percentage distribution across childhood SES measures of parents' highest education, parents' highest occupation, and childhood area-level SES quarter.

	Male (N = 678)				Female (N = 804)			
	Childhood area-level SES quarter [†] , %							
	High	Med-high	Med-low	Low	High	Med-high	Med-low	Low
Parents' highest education								
University	10.3	6.9	7.7	0.3	11.8	5.8	5.6	0.6
Vocational	7.2	10.6	12.2	2.5	9.2	11.1	12.3	2.5
School only	6.2	10.8	20.2	5.0	6.1	13.1	18.4	3.5
	Parents' highest occupation, %							
	Professional/ Manager	Non- manual	Manual	Not in workforce	Professional/ Manager	Non- manual	Manual	Not in workforce
Childhood area-level SES [†]								
High	18.0	3.7	2.1	0.0	19.8	3.9	3.4	0.1
Medium-high	16.4	6.0	5.6	0.3	16.5	5.7	7.3	0.4
Medium-low	18.6	7.7	13.7	0.1	15.5	8.6	11.4	0.7
Low	2.1	2.1	3.7	0.0	2.1	1.1	3.1	0.2
Parents' highest education								
University	23.3	1.0	0.7	0.1	22.8	0.6	0.5	0.0
Vocational	15.9	7.8	8.8	0.0	16.9	8.1	9.7	0.4
School only	15.8	10.6	15.5	0.3	14.3	10.6	15.0	1.1

[†] Area-level SES quarter defined using the 1981 SEIFA index, a measure of area disadvantage.

Table S5. Percentage participant distribution across adulthood SES measures of highest attained education, current occupation, and adult area-level SES

	Male (N = 678)				Female (N = 804)			
	Adulthood area-level SES quarter [†] , %							
	High	Med-high	Med-low	Low	High	Med-high	Med-low	Low
Highest education								
University	15.0	10.3	7.8	2.8	18.3	10.9	9.7	5.2
Vocational	11.2	9.9	10.0	6.8	8.3	7.5	6.2	3.6
School only	6.5	7.8	6.2	5.6	6.8	9.0	8.8	5.6
	Current occupation, %							
	Professional/ Manager	Non- manual	Manual	Not in workforce	Professional/ Manager	Non- manual	Manual	Not in workforce
Adult area-level SES [†]								
High	23.5	1.9	5.8	1.6	18.5	6.8	1.0	7.1
Medium-high	15.6	1.8	9.9	0.7	13.1	7.6	0.6	6.1
Medium-low	12.8	1.6	8.7	0.9	10.3	7.3	1.7	5.3
Low	7.1	1.0	6.6	0.4	5.2	3.7	1.9	3.6
Highest education								
University	32.4	1.0	1.3	1.2	34.3	2.9	0.4	6.6
Vocational	15.8	2.5	18.1	1.5	8.2	8.6	2.4	6.5
School only	10.8	2.8	11.5	1.0	4.6	14.1	2.5	9.1

[†] Area-level SES quarter defined using the 2006 SEIFA index, a measure of area disadvantage.

Table S6. Percentage participant distribution across SES mobility measures of education, occupation, and area-level SES

	Male (N = 678)					Female (N = 804)				
	Area-level SES mobility [†] , %									
	Stable high	Stable intermediate	Stable low	Upward mobility	Downward mobility	Stable high	Stable intermediate	Stable low	Upward mobility	Downward mobility
Education										
Stable high	3.1	1.9	0.0	3.8	4.9	5.2	1.9	0.1	4.0	5.0
Stable intermediate	1.6	4.4	0.4	4.3	4.7	1.6	2.1	0.1	4.4	3.7
Stable low	0.4	3.5	0.7	6.3	5.3	0.7	5.0	0.2	5.0	6.3
Upward mobility	3.8	7.5	0.9	14.9	10.2	4.5	6.3	0.6	15.2	10.4
Downward mobility	3.4	3.4	0.3	5.3	4.7	2.2	3.4	0.0	4.7	7.2
	Occupational mobility, %									
	Stable high	Stable intermediate	Stable low	Upward mobility	Downward mobility	Stable high	Stable intermediate	Stable low	Upward mobility	Downward mobility
Area-level SES [†]										
Stable high	7.7	0.1	0.4	1.3	2.8	7.6	0.7	0.1	1.7	4.1
Stable intermediate	5.9	0.6	2.4	4.4	7.5	4.4	1.4	0.2	6.0	6.7
Stable low	0.1	0.0	1.0	0.7	0.4	0.1	0.0	0.1	0.7	0.1
Upward mobility	12.4	0.6	5.3	10.0	6.3	8.6	2.1	1.2	10.3	10.9
Downward mobility	12.4	0.9	3.1	5.5	8.0	10.0	1.9	1.5	6.3	13.1
Education										
Stable high	12.1	0.0	0.0	0.6	1.0	12.6	0.1	0.0	0.6	2.9
Stable intermediate	3.5	0.3	2.5	3.4	5.8	2.6	0.7	0.5	3.0	5.1
Stable low	3.5	0.7	4.1	2.9	5.0	0.9	1.9	1.0	5.1	8.5
Upward mobility	13.3	0.7	3.8	13.7	5.8	11.8	1.7	1.2	14.1	8.2
Downward mobility	6.0	0.4	1.8	1.3	7.5	2.7	1.6	0.5	2.4	10.3

[†] Area-level SES quarter defined using the 1981 SEIFA index in childhood and the 2006 SEIFA index in adulthood, a measure of area disadvantage.