Exploring reasons for parental weight change after a preschooler's sleep intervention

Aria Anstey

A thesis
submitted in partial fulfillment of the
requirements for the degree of

Master of Public Health

University of Washington
2022

Committee:
Michelle Garrison
Jessica Jones-Smith

Program Authorized to Offer Degree:
Department of Health Systems and Population Health

University of Washington

Abstract

Exploring reasons for parental weight change after a preschooler's sleep intervention

Aria Anstey

Chair of the Supervisory Committee:

Michelle Garrison

Department of Health Systems and Population Health

Background: After a sleep intervention for their preschool-aged children, parents with bigger bodies at baseline showed a significant weight difference at 12-month follow-up compared to their control counter parts; in part due to weight maintenance or loss in the intervention-arm, and weight gain in the control-arm. Now, a new study is underway to elucidate possible reasons for these weight differences. Since food and cooking skills have been linked to body weight, we explore the use of these skills as a possible explanation for the weight change.
Methods: Woman participants in bigger bodies at baseline were used to compare intervention (n=73) and control (n=65) arms self-reported cooking and food skill use at 36 or 42-month follow-up. Multiple linear regression A. was used to look for any significant associations between food and cooking skill use and study-arm. Multiple linear regression B. was used to look for significant associations between weight change and cooking or food use skills in each study arm.

Results: Most cooking and food skill usage scores were unassociated with study-arm. Weight change was associated with use of ‘cooking method’ skills in the intervention group; for every 1 unit increase in reported cooking method subscale score, weight decreased 1.2kg (p-value 0.01), after adjusting for potential confounders.

Conclusions: For this cohort, the use of cooking skills seems to be associated with weight change and may serve as a possible explanation for the observed difference in weight change between intervention and control groups after the preschooler’s sleep intervention. Additional research is needed to substantiate this finding and to examine if these findings are transferable to a larger, more diverse population group.

Introduction

The Sleep Health in Preschoolers (SHIP) is an on-going randomized control trial that examines the impact of a behavioral sleep intervention for 2.5 – 5 year-olds on the preschooler and their parent[1] by Seattle Children's Research Institute (SCRI). This study examines the impact of sleep on emotional, behavioral, and cognitive functioning, and other health markers such as weight. In as-of-yet unpublished data by the principal investigator, a difference was observed among parents who had overweight or obesity at baseline, and those in the control group[2]; at one-year follow up, the intervention group weighed an average of 4kg less than the control group. Additionally, there was a difference in waist circumference of 5cm, suggesting that the change in weight may have been due to adipose tissue, not muscle mass[3]. These differences were in part due to increased BMI and waist circumference in the control group while the intervention group decreased both weight and waist circumference. The question of why this weight changed occurred is the topic of the new study Sleep Obesity and Parent Health Outcomes (SOPHOS). See the SOPHOS conceptual diagram for theorized weight altering mechanisms (Figure 1).

One proposed mechanism is increased time available to spend on meal planning and/or preparation of healthier meals. Processed meals have been shown to be higher in calories than home prepared foods[4] but are often used due to time constraints of preparing healthier options. Studies generally agree home-cooked meals are healthier than prepared/take-away meals; having higher diet quality (e.g. increased fruits and vegetables) versus take-away meals[5–7]. Theoretically, higher diet quality, particularly higher intake of more fruits and vegetables which are lower in caloric value compared to many other foods, would have a positive association with reducing weight and limiting weight gain. However, in the same

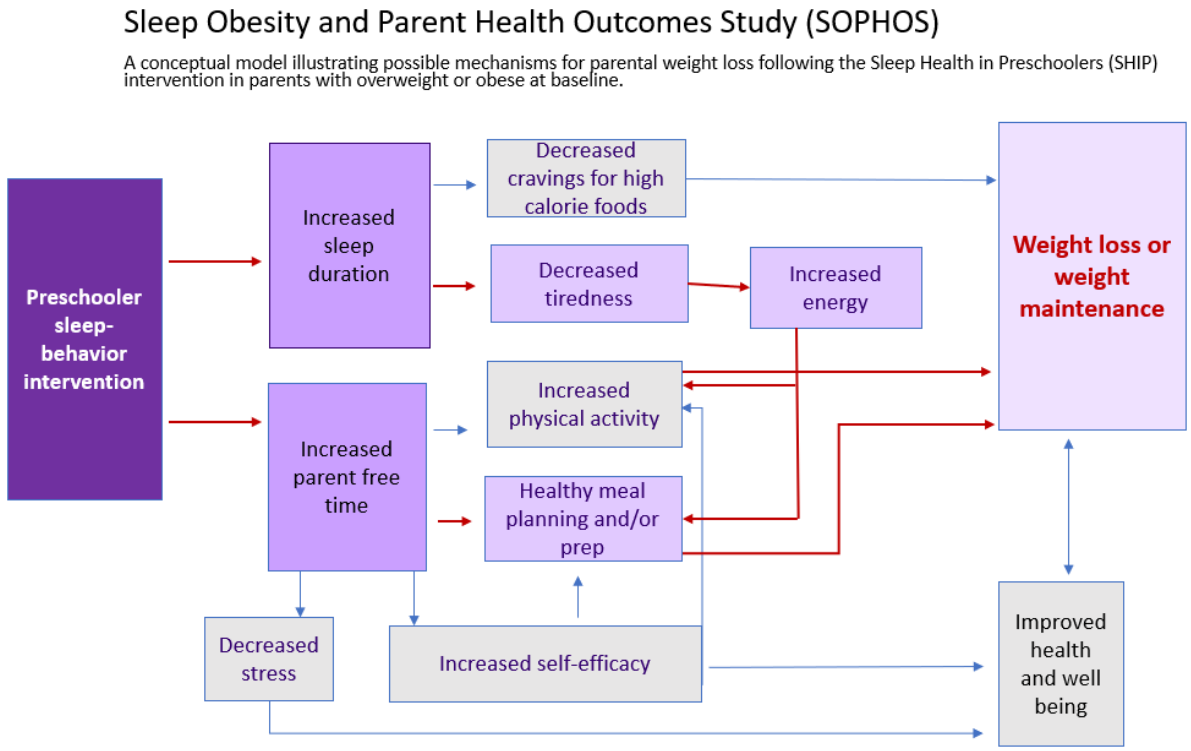
studies that found higher diet quality associations with home-cooked meals, they did not show home cooking to be associated with BMI[5–7]. One large study, Study of Women's Health Across the Nation (SWAN), showed increased meal preparation time and time spent cleaning up after meals had increased odds of many aspects of metabolic syndrome, however not abdominal obesity[8]. In contrast, other large studies have shown increased intake of home-cooked meals are positively associated both with higher diet quality and normal BMI as well[9,10].

Increased sleep in those who are sleep deprived has been associated with weight loss[11–13]. Multiple pathways to weight loss are accessed by increasing sleep duration. In one study by Yang, et al., in caregivers that were sleep deprived prior to the intervention, short sleep duration was associated with worse diet quality and cravings for higher calorie foods, leading ultimately to weight gain[12]. Therefore, it is possible that with increased sleep duration after the SHIP intervention, food cravings may have decreased and diet quality increased, leading to the possible weight loss. Metabolism has been found in both human and animal models to be associated with sleep[11,12,14,15]. Hormonal feeding responses such as ghrelin (causing hunger cues) and leptin (causing satiety cues) have been shown to be disrupted when one is sleep deprived[11,12,14,15]. An increase in ghrelin and a decrease in leptin lead to increased calories resulting in weight gain.

Many studies have focused on adult sleep and effects on adult obesity or the effects of child sleep on child obesity, however studies focusing on how child sleep effects adult obesity are lacking. SOPHOS seeks to elucidate pathways by which intervening on child's sleep health may be associated with beneficial health effects for parents as well. This thesis will specifically focus on one health behavior outcome, food and cooking skill usage. If the

mechanism for weight change can be discerned, it may be possible to offer other parents of young children with overweight and obesity an additional tool to help decrease their weight. As such, their risk factors for a plethora of weight related health concerns including diabetes, hypertension, cardiovascular disease, cancer, mental health, and reduced quality of life among others,[16] could be reduced.

Figure 1. SOPHOS Conceptual Diagram



This thesis seeks to address gaps in the current literature by seeking to answer how preschooler's sleep habits and may affect parent health habits; specifically, if the SHIP intervention is associated with use of cooking and food skills in adults with overweight or obesity. Questions to be answered are two-fold: Among adults in the study with a high BMI at baseline, are food and/or cooking skills utilized more frequently among adults who received the SHIP intervention compared to those in the control group? And, if there are significant

differences between the control and intervention groups, does this explain the weight change after the intervention?

Methods

Study design and intervention

This is a cohort study design using adults who had overweight or obesity at baseline in the ongoing SHIP randomized control trial. As part of the SHIP follow-up surveys, participants were emailed an invitation to fill out an additional survey online that included questions regarding food and cooking skills usage. Because of timing of participant follow-up and their vintage in the study, some participants received the SOPHOS questions three years after baseline (t36), while others received the SOPHOS questions three and a half-years after baseline (t42). From the participants who answered the SOPHOS survey questions, only participants who had overweight or obesity at baseline were used for this cohort due to the weight change that was found in those participants between the baseline and 12-month follow-up weights in the SHIP study.

This SOPHOS study uses secondary data gathered at baseline (t0) in the SHIP study where height and weight were gathered in the participants home by trained staff using stadiometers and scales. Using these heights and weights to calculate participants' BMI will determine eligibility for SOPHOS. Data will also be used from the SOPHOS questionnaire at t36 or t42 for other descriptors and variables.

Study participants

SHIP participants who answered the voluntary follow-up survey at t36 or t42 with SOPHOS questions and had above a 24.9 BMI at t0 are included in this cohort, using the accepted BMI cut-off for overweight/obesity of 24.9[17]. It was also decided to use a women-only cohort since gender differences exist around cooking, and the group of participants who self-identified as male was too small (4 males in each group, and 1-2 missing from each) to form their own sizeable group for analysis.

Study measures and variables used for analysis

Demographics

Demographic variables will be used to summarize the study population. Study arms include two groups: those who received the SHIP intervention and the control group (no intervention). Participant's age will be used in years. BMI(kg/m^2) of participants who had overweight or obesity at baseline will use the accepted BMI cut-off of between 24.9-29.9 and >29.9, respectively [17]. Number of pregnancies since SHIP intervention was used for description and for comparison between study arms, recoded as a binary variable of 1 or more pregnancies, or no pregnancies. Race and ethnicity were captured using non mutually exclusive categories and are presented as descriptive statistics only since we do not have adequate representation of non-white racial groups to look at differences by race or ethnicity[18]. Independent variables used include study arm, age and education. Age is categorized in the following groups: under 30, 30-34 years old, 35-39, 40 or better. Education level was used by grouping participants into three categories: those with two-years of college or less, 4 years of college or bachelor's degree, and those with greater than 4 years of college.

Cooking and Food Skill variables

Cooking and food skill use scores are used as the dependent variables in regression A and independent variables in regression B. A food skills utilization score and cooking skills utilization score was calculated using food skills and cooking skills confidence questions set forth in a validated survey by Lavelle, et al.[19], and responses altered for SOPHOS to capture frequency of utilization of food and cooking skills (see appendix A. for list of food and cooking skill use questions used). Cooking skill use was used as a total score and has two subscale scores: food preparation and cooking methods. Food skill use contains a total score and five subscale scores: meal planning and preparing, shopping, budgeting, resourcefulness, and label reading/consumer awareness. Scores were calculated using a Likert-scale of 0=never, 1=rarely, 2=a few times a month, 3=a few times a week, 4=every day. Those scores were then compiled, the higher the score, the more frequent utilization of this skill.

Weight Change variable

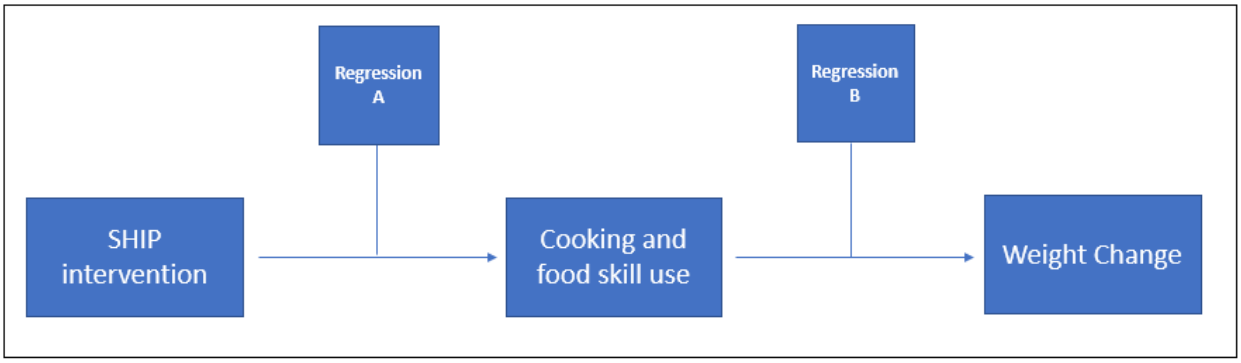
In regression B, the dependent variable is weight change. The weight change variable is defined by subtracting the participant's weight (in kilograms) at t0 from their weight at t36 or t42.

Statistical methods

To assure quality data, data will be analyzed for discrepancies including generation of histograms and/or skew tests to identify extreme outliers. Chi Square tests were used to assess for any significant differences between intervention and control groups for the categorical variables age, BMI, pregnancies since SHIP, and education level (See table 2.). Two regression models will be used (figure 2). Linear regression A was used to assess for any associations between cooking and food skill usage scores and study arm, after adjusting for

age and education; separate regression analyses were run for each of the total and subscale scores. Linear regression B is used to assess for associations between cooking and food skill use and weight change after adjusting for age and education level. Separate regressions will be run for the intervention and control arms. All analyses were conducted with STATA version 17 statistical software[20].

Figure 2. Regressions diagram



IRB

The original SHIP study was approved by the IRB of Seattle Children's Research Institute. All data used in this analysis was de-identified, and under an approved IRB modification by Seattle Children's Research Institute as authorized by the University of Washington IRB.

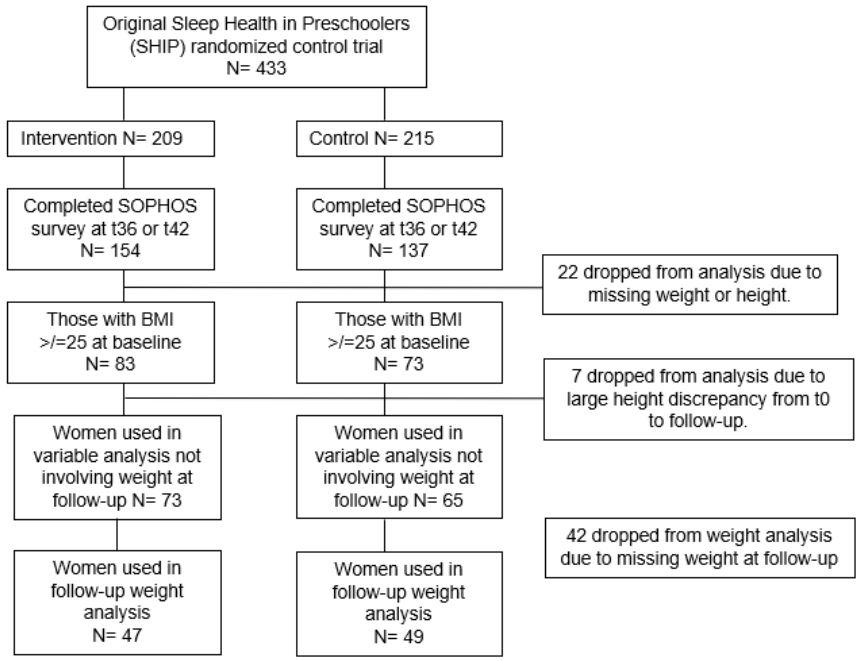
RESULTS

Participant sample

Out of the original (n=433) parent-child dyads in the SHIP RCT, 291 completed a voluntary follow up survey for SOPHOS. For some participants, the SHIP 36-month follow-up had already

been completed, 42% of participants completed the SOPHOS survey at their 36-month follow up. The other 58% had already completed their SHIP 36-month follow up and so completed the new SOPHOS questions as a separate 42-month survey. These follow up surveys included 137 participants from the control group and 154 participants from the intervention group (see figure 3.). From those participants, those who identified as males or missing in gender data, and those with missing or biologically implausible weight or height data were dropped from analysis. After limiting the sample to those overweight or obese at baseline (BMI 25+), this left 73 participants in the intervention arm and 65 participants in the control arm as the potential pool for this analysis. However, due to missing follow-up weight data, (n=42) final analytic models incorporating weight change as a variable included 47 participants in the intervention arm and 49 in the control arm.

Figure 3. SOPHOS Cohort



Demographics

See table 1 for descriptive statistics for the overall SOPHOS cohort. The average age of participants at base line was 36 years old. With the youngest participants being 27 and the oldest being 46. Participants with overweight at baseline made up 52% (38 intervention, 34 control) of the cohort, with a mean BMI of 27. Slightly fewer participants had obesity, 48% (35 intervention and 31 control), with a mean BMI of 36. Most participants, 53%, had not had any additional pregnancies since starting the SHIP study while 14 participants had one pregnancy, four participants had two pregnancies, and just three participants had had three pregnancies. For race and ethnicity, participants were asked to select all racial and ethnic categories that applied; the sample was predominantly White, with 90% selecting only White. As a whole, the SOPHOS cohort appears to be highly educated with only 14% having a two-year college degree or less, 44% having a bachelor's degree, and 42% having more than four years of college. Results from the Chi-square analysis indicate no significant association between the intervention and control arm for age, overweight or obese, number of pregnancies since SHIP, or education level (see table 2.), indicating that not only was randomization successful in balancing these characteristics across study arms but that even after taking dropouts and missing data into consideration the samples remain quite similar.

Cooking Skill Use

Being in the intervention versus control arm showed no statistically significant association with cooking skill usage. The most reported cooking skill used was the food preparation technique 'using herbs and spices to flavor dishes', reported to be used a few times a week or more by 89% of participants. Cooking skill use scores including the subscales 'food preparation

techniques', 'cooking methods', and the overall cooking skill usage score were not statistically significantly associated with study arm (table 3) when using a significance level of 0.05.

Food Skill Use

Out of food skill use variables, using a significance level of 0.05, being in the intervention group was not statistically significantly associated with the food skill use subscales 'budgeting', 'meal planning', 'shopping', 'resourcefulness', and 'label reading/consumer awareness' (tables 4a. and 4b.). There was a slight trend (p-value 0.06) for the 'budgeting' subscale to be associated with the intervention arm when controlling for age group and education level (see table 4a.). Individuals in the intervention group on average scored 1.64 points higher in their budgeting score than the control group. The average budgeting score was 8 out of a possible 16; there were a wide range of scores in this category, with a low score of 0 and a high score of 16. The budgeting subscale comprised questions about comparing prices, budget allowance, and saving money by buying less expensive meats or buying food in season. Participants reported using the skill 'buy food in season to save money' most frequently, with 48% reporting they use this skill a few times a week or more.

Weight Change

Weight change was associated with the 'cooking method' subscale in the intervention group only, see table 5. Each 1 unit increase in the 'cooking method' subscale score is associated with a 1.2 kg decrease in weight when controlling for age and education level (p-value 0.01). The average cooking method score was 18 out of a possible 32 points where the lowest score was a 6 and the highest score was 25. Participants reported using the cooking method skill 'chop, mix, and stirring foods' most frequently, with 92% reporting they do this a few times a week or more. See appendix A. for a full list of 'cooking method' questions. Other cooking and food use

subscales and total scores were unassociated with weight change in both study arms when controlling for age and education level.

Discussion

Both arms of this cohort were relatively equally distributed as far as age, BMI at baseline, recent pregnancies, and education level. This helps to substantiate that any significant findings associated with study arm are less likely the result of confounding in this cohort of well-educated, mostly white women having overweight or obesity at baseline. The SOPHOS survey was voluntary and the fact that 291 out of the original 433 SHIP participants completed the SOPHOS survey gave us a relatively large group with which to form our new cohort. Although this study did not screen for current pregnancy at time of survey completion, which could affect weight significantly, this room for error is likely to be equally distributed among both study arms. As is the possibility of error for self-reported measures such as weight at follow-up and food/cooking skill use. The use of the validated survey by Lavelle, et al., was a major strength of this study to measure food and cooking skill use, giving us a high likelihood of measuring food and cooking skill use accurately[19].

SOPHOS participants that had been in the SHIP intervention arm did not show associations with cooking or food skill use scores expect for the slight trend in the 'budgeting' subscale score among people who were heavier at baseline. Interestingly, the association between being in the intervention group and scoring higher for budgeting skill use could perhaps be related to skills learned or practiced during the intervention. Forte-Celaya, et al. posit creative-thinking and active learning are keys to long-lasting learning in their analysis of creative

thinking skills[21]. The individualized bedtime strategies such as the use of sleep charts for the children, or tracking sleep, for example, may be transferable critical-thinking skills that also enhance budgeting. Perhaps simply gaining parental child-free time left more time and/or energy for budgeting (see appendix A. for food and cooking use questions). Alternatively, we tested many outcomes in this study and it's possible the association between intervention and budgeting is due to chance.

SOPHOS participants that had received the SHIP intervention showed use of 'cooking methods' to be associated with decreased weight. 'Cooking methods' were largely use of day-to-day cooking techniques, which signals higher frequency of home-cooked meals in the intervention group. Perhaps SHIP participants who received the intervention were able to use more time to prepare healthy meals instead of spending time on bedtime routines for their preschoolers versus the control group. This could have led to decreased weight in the intervention group while the control group had increased weight. This association is in line with other studies where frequency of home-cooked meals have been associated with weight[9,10]. This suggests that use of cooking skills are a possible an explanation for the observed weight change in association with the intervention among participants with bigger bodies at baseline.

Limitations

The SHIP study did not expect to find changes in adult weight after the preschooler's sleep intervention. As such, no data were collected regarding caloric intake or food habits. Therefore, we are unable to delineate cause and effect with this model since we do not have baseline food and cooking skill use scores for comparison. Because SPOHOS is largely a cohort of white, well-educated women, it is difficult to say if any findings would be transferable to larger, more

diverse population groups.

The impact of COVID-19 cannot be understated. For almost two years we have all experienced a pandemic which has impacted all areas of life such as mental health, stress, sleep, work-life balance, eating and exercising. Weight changes due to Covid-19 versus weight change that would have happened without Covid-19 are impossible to tease out of this study as weight is interrelated to many aspects of life[22–27]. Weight change due to pandemic could have several causes. More individuals are working from home, decreasing distance one may have walked or biked to work, and or/spent walking during the workday. Thus, calorie expenditure might be less in those individuals compared to pre-pandemic expenditures. Those at home have food items available all-day versus on a work-break schedule in an office for example, increasing calories available. There may also be decreased calories burned since many altered their exercise routine as gyms had limited space or may have closed during the pandemic[25]. Alterations in household economic status and food availability due to COVID-19 have affected food and cooking skill use whether by choice or necessity[23,28,29]. These opportunities for decreased energy expenditures and increased caloric intake may have functioned created a "perfect storm" for weight gains in some individuals.

This SOPHOS analysis uses only a small subset of those who were initially randomized in the SHIP trial; it is possible because of the smaller sample size, intervention and control assignment is not balancing unobservable COVID-19 factors. Assuming both study arms *have* experienced similar affects due to the pandemic, the food and cooking skill use that may have changed due to the pandemic is likely equally distributed between the groups. This makes it very difficult to discern if being in the intervention group would have been differently associated with food and cooking skill use had COVID-19 not happened.

Table 1. Overall SOPHOS participant descriptive statistics used in this analysis

Group number of participants	
Intervention	73
Control	65
Age in years mean (sd) t0	36.25 (4.5)
BMI t0	
Overweight	52.17%
Obese	47.83%
One or more pregnancy since SHIP	
Yes (1 or more)	21 (15.22%)
no	73 (52.9%)
No answer	44 (31.88%)
Race/ethnicity (not mutually exclusive) **t0**	
American Indian or Alaskan Native	2.17%
Asian	6.52%
Black	2.17%
Hispanic	7.24%
Non-Hispanic	1.45%
White	89.86%
Other	1.45%
no answer	0.72%
Education level[b], % t0	
</= 2 years of college or vocational degree	13.77%
4 years of college or bachelor's degree	44.2%
> 4 years of college	42.03%

Table 2. Comparison of general characteristics of the SOPHOS study groups

	SOPHOS participants from SHIP intervention n= 73	**SOPHOS participants from SHIP control group n= 65**	**P-value**
Age (t0)*			0.75
Under 30 years old	4	5	
30-34 years old	20	17	
35-39 years old	30	22	
Over 40 years old	16	18	
BMI groups (kg/m$^{2)}$, t0)			0.98
Overweight (BMI 25-29)	38	34	
Obese (BMI >30)	35	31	
Pregnancies since SHIP*			0.89
Yes, 1 or more	10	11	
None	37	36	
Education level, % t0			0.70
</= 2 years of college or vocational degree	10	9	
4 years of college or bachelor's degree	30	31	
> 4 years of college	33	25	

* Chi square analysis. Age-132 observations. Pregnancies: 94 observations. BMI at follow-up: 96 observations.

Table 3. Multiple Linear Regression A. Comparing factors associated with cooking skill use at follow up.

	Food preparation techniques			Cooking methods			Cooking skills overall total		
	Coefficient Estimate	S.E.	p-value	Coefficient Estimate	S.E.	p-value	Coefficient Estimate	S.E.	p-value
Intervention (vs. Control)	0.38	0.74	0.60	-0.42	0.79	0.59	-.22	1.336	0.87
Age in years									
< 30	(ref)			(ref)			(ref)		
30-34	-0.10	1.67	0.55	1.22	1.71	0.48	-0.29	3.03	0.92
35-39	-0.57	1.65	0.73	1.10	1.68	0.51	-0.21	2.10	0.94
40 or better	-0.18	1.67	0.92	1.25	1.71	0.47	0.75	3.02	0.81
Education									
2 years of college or less	(ref)			(ref)			(ref)		
4 year degree	0.20	1.18	0.87	0.80	1.28	0.54	1.14	2.13	0.59
More than 4 years of college	0.39	1.20	0.75	1.08	1.30	0.41	1.90	2.18	0.39

Table 4a. Multivariate Linear Regression A. Comparing factors associated with food skill use at follow up.

	Meal planning and preparing			Shopping			Budgeting		
	Coefficient Estimate	S.E.	p-value	Coefficient Estimate	S.E.	p-value	Coefficient Estimate	S.E.	p-value
Intervention (vs. Control)	0.16	0.50	0.75	-.059	0.50	0.91	1.64	0.84	0.06
Age in years									
< 30	(ref)			(ref)			(ref)		
30-34	-0.62	1.08	0.57	-1.66	1.10	0.13	-1.82	1.82	0.32
35-39	0.29	1.07	0.79	-0.14	1.08	0.90	-1.58	1.80	0.38
40 or better	-0.48	1.09	0.66	-1.70	1.10	0.13	-2.25	1.83	0.22
Education									
2 years of college or less	(ref)			(ref)			(ref)		
4 year degree	0.10	.81	0.90	-0.61	0.82	0.46	0.51	1.37	0.71
More than 4 years of college	-0.11	0.83	0.89	0.43	0.84	0.61	-1.18	1.39	0.40

Table 4b. Multivariate Linear Regression A. Comparing factors associated with food skill use at follow up.

	Resourcefulness			Label reading/consumer awareness			Food skills overall total		
	Coefficient Estimate	S.E.	p-value	Coefficient Estimate	S.E.	p-value	Coefficient Estimate	S.E.	p-value
Intervention (vs. Control)	.092	0.58	0.12	-0.65	0.68	0.34	1.77	2.18	0.42
Age in years									
< 30	(ref)			(ref)			(ref)		
30-34	1.02	1.26	0.42	-0.73	1.48	0.63	-3.71	4.66	0.43
35-39	1.87	1.24	0.14	0.27	1.46	0.86	0.75	4.60	0.87
40 or better	2.02	1.26	0.11	-0.18	1.48	0.91	-2.62	4.68	0.58
Education									
2 years of college or less	(ref)			(ref)			(ref)		
4 year degree	0.90	0.94	0.34	1.85	1.11	0.10	2.79	3.49	0.43
More than 4 years of college	0.00	0.96	1.00	1.51	1.13	0.19	0.51	3.57	0.89

Table 5. Multivariate Linear Regression B. Comparing factors associated with weight change at follow up in intervention and control groups.

	Intervention group n=47			Control group n= 49		
	Coefficient Estimate	S.E.	p-value	Coefficient Estimate	S.E.	p-value
Cooking skill usage subscales						
Food preparation techniques	0.30	0.49	0.55	-0.03	0.73	0.97
Cooking methods	-1.18	0.44	0.01	0.80	0.65	0.23
Food skill usage subscales						
Meal Planning and preparing	1.22	0.73	0.10	-1.37	.93	0.15
Shopping	-1.26	0.68	0.08	0.91	0.76	0.24
Budgeting	0.43	0.49	0.39	0.84	0.50	0.11
Resourcefulness	-0.08	0.71	0.91	-0.62	0.70	0.38
Label reading/consumer awareness	-0.42	0.49	0.40	-0.74	0.55	0.19
Age in years						
< 30	(ref)			(ref)		
30-34	-6.42	10.27	0.54	14.49	5.82	0.02
35-39	-1.26	10.67	0.91	12.86	6.11	0.04
40 or better	-7.05	10.63	0.51	11.07	5.89	0.07
Education						
2 years of college or less	(ref)			(ref)		
4 year degree	-8.27	5.42	0.14	-7.69	4.35	0.09
More than 4 year degree	-6.53	5.27	0.23	-3.32	4.67	0.48

Appendix

A. Actual cooking and food skill survey from SOPHOS study[19,30]

Cooking Skills: When answering the following items think about how you prepare food for yourself and for your child.

	Please answer about **yourself**				
How often do you:	Never	Rarely	A few times a month	A few times a week	Every day or almost every day
Cooking Method					
'Chop, mix and stir foods, for example chopping vegetables, dicing an onion, cubing meat, mixing and stirring food together in a pot/bowl'	☐	☐	☐	☐	☐
'Blend foods to make them smooth, like soups or sauces' (using a whisk/blender/food processor etc.)	☐	☐	☐	☐	☐
Steam food (where the food doesn't touch the water but gets cooked by the steam)	☐	☐	☐	☐	☐
Boil or simmer food (cooking it in a pan of hot, boiling/bubbling water)	☐	☐	☐	☐	☐
Stew food (cooking it for a long time (usually more than an hour) in a liquid or sauce at a medium heat, not boiling) e.g. beef stew	☐	☐	☐	☐	☐
Roast food in the oven, for example raw meat/chicken, fish, vegetables, etc.	☐	☐	☐	☐	☐
Fry/stir-fry food in a frying pan/wok with oil or fat using the hob/gas rings/hot plates	☐	☐	☐	☐	☐
Microwave food (not drinks/liquid) including heating ready-meals	☐	☐	☐	☐	☐
Food Preparation Techniques					
Bake goods such as cakes, buns, cupcakes, scones, bread etc., using basic/raw ingredients or mixes	☐	☐	☐	☐	☐
Peel and chop vegetables (including potatoes, carrots, onions, broccoli)	☐	☐	☐	☐	☐

Prepare and cook raw meat/poultry	☐	☐	☐	☐	☐
Prepare and cook raw fish	☐	☐	☐	☐	☐
Make sauces and gravy from scratch (no ready-made jars, pastes, or granules)	☐	☐	☐	☐	☐
Use herbs and spices to flavor dishes	☐	☐	☐	☐	☐
Use herbs and spices to flavor dishes	☐	☐	☐	☐	☐

Food Skills

	Please answer about **yourself**				
How often do you:	Never	Rarely	A few times a month	A few times a week	Every day or almost every day
Meal Planning and Preparing					
…plan meals ahead? (e.g. for the day/week ahead)	☐	☐	☐	☐	☐
…prepare meals in advance? E.g. packed lunch, partly preparing a meal in advance	☐	☐	☐	☐	☐
…follow recipes when cooking?	☐	☐	☐	☐	☐
Shopping					
…ship with a grocery list?	☐	☐	☐	☐	☐
…shop with specific meals in mind?	☐	☐	☐	☐	☐
…plan how much food to buy?	☐	☐	☐	☐	☐
Budgeting					
…compare prices before you buy food?	☐	☐	☐	☐	☐
…know what budget you have to spend on food?	☐	☐	☐	☐	☐
…buy food in season to save money?	☐	☐	☐	☐	☐
…buy cheaper cuts of meat to save money?	☐	☐	☐	☐	☐
Resourcefulness					

…cook more or double recipes which can be used for another meal?	☐	☐	☐	☐	☐
…prepare or cook a healthy meal with only a few ingredients on hand?	☐	☐	☐	☐	☐
…prepare or cook a meal with limited time?	☐	☐	☐	☐	☐
…use leftovers to create another meal?	☐	☐	☐	☐	☐
…keep basic items in your cupboard for putting meals together? e.g. herbs/spices, dried/tinned goods?	☐	☐	☐	☐	☐
Label reading/consumer awareness					
…read the best-before date on food?	☐	☐	☐	☐	☐
…read the storage and use-by information on food packages?	☐	☐	☐	☐	☐
…read the nutrition information on food labels?	☐	☐	☐	☐	☐
…balance meals based on nutrition advice on what is healthy?	☐	☐	☐	☐	☐

References:

1. Hale L, Kirschen GW, LeBourgeois MK, et al. Youth Screen Media Habits and Sleep. *Child and Adolescent Psychiatric Clinics of North America*. 2018;27(2):229-245. doi:10.1016/j.chc.2017.11.014

2. Garrison MM. Unpublished data from SHIP study.

3. Lauria MW, Moreira LMP, Machado-Coelho GLL, Neto RM do N, Soares MMS, Ramos AV. Ability of body mass index to predict abnormal waist circumference: receiving operating characteristics analysis. *Diabetol Metab Syndr*. 2013;5(1):74. doi:10.1186/1758-5996-5-74

4. Celnik D, Gillespie L, Lean MEJ. Time-scarcity, ready-meals, ill-health and the obesity epidemic. *Trends in Food Science & Technology*. 2012;27(1):4-11. doi:10.1016/j.tifs.2012.06.001

5. Mejean C, Lampure A, Hassen WS, et al. Influence of food preparation behaviors on 5-year weight change and obesity risk in a French prospective cohort. *The International Journal of Behavioral Nutrition and Physical Activity*. 2018;15(1). doi:10.1186/s12966-018-0747-4

6. Tani Y, Fujiwara T, Kondo K. Cooking skills related to potential benefits for dietary behaviors and weight status among older Japanese men and women: a cross-sectional study from the JAGES. *Int J Behav Nutr Phys Act*. 2020;17(1):82. doi:10.1186/s12966-020-00986-9

7. Mills S, White M, Brown H, et al. Health and social determinants and outcomes of home cooking: A systematic review of observational studies. *Appetite*. 2017;111:116-134. doi:10.1016/j.appet.2016.12.022

8. Appelhans BM, Segawa E, Janssen I, et al. Meal preparation and cleanup time and cardiometabolic risk over 14years in the Study of Women's Health Across the Nation (SWAN). *Preventive Medicine*. 2015;71:1-6. doi:10.1016/j.ypmed.2014.11.025

9. Mills S, Brown H, Wrieden W, White M, Adams J. Frequency of eating home cooked meals and potential benefits for diet and health: cross-sectional analysis of a population-based cohort study. *The International Journal of Behavioral Nutrition and Physical Activity*. 2017;14(1). doi:10.1186/s12966-017-0567-y

10. Horst K van der, Brunner TA, Siegrist M. Ready-meal consumption: associations with weight status and cooking skills. *Public Health Nutrition*. 2011;14(2):239-245. doi:10.1017/S1368980010002624

11. McHill AW, Wright KP. Role of sleep and circadian disruption on energy expenditure and in metabolic predisposition to human obesity and metabolic disease. *Obesity Reviews*. 2017;18(S1):15-24. doi:https://doi.org/10.1111/obr.12503

12. Yang CL, Schnepp J, Tucker RM. Increased Hunger, Food Cravings, Food Reward, and Portion Size Selection after Sleep Curtailment in Women Without Obesity. *Nutrients*. 2019;11(3). doi:10.3390/nu11030663

13. Kracht CL, Chaput JP, Martin CK, Champagne CM, Katzmarzyk PT, Staiano AE. Associations of Sleep with Food Cravings, Diet, and Obesity in Adolescence. *Nutrients*. 2019;11(12). doi:10.3390/nu11122899

14. Vgontzas AN, Bixler EO, Chrousos GP. Metabolic disturbances in obesity versus sleep apnoea: the importance of visceral obesity and insulin resistance. *Journal of Internal Medicine*. 2003;254(1):32-44. doi:10.1046/j.1365-2796.2003.01177.x

15. Mosavat M, Mirsanjari M, Arabiat D, Smyth A, Whitehead L. The Role of Sleep Curtailment on Leptin Levels in Obesity and Diabetes Mellitus. *OFA*. 2021;14(2):214-221. doi:10.1159/000514095

16. CDC. Adult Obesity. Centers for Disease Control and Prevention. Published March 22, 2021. Accessed May 3, 2021. https://www.cdc.gov/obesity/adult/causes.html

17. CDC. Defining Adult Overweight and Obesity. Centers for Disease Control and Prevention. Published June 7, 2021. Accessed December 7, 2021. https://www.cdc.gov/obesity/adult/defining.html

18. Flanagin A, Frey T, Christiansen SL, AMA Manual of Style Committee. Updated Guidance on the Reporting of Race and Ethnicity in Medical and Science Journals. *JAMA*. 2021;326(7):621-627. doi:10.1001/jama.2021.13304

19. Lavelle F, McGowan L, Hollywood L, et al. The development and validation of measures to assess cooking skills and food skills. *Int J Behav Nutr Phys Act*. 2017;14(1):118. doi:10.1186/s12966-017-0575-y

20. Stata: Software for Statistics and Data Science. Accessed December 7, 2021. https://www.stata.com/

21. Forte-Celaya J, Ibarra L, Glasserman-Morales LD. Analysis of Creative Thinking Skills Development under Active Learning Strategies. *Education Sciences*. 2021;11(10):621. doi:10.3390/educsci11100621

22. Robinson E, Gillespie S, Jones A. Weight-related lifestyle behaviours and the COVID-19 crisis: An online survey study of UK adults during social lockdown. *Obes Sci Pract*. 2020;6(6):735-740. doi:10.1002/osp4.442

23. Chenarides L, Grebitus C, Lusk JL, Printezis I. Food consumption behavior during the COVID-19 pandemic. *Agribusiness*. 2021;37(1):44-81. doi:10.1002/agr.21679

24. Pellegrini CA, Webster J, Hahn KR, Leblond TL, Unick JL. Relationship between stress and weight management behaviors during the COVID-19 pandemic among those enrolled in an internet program. *Obesity Science & Practice*. 2021;7(1):129-134. doi:10.1002/osp4.465

25. Americans bulk up on home gym equipment to stay fit while staying at home. *Reuters*. https://www.reuters.com/article/us-health-coronavirus-fitness-equipment-idUSKBN22Q3OM. Published May 14, 2020. Accessed January 23, 2022.

26. Diniz TA, Christofaro DGD, Tebar WR, et al. Reduction of Physical Activity Levels During the COVID-19 Pandemic Might Negatively Disturb Sleep Pattern. *Frontiers in Psychology*. 2020;11. Accessed January 23, 2022. https://www.frontiersin.org/article/10.3389/fpsyg.2020.586157

27. Ghani S, Kennedy K, Seixas A, et al. 205 Changes in Sleep Due to COVID Pandemic Associated with Changes to Dietary Patterns. *Sleep*. 2021;44(Supplement_2):A82-A83. doi:10.1093/sleep/zsab072.204

28. Hayashi F, Takemi Y. Factors Influencing Changes in Food Preparation during the COVID-19 Pandemic and Associations with Food Intake among Japanese Adults. *Nutrients*. 2021;13(11):3864. doi:10.3390/nu13113864

29. Janssen M, Chang BPI, Hristov H, Pravst I, Profeta A, Millard J. Changes in Food Consumption During the COVID-19 Pandemic: Analysis of Consumer Survey Data From the First Lockdown Period in Denmark, Germany, and Slovenia. *Frontiers in Nutrition*. 2021;8. Accessed January 23, 2022. https://www.frontiersin.org/article/10.3389/fnut.2021.635859

30. Garrison MM. Unpublished data from SOPHOS study.