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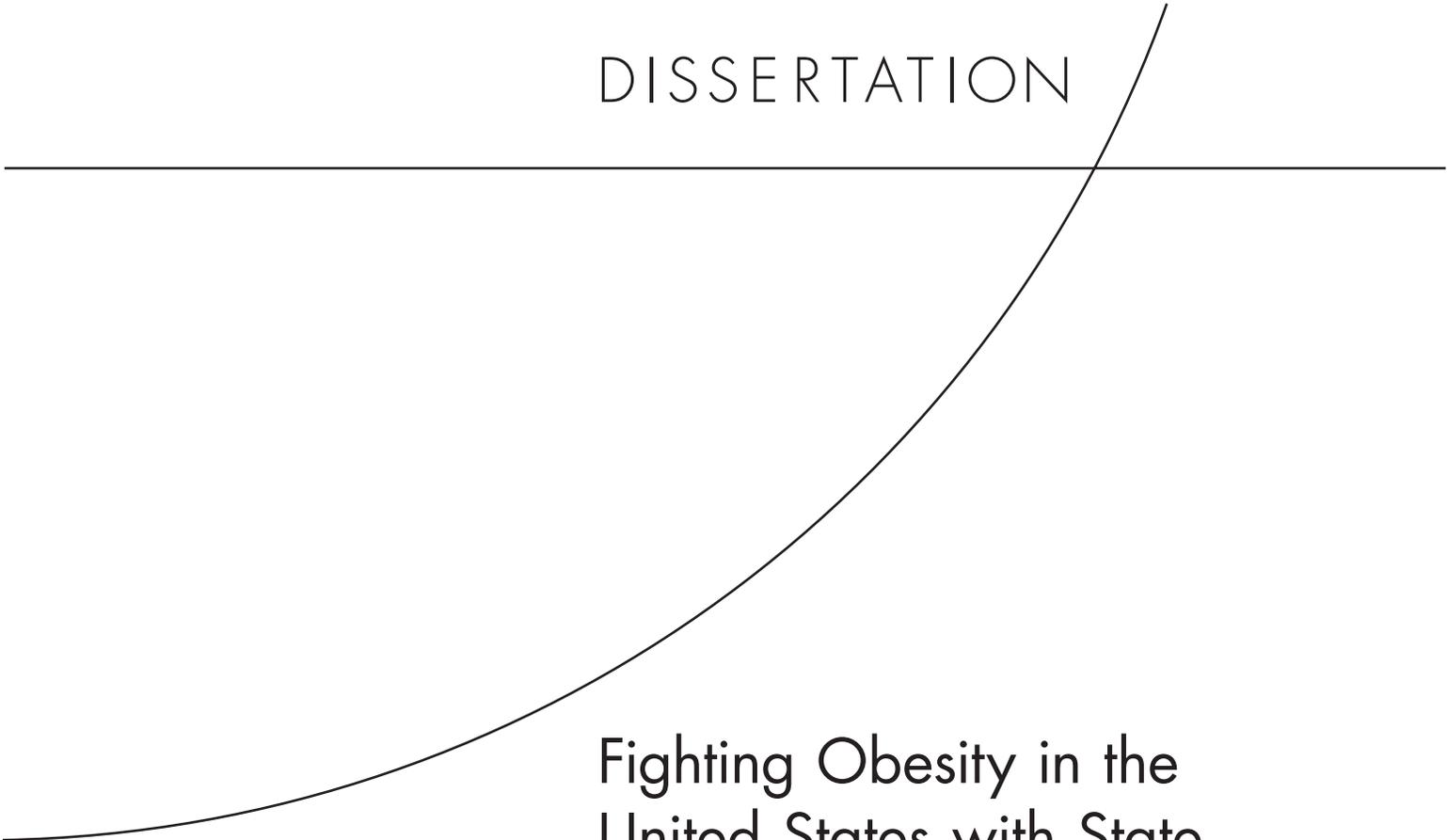
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DISSERTATION



Fighting Obesity in the United States with State Legislation

Stephanie S. Chan

This document was submitted as a dissertation in June 2013 in partial fulfillment of the requirements of the doctoral degree in public policy analysis at the Pardee RAND Graduate School. The faculty committee that supervised and approved the dissertation consisted of Sarah Meadows (Chair), Nelson Lim, and Homero Martinez.



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Summary

Obesity Is a Public Health Concern

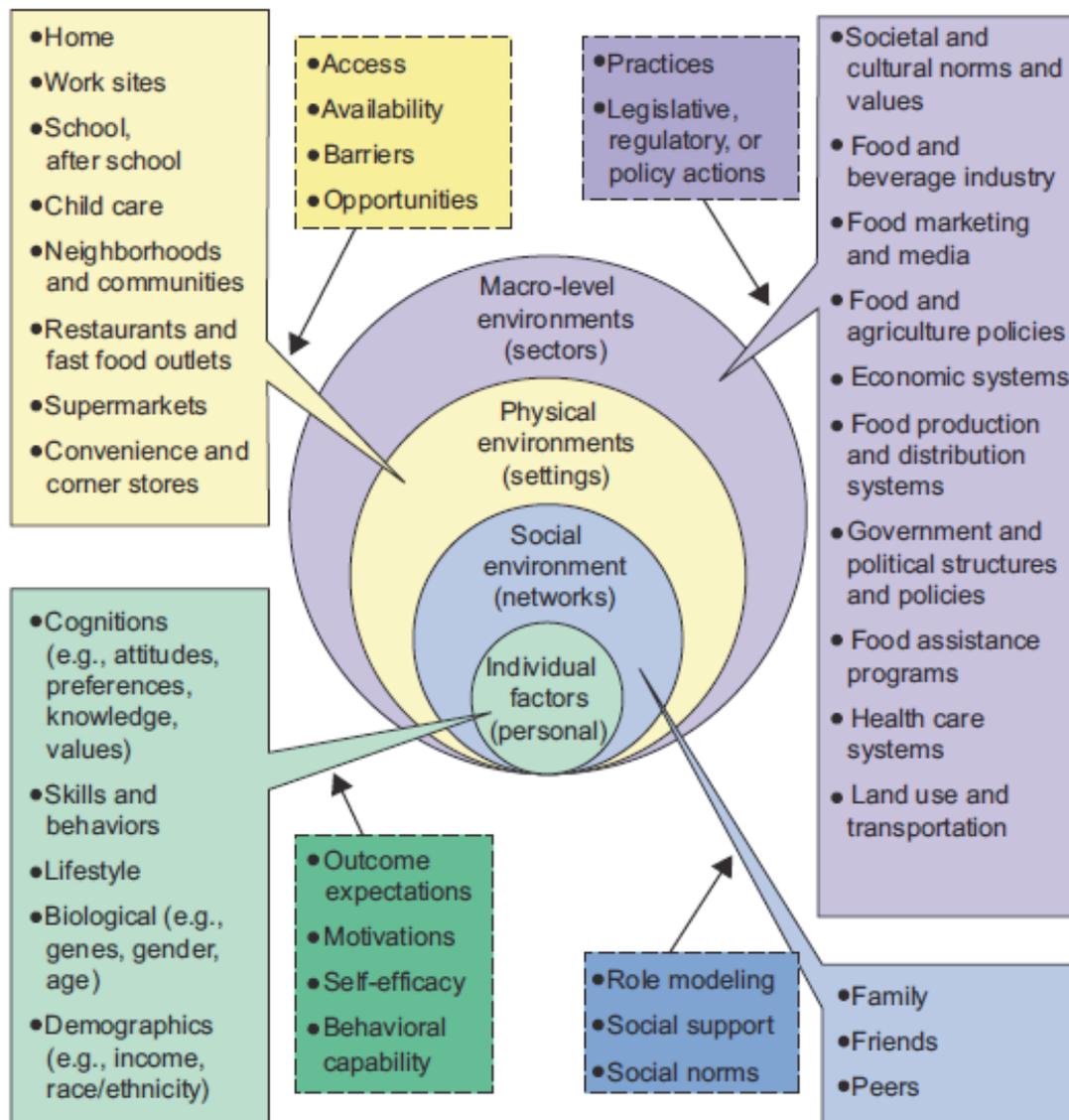
Obesity is a major public health problem with devastating health, social and economic consequences. From 1980 to 2008, the prevalence of obesity has more than doubled from 15% to 34% in adults and tripled from 5% to 17% among children and adolescents (Flegal et al 2010; Ogden et al 2010). That translates to 73 million adults and 12.5 million children and adolescents who are obese in the country. Body mass index (BMI), expressed as weight in kilograms divided by height in meters squared (kg/m^2), is commonly used to classify weight status. For adults aged ≥ 20 years, a BMI between $25 \text{ kg}/\text{m}^2$ and $30 \text{ kg}/\text{m}^2$ is considered overweight and $\text{BMI} \geq 30.0 \text{ kg}/\text{m}^2$ is considered obese. Children with BMI values at or above the 95th percentile of the sex-specific BMI growth charts are categorized as obese (NIH/NHLBI 1998).

Figure S1 below is a visual representation of the Story et al's (2008) Ecological Framework to organize various influences of eating behavior. Some of the influences of behavior are individual factors, social environment, physical environment and macro environment. It illustrates that there are various possible levels of influences, which are not independent of each other but can be influenced by a factor in a higher level. For example, individual factors are affected by physical environments, which can be influenced by macro-level environments. Individual factors can include genetics and physiology. Environmental influences can be described as the following:

- Social environments are networks connecting people, such as family and friends, through social support or social norms.
- Physical environments are the settings where behavior takes place, such as supermarkets, schools, and neighborhoods. Physical environment affects behavior through access, availability, barriers or opportunities
- Macro-level environments are sectors and larger institutions of society such as the food and beverage industry, agricultural industry, land use and transportation systems, and government agencies and policies.

(Story et al 2009, Swinburn & Egger 2002)

Figure S1. An ecological framework depicting the multiple influences on what people eat



Focus on state policies

Since the Surgeon General’s call to action there has been an increase in efforts to address the nation’s obesity epidemic, including state legislative efforts. Since 2001, states introduced almost 4,000 bills of legislative actions for physical activity, nutrition and obesity topics (CDC SLRA). Specific topic areas include active transit, breastfeeding, school nutrition, television time, and Safe Routes to Schools, access to healthy foods and access to drinking water. This variety and large volume of state laws make state legislation a rich data set to study.

The authors of *Healthy People 2020*, the National Governors Association, and National Association of State Boards of Education all recommended that states be involved in the development of obesity prevention policies and take an active role in shaping local policies

(Taber et al 2012). Taber et al (2012) found that state policies can influence local level policies. Districts have made little progress in developing strong wellness policies except in states that either had strong policies in place or developed strong policies over time, which may suggest district policies lack specific requirements or enforcement language.

States face growing financial pressure during budget cuts (State Budget Crisis 2012) and continued growth in state healthcare expenses (NGA 2012). An analysis of policy options available to states for a state level problem can be helpful for reducing obesity and, ultimately, expenses.

Research Aims

Since various states already acknowledge obesity as a public health priority and many already have state policies in place, this dissertation investigates the policy question “***Does state legislation reduce and prevent obesity at the state level? If not, why?***”

To address that policy question, this study identifies laws related to obesity, healthy nutrition and physical activity and then takes three paths in answering the policy question: 1) describe the landscape of anti-obesity laws across all states, 2) quantify the association between these laws and obesity-related health outcomes, and 3) explore how obesity prevention laws are formulated and implemented. This dissertation focuses on states, and all 50 states and Washington, D.C. are included in the analyses for a comprehensive examination of state laws.

Aim #1: Description of the Legislative Landscape

Data: Identify State Legislation

The anti-obesity laws included in the analysis come from the database of State Legislative and Regulatory Action to Prevent Obesity and Improve Nutrition and Physical Activity (SLRA) [CDC 2013], which was developed and maintained by the CDC, Division of Nutrition, Physical Activity, and Obesity (DNPAO). The database contains state legislation for selected topics starting from 2001. This online and publicly available database allows users to search for state-level legislation and regulation by category, topic, record type, setting, year, bill or regulation number, agency, and status. The SLRA Database was used in this study for its list of state legislative bills and brief description of each bill (the abstract) by state and year. The database of SLRA reported 3,067 legislative actions from 2001 – 2010 for all fifty states, when accessed in October 2011.

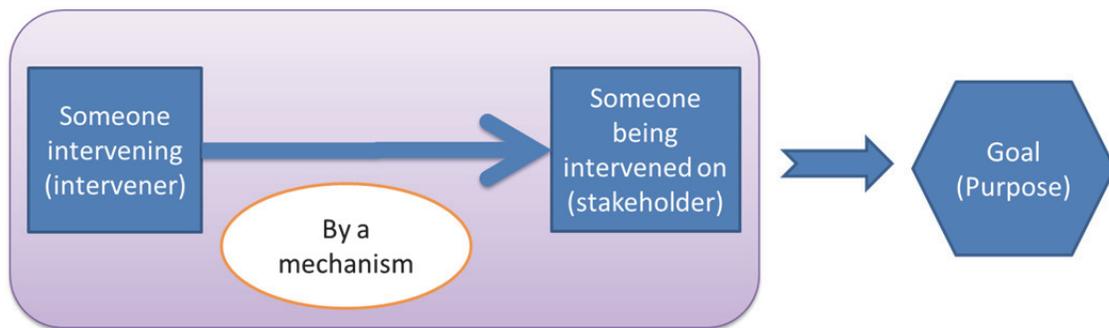
Method: Categorize State Legislation

Guiding framework

To collect data about legislation, I created a logical framework as a structure for how to think about the policy. This framework distills a legislative action into four parts (see Figure S2):

1. Who is intervening?
2. What is the mechanism?
3. What target stakeholder is being directly affected?
4. What is goal or desired outcome of the intervention?

Figure S2. Logical framework for describing a policy intervention



Aim #1 Findings

Mechanism describes the action step incorporated in the legislation to achieve the desired change or outcome.

I categorized the laws according to eight categories of mechanisms, each describing a different type of legislative intervention. These categories of interventions, ordered by frequency, are: 1) require something to happen and associated definitions (59% of laws included in the analysis), 2) appropriate funds (14%), 3) establish a new group (10%), 4) give authority (8%), 5) incentivize (6%), and 6) encourage (3%).

Table S1. Categories of Interventions for bills enacted from 2001 to 2011

Intervention Category	Definition	Example	Number of bills	Percent of bills
Require and define rules	Requires an action or condition to take place; set requirement or standards; define rules, duties, or responsibilities; includes bans and restrictions	Requires the State Board of Education adopt content standards in the curriculum area of health education.	591	59%
Appropriate funds	Allocates budget, funds, grants, or other resources	Relates to education finance, provides additional funding for local and healthy school lunches.	140	14%
Establish a new group	Establishes, creates, or develops something new for a set purpose, e.g. taskforce, council, advisory board,	Creates the Local Foods Initiative to encourage market opportunities for food produced close to its point of	101	10%

	programs	consumption.		
Authorize	Allows or give permission or authority to do something	Allows establishment of farmers markets and flea markets.	79	8%
Incentivize	Gives incentive to change behavior, e.g., taxes or tax credits	Creates a local farmer and food security income tax credit for individual and corporate income taxpayers, provides that the credit is available to grocers who contract with local producers for unprocessed or minimally processed fruits and vegetables, grains, and meat.	61	6%
Encourage	Passive measures to cause behavior change, no defined requirement or penalty	Urges the Governor and Surgeon General of State and the State Department of Community Health to raise awareness about the benefits of breastfeeding.	29	3%
Unclear	Unclear - Abstract is too short, vague or does not have not enough information to code		54	5%
Miscellaneous	Miscellaneous		38	4%
Total Number of Included Bills			1004	

Purpose describes the outcome or change that the legislation tries to accomplish.

I categorized the laws according to five categories of Purpose. Most of the observations fall into the categories related to 1) Physical Activity (50% of laws), 2) Nutrition (35%), and 3) Other aspects of Obesity not directly related to the first two (15%).

Table S2. Categories of Purpose for bills enacted from 2001 to 2010

Purpose Category	Definition	Number of bills	Percent of bills
Physical Activity	Relates to Energy Output by creating more opportunities for people to move around more	506	50%
Nutrition	Relates to Energy Input - mostly about eating and purchasing food, and some related to production, distribution	351	35%
Other Obesity	Other aspects of obesity that is not directly related to nutrition or physical activity, i.e., BMI or fitness testing, breastfeeding, research about obesity	148	15%
Unrelated	Abstract is irrelevant to the topic of obesity prevention or reduction	46	5%

Unclear	Unclear - Abstract is too short, vague or does not have not enough information to code	3	0%
Total Number of Included Bills		1004	

Stakeholder describes the person or entity that legislation is targeting to achieve the desired outcome. The Stakeholder does not necessarily have to be an individual, but can be an entity or a physical place. If it is an entity, there will be some associated stakeholder group that will be affected. A physical place can imply changes to the built environment.

I categorized the laws according to five categories of Stakeholder. These categories of Stakeholders, ordered by frequency, are: 1) Government (44% of laws), 2) School (16%), 3) People (8%), 4) Food-related places (8%), and Other (19%). Laws with unidentifiable stakeholders are categorized as ‘Missing’ (10%).

Each law was assessed to see if it aligned with evidence-based recommendations to prevent or reduce obesity by comparing the law to CDC’s “Recommended Community Strategies and Measurements to Prevent Obesity in the United States: Implementation and Measurement Guide” (CDC2009). There are 24 strategies, and they can be grouped into six broader categories. Table 8 below shows the frequency and percent of the laws that align with CDC’s Recommended Community Strategy categories.

When considering all laws in the sample, 46% of laws aligned with CDC Recommendations for strategies to prevent and reduce obesity. More than half of the enacted laws do not match any of the CDC strategies.

Aim #2: Association Between Legislation and Obesity Prevalence

The second empirical analysis is an exploratory investigation for quantifying the association state legislative regime and obesity prevalence. This chapter explores the following research questions:

1. Is the presence of obesity prevention laws associated with obesity reduction?
2. Are obesity prevention laws that meet CDC recommendations associated with obesity reduction?
3. What attributes of obesity prevention laws are associated with obesity reduction?

Data

Overweight and obesity result from an excess of energy intake over output, which is affected by an individual’s level of physical activity and food consumption. The socio-ecological model organizes these influences into multiple layers: individual factors, social networks, physical

settings, and macro-level environments. In the macro-level environment, laws can affect obesity through the channel of changing behaviors of physical activity and food consumption. The influence may be directly on the individual or through changing other sectors, like through physical environments, but all ultimately affect behavior.

Data for the outcome measures come from the Behavioral Risk Factor Surveillance System (BRFSS). BRFSS is a state-based system of health surveys of established by the Centers for Disease Control and Prevention (CDC) that collects information on health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury. A sample of adult survey respondents is randomly selected for each year and state, thus making BRFSS a repeated cross-sectional dataset.

This analysis includes the years 1996 to 2010 for all fifty states and the District of Columbia. The four state-level outcomes investigated are: obesity prevalence, overweight prevalence, average body mass index (BMI), and average weight (kg). The standard BMI categories for adult weight status are: underweight (BMI = <18.5 25 kg/m²); Normal weight (BMI 18.5–24.9 25 kg/m²); Overweight (BMI 25–29.9 25 kg/m²); and Obesity (BMI ≥ 30 kg/m²).

This analysis used a sample of 1,004 laws that were enacted during the years of 2001 to 2010 in all fifty states and the District of Columbia. Data on state laws were available starting in 2001 to 2010 at the time of the analysis. Table 14b shows the number of new laws enacted each year during the period of analysis and the number of laws that address adult obesity.

Methods

The empirical strategy is to find out whether a change in the legislative regime is associated with a change in obesity prevalence. The econometric model that fits this nature of the data is an OLS model with fixed effects:

$$OBESITY_{s(t+n)} = \beta LAW_{st} + \alpha_s + \mu_t + \varepsilon_{st} \quad s=1,2,\dots, 51; t=1,2,\dots,15; n= 1,2,3$$

In this model, $OBESITY_{s(t+n)}$ is obesity prevalence for state s in time $(t+n)$. s is one of the 50 states and the District of Columbia, t is a year from 1996 to 2010, n is a time difference that can range from 1 to 3 years. I examine the association between legislation and weight outcomes one, two, and three year after the law was adopted. For any law that was adopted after the first few months of the year, obesity prevalence of the same year will not capture the effect of the law. It is also likely that it will take time for the law to legally go into effect, time for administrators of the law to implement the law, and time for the law to work to change the

outcome. The analysis is repeated for other weight-related outcomes of interest: state overweight prevalence, state average BMI (kg/m^2), and state average weight (kg).

LAW_{st} is the vector of attribute categories describing the legislative regime, operationalized as the number of new laws, for each state and year. These predictors are included separately by Attribute type and included altogether, Table S3 summarizes the predictor variables used. α_s represents all the differences between states that are stable over time. The state fixed effects accounts for all variation across states that do not vary with time, all factors observed and unobserved that vary across state. μ_t represents all differences between years that are stable across states. ε_{st} is a random disturbance term that represents the unobserved differences that vary by state and by time.

Table S3. Attributes and associated categories of obesity prevention laws

Attribute	Categories within Attribute
Intervention Mechanism	Require and define rules, Appropriate, Establish a group, Authorize, Incentivize, Unclear, Miscellaneous, Encourage
Stakeholder	Government, School, People, Food-related places, Other, Missing
Purpose or Intended Outcome	Physical Activity, Nutrition, Other Obesity
Meets CDC Recommended Strategies	Yes, No

Aim #2 Findings

I examined the relationship between state-level obesity prevention legislation and state-level obesity prevalence 1 year after the legislation in Table 15. The table provides the estimated coefficient and p-value from OLS models with state and year fixed effects. The results came from 6 different specifications of state legislation, each in its own model: Total number of new laws (1); number new laws that meet CDC recommendations (2); number of new laws for each category of Intervention Mechanism (3); number of new laws for each category of Purpose (4); number of new laws for each category of Purpose Subgroups (5); and number of new laws for each category of Stakeholder (6). The only predictor with a statistically significant association with a decrease in obesity prevalence is the number of new laws that gives authority or permission to an entity to act. That is the only characteristic of obesity prevention laws that has a statistically significant association. The magnitude of that coefficient is 0.004, which can be interpreted as: on average one extra new law year that gives authority to an entity to act is associated with a reduction of state obesity prevalence by 0.004 percentage point.

Table S4. Association of state legislation on obesity prevalence with 1 year lag, Predictors in different models

		Dependent Variable: State Prevalence of Obesity w/ 1 year lead											
Predictors		1		2		3		4		5		6	
		Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
Number of New Laws		-0.0003	0.23										
CDC Recommendations				-0.0003	0.37								
Intervention													
Categories	Appropriate funds					-0.0006	0.47						
	Authorize					-0.0040	0.01						
	Encourage					0.0006	0.77						
	Incentivize					-0.0002	0.86						
	Require and define rules					-0.0002	0.70						
	Establish a new group					0.0019	0.09						
	Miscellaneous					0.0028	0.14						
	Unclear					0.0019	0.30						
Purpose													
Categories	Nutrition							-0.0005	0.31				
	Other Obesity							-0.0012	0.22				
	Physical Activity							0.0001	0.76				
Purpose													
Categories	Promote healthy foods									-0.0004	0.57		
(version2)	Discourage unhealthy foods									0.0015	0.65		
	Food Information									0.0008	0.81		
	Food Miscellaneous									-0.0012	0.28		
	Active Transport									-0.0003	0.50		
	Occupational Activity									0.0022	0.06		
	Recreation									-0.0005	0.67		
	Physical Activity												
	Miscellaneous									0.0045	0.43		
	Other Obesity									-0.0016	0.11		
Target													
Categories	People											0.0015	0.23
	School											0.0000	0.97
	Food related places											-0.0015	0.13
	Other											-0.0002	0.84
	Government											-0.0001	0.80
	Missing											-0.0017	0.14
Controls													
	State fixed-effects	X		X		X		X		X		X	
	Year fixed-effects	X		X		X		X		X		X	
	Number of Observations	713		713		713		713		713		713	

Notes: OLS regression model with state and year fixed effects as control variables. Outcome variable is the state obesity prevalence 1 year after the law was counted. Predictors are the number of new laws adopted for each year each state by for the law's attributes. Statistically significant results with $p < 0.05$ are highlighted in red.

Table S5 shows the results from the association of all legislative attributes together (i.e., all predictors entered into the model simultaneously) with state-level obesity prevalence 1, 2, and 3 years after the law was enacted. The time difference reflects the time lag that may exist between the time a law is enacted and the time it starts to have an effect on changing behavior and weight status. The variable ‘Total number of new laws’ is excluded from the analysis because it is perfectly collinear with the other predictors that describe the legislation.

All statistical significance (p-value less than 0.05) disappears when all predictors are included together for predicting state-level obesity prevalence. There are also no statistically significant results either for varying time differences or when predicting different weight-related outcomes. The absence of statistical significance means that this analysis fails to reject the null hypothesis. Failure to reject the null hypothesis does not lead to its acceptance, but implies insufficient evidence to reject it.

Table S5. Association of state legislation on obesity prevalence, using 3 different time differences

		Outcome: State-level Obesity Prevalence w/ lead					
Predictors		1 Year Lead		2 Year Lead		3 Year Lead	
		Estimate	P-value	Estimate	P-value	Estimate	P-value
Intervention Categories	CDC Recommendations	0.0000	0.96	0.0009	0.40	-0.0002	0.85
	Appropriate funds	-0.0006	0.75	-0.0003	0.92	-0.0022	0.43
	Authorize	-0.0043	0.06	0.0034	0.29	-0.0001	0.97
	Encourage	0.0005	0.87	0.0003	0.94	0.0006	0.88
	Incentivize	0.0009	0.71	-0.0007	0.86	0.0021	0.59
Purpose Categories	Require and define rules	-0.0005	0.77	-0.0006	0.81	0.0002	0.95
	Establish a new group	0.0019	0.38	0.0021	0.41	0.0040	0.18
	Miscellaneous	0.0021	0.46	0.0001	0.98	-0.0013	0.73
	Unclear	0.0026	0.33	-0.0027	0.49	-0.0014	0.72
Target Categories	Nutrition	0.0004	0.85	-0.0017	0.54	-0.0020	0.49
	Other Obesity	-0.0008	0.71	-0.0002	0.95	-0.0014	0.63
	Physical Activity	0.0007	0.75	-0.0013	0.65	-0.0006	0.84
Target Categories	People	0.0013	0.56	-0.0013	0.68	-0.0006	0.86
	School	0.0001	0.96	0.0016	0.58	0.0019	0.53
	Food related places	-0.0010	0.70	0.0039	0.27	0.0015	0.67
	Other	-0.0005	0.84	-0.0004	0.90	-0.0003	0.92
	Government	-0.0001	0.97	0.0006	0.82	0.0013	0.65
	Missing	-0.0022	0.36	0.0021	0.51	0.0001	0.98
Controls	State fixed-effects	X		X		X	
	Year fixed-effects	X		X		X	
Number of Observations		713		662		611	

Notes: OLS regression model with state and year fixed effects as control variables. Outcome variable is the state obesity prevalence 1, 2, or 3 years after the law was counted. Predictors are the number of new laws adopted for each year each state by for the law's attributes. Statistically significant results with $p < 0.05$ are highlighted in red.

I conduct a robustness check by limiting the predictor variables to a subset of laws that excludes laws directly aim at the children population. This subset of laws more closely matches

the outcome variable, which reflects the sample of adults captured in BRFSS. Laws were considered to address childhood obesity and excluded if: 1) the Stakeholder category only has the value of School, or 2) the Purpose Subgroup only has the value Occupational Activity.

Table S6 presents the results of this analysis with a subset of laws that apply to adults, and includes all predictors previously used to describe the legislative landscape and a 1-year time difference for the law to take effect. Similar to the original analysis, results from this robustness check also fail to reject the null hypothesis.

Table S6. Association of state laws with weight outcomes, subset of laws addressing adults

Predictors*		Outcome with 1 Year Lead, Adult Laws							
		Obesity Prevalence		Overweight Prevalence		Average BMI		Average Weight (kg)	
		Estimate	P-value	Estimate	P-value	Estimate	P-value	Estimate	P-value
Intervention Categories	CDC Recommendations	0.0001	0.91	0.0007	0.35	0.00	0.86	0.01	0.67
	Appropriate funds	-0.0014	0.51	-0.0025	0.30	-0.02	0.43	-0.11	0.24
	Authorize	-0.0041	0.10	-0.0054	0.05	-0.05	0.10	-0.15	0.16
	Encourage	0.0009	0.78	-0.0025	0.49	-0.02	0.72	-0.12	0.38
	Incentivize	0.0005	0.83	-0.0005	0.85	0.01	0.82	0.01	0.90
Purpose Categories	Require and define rules	-0.0011	0.57	-0.0018	0.42	-0.02	0.57	-0.10	0.25
	Establish a new group	0.0012	0.60	-0.0005	0.84	0.01	0.68	-0.02	0.83
	Miscellaneous	0.0018	0.55	0.0011	0.75	0.03	0.48	0.05	0.68
	Unclear	0.0026	0.36	-0.0006	0.86	0.02	0.52	0.00	0.99
Target Categories	Nutrition	0.0013	0.58	-0.0014	0.59	0.01	0.85	0.09	0.36
	Other Obesity	-0.0004	0.89	-0.0001	0.98	0.00	0.95	0.05	0.65
	Physical Activity	0.0010	0.67	-0.0003	0.90	0.01	0.73	0.08	0.45
Target Categories	People	0.0015	0.57	0.0003	0.91	0.00	0.90	0.05	0.67
	School	-	-	-	-	-	-	-	-
	Food related places	-0.0012	0.70	0.0018	0.59	0.00	0.93	-0.03	0.81
	Other	-0.0002	0.94	0.0006	0.84	0.00	0.93	0.00	0.97
	Government	-0.0003	0.90	0.0027	0.38	0.01	0.88	-0.02	0.89
	Missing	-0.0025	0.38	0.0029	0.36	-0.02	0.58	-0.06	0.59
Controls	State fixed-effects	X		X		X		X	
	Year fixed-effects	X		X		X		X	
	Number of Observations	713		713		713		713	

Notes: OLS regression model with state and year fixed effects as control variables. Outcome variables are state obesity prevalence, overweight prevalence, state average BMI, state average weight (kg). Each outcome variable is 1 year after the law was counted, and each outcome is estimated in a separate model.

Predictors are the number of new laws adopted for each year each state by for the law's attributes. Statistically significant results with $p < 0.05$ are highlighted in red.

* The laws included in this analysis are not directed at children. See Appendix B, Table B2 to see the number of laws included in the analysis

Aim #3: Understanding How Obesity Prevention Legislation is Formulated and Implemented

The motivation for this third research aim is influenced by the findings from the previous two aims. Results from Aim #1 indicated that states used a variety of legislative options in their efforts to reduce and prevent obesity. Results from Aim #2 failed to reject the null hypothesis that the presence of new obesity prevention laws are associated with changes in obesity prevalence. I supplement the quantitative approach by exploring several plausible substantive reasons for why anti-obesity laws may not be associated with reductions in obesity rates. By combining the results from the case study with the empirical analysis, I can triangulate the findings to provide a richer discussion about ‘Does State Legislation Reduce and Prevent Obesity?’ and some of the key issues surrounding that policy question.

For Research Aim 3, the objectives are to 1) understand the motivation and process involved with in formulating strategy to prevent obesity; and 2) identify those factors that positively or negatively impact the effect of obesity prevention law on reducing obesity.

The specific research questions are:

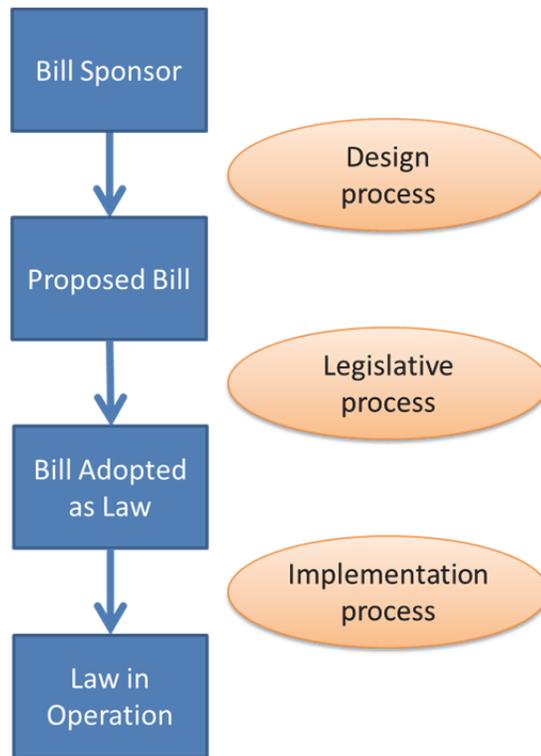
1. What is the motivation and process involved with formulating obesity preventions laws?
2. How does research influence the motivation?
3. How does implementation affect the effectiveness of a law to reduce obesity?

The key issues of interest are:

- What was the motivation of the law?
- What was the policy context?
- What were the key features of the legislation and could the law be considered to be research-based? If so, how did the bill sponsor and administrators incorporate evidence-based practices into the formulation and implementation?
- Who were the key stakeholders and actors involved in the formulation of the law? In its implementation?
- What were the enablers and challenges in the formulation and implementation phases of the law?
- What are lessons learned from this strategy?

I conceptualize a law as having three phases: 1) the design, or motivation and formulation of a bill before it is introduced; 2) the process of modifying the bill as it is considered by various committees and negotiated between the Senate and Assembly; and 3) after the bill is enacted as law. The possible reasons and factors that may influence a law’s effectiveness can be organized into one of these three stages. Figure S3 illustrates these three stages in the lifecycle of a law.

Figure S3. Three Stages in the Lifecycle of a Law



Data and Analysis

I collected data on these key features for each of the three phases (proposal, legislative, and implementation/enforcement). Data collection can be organized in a matrix, illustrated in Table S7.

Table S7. Matrix used to organize data collection

	Stages of Interest		
Themes of Interest	Proposal Process: Impetus and Design	Legislative Process: Design and Modification	Implementation & Enforcement: Actual and Monitoring
Research or References used			
Motivation			
Key Stakeholders Involved			
Policy Context			

Enablers			
Challenges			
Key Issues			
Lessons learned			

Data sources included legislative bill analyses, review of journal articles, and interviews with key stakeholders involved in formulating or implementing the selected piece of legislation. Participants for semi-structured interviews were selected to provide information for each of the three phases of the law on the questions of interest listed above.

The method of case selection involved two parts: 1) first select a state as a case of interest then 2) select one law within the state.

California is the subject of this case study because it has low obesity rates, high volume of legislative activity to reduce obesity, multi-pronged legislation, localities with progressive initiatives (e.g., San Francisco’s restriction on toys given away as part of unhealthy meals), and declining childhood obesity.

After selecting a state for as the study case, I continued to select specific laws within that state to study. I chose to focus on California’s Senate Bill (SB) 12, passed in 2005. This bill was selected because it is from a state that is very active with legislation and incorporates a multi-faceted approach to reduce obesity, and the bill itself appears to be research based and has had several years after the law was adopted for implementation to take place. SB12 was first introduced to the California state Senate in December 2004, then was passed and approved by the Governor in September 2005, and went into effect in July 2007. This legislation was authored by Senator Martha Escutia and sponsored by the California Center for Public Health Advocacy (CCPHA).

SB12 is a statewide school nutrition law that regulates food outside of the meal programs, also known as competitive foods, by setting nutritional guidelines regarding individual sold snacks and entrees at public schools at all grade levels from kindergarten to 12th grade. The nutrition guidelines address the amount of calories and calories from fat that a snack or entrée can include (see Table S8). SB12, along with two others, are significant nutrition guidelines that change the landscape of competitive foods in Californian schools. California was one of the first states to regulate competitive food nutrition content.

Table S8. Summary of Senator Bill 19 Nutrition Guidelines to Schools

An individually sold snack may have no more than:	An individually sold entree may have no more than:
35% of its calories from fat (excluding legumes, nuts,	4 grams of fat per 100 calories

nut butters, seeds, eggs, non-fried vegetables, and cheese packaged for individual sale)	
10% of its calories from saturated fat (excluding eggs and cheese packaged for individual sale)	400 calories
35% sugar by weight (excluding fruits and vegetables)	Must qualify under the federal meal program
175 calories (elementary schools)	
250 calories (middle and high schools)	

Source: CCPHA 2007

For the case study, I conducted in-depth interviews with key actors who have been involved in the development or implementation of obesity prevention legislation in California at the state-level and local levels. I conducted interviews with representatives from a total of 15 unique organizations representing varied perspectives. Interviewees included a wide range of personnel from co-sponsors of the legislation, state level school associations, local health departments, school food services, advocacy organizations, policy consulting organizations, and researchers. Table S9 summarizes the stakeholder groups and organizations included in the interviews. To analyze the interview data, I reviewed the transcripts and used a cutting-and-sorting technique to identify specific themes and to identify individual quotes or expressions that summarized the key discussion points.

Table S9. List of Stakeholder Groups and Organizations Interviewed

Stakeholder group	Organization
Policy Consulting, Advocacy, and Research	CA Food Policy Advocates CA Project LEAN ChangeLab Solutions Forward-Solutions National Academy of State Public Health
School Food Services	State Dept of Education – food services Local School Board Local school district – food services
Public Health	Local Dept of Public Health – food procurement
Bill Co-sponsors	Bill Sponsor – CA Center for Public Health Advocacy Bill Co-sponsor & Opposition –CA School Nutrition Association Bill Co-sponsor & Opposition –CA School Board

	Association Legislator – SB19 (legislative staff)
	15 Unique Organizations represented

In addition, I collected relevant documentation from each locality visited, including descriptions of implemented programs, planning and lessons learned documents, and reports describing local public health and hospital initiatives. Written documentation was used to augment the information from the interviews and helped identify any discrepancies in what the interview team learned.

Aim #3 Findings

Design Process

A major motivation for introducing the law was public attention and awareness about obesity. In a time when obesity was rising and receiving more public recognition, several public health leaders partnered with legislators who understood the severity of the problem to create healthier environments through legislation. Research studies also helped motivate legislative activity by quantifying obesity prevalence in the state by legislative district, the prevalence of junk food on school campuses, the how few servings of fruits and vegetables children actually ate (which was below recommendations). For childhood obesity, which was rising even more rapidly than adult obesity at the time, research findings recommend schools put their efforts in improving food and physical activity environments in the school setting where children spend a significant of their time there.

Prior to SB12, the existing guidelines for competitive foods in a school setting were considered archaic and not practically functional. The nutritional guidelines detailed in SB12 were established based on a consensus panel of top experts on nutrition and school settings from around the country.

Strong leadership dedicated to the cause helped move the legislative efforts forward. Several bills aiming to improve school nutrition were introduced in the late 1990s and early 2000s but were unsuccessful (Isaacs and Swartz 2006). But these leaders continued to champion for nutritional guidelines even when several prior attempts were unsuccessful. Then after some modifications, SB12 was introduced in 2004 to the California state Senate by Senator Escutia and the CA Center for Public Health Advocacy. Los Angeles Unified School District (LAUSD) voluntarily adopted a stricter version of SB12 nutrition guidelines and had already implemented it for several years by the time SB12 was introduced to the state Senate.

Legislative Process

When the bill was brought into the legislative process, there was fierce opposition against it, even though targeting children in school settings seemed to be the most favorable setting to regulate. During the legislative process, similar issues of contention that challenged the bill's precursor also challenged SB12. Strongest opposition came from school associations; most of the opposition was borne out of worry of lost revenue. The key challenges were concerns about the nutrition guideline's potential negative financial impact to school food services, school administration, and student groups; the potential negative impact to the snack food industry; nanny state government involvement, and disagreement on nutritional science. There was strong disagreement between public health advocates and school nutritionists over the nutrition guidelines and nutrition sciences. A previous version, SB19 (California, 2001), was adopted as law but not implemented because of lack of funding.

Over time, sponsors of SB12 were able to eventually win the support of the school based opposition – that was a major success and turning point for the outcome of the bill. Various other factors enabled the bill to successfully pass through the legislative process, including: a strong support base, strong leadership, collaboration, necessary research to address opposition's concerns, and finding a compromise with opposition to gain the support of some key players. The CA School Board Association and CA School Nutrition Association presented some of the strongest opposition to the bill but became supporters over time.

Implementation Process

During the implementation stage, the key stakeholders were students, parents, teachers, school level food services department, school level administrators, district level administrators, state department of education, and food manufacturers. A key issue during the implementation related to the nature of the existing structure for selling competitive foods on school campuses.

The main challenge during the implementation stage was non-compliance, which stemmed from several deeper issues regarding lack of enforcement, multiple entry points for competitive foods, loss of revenue, and lack of education and training for target audiences. The key factors that helped enable the implementation process were food manufacturers reformulating products to be compliant with the law and doing so in such a way that it absorbed the costs, and a growing public acceptance of the law.

The main challenge in the implementation stage was non-compliance. In a study describing implementation of competitive food (SB12) and beverage (SB965) standards in low-income communities, Samuels et al (2010) found about 24% of school competitive food items met the nutrition standards of SB12 in 2005 (before SB12 implemented). The compliance of school food items to SB12 guidelines increased 67% in 2008 (after SB12), but schools did not achieve full compliance after SB12 was implemented.

Sanchez-Vaznaugh et al (2010) found the rate of increase in overweight lowered significantly after state policies to restrict competitive foods and beverages in schools were implemented.

LAUSD leadership took the initiative to voluntarily adopted regulations on competitive foods and beverages in 2002 and 2003, several years before the analogous state laws. Several years later, the LAUSD conducted an internal audit based upon visits to 70 school sites located throughout LAUSD and they found that most schools were not in compliance. LAUSD is an example of without minding details of implementation, even the presence of leadership and a stringent law are not enough for a successful policy (Sanchez-Vaznaugh et al 2010).

Lessons Learned from Interviewee's Perspective

The interviewees shared the following lessons they learned during the legislative and implementation stages. The lessons learned have a common theme of needing to work together and bridging the gap between different stakeholders.

- a. Identify benefits that are relevant to the decision makers
- b. Communicate with those who will implement the policy
- c. Educate the target audience

Conclusion

This dissertation took a multi-prong approach to explore the issues surrounding the role of state legislation in preventing obesity. Obesity is a complex problem with many factors of influence and no single intervention, or even one type of intervention, can solve the obesity problem in the US. Looking at the landscape of existing obesity prevention legislation, I find there is legislation addresses obesity prevention through a variety of ways. There is variety in the mechanisms to induce behavioral change, the stakeholder groups to influence, and in the intended outcome of change. I examined the relationship between state-level obesity prevention legislation and state-level obesity prevalence and failed to reject the null hypothesis, which does not lead to accepting the null but implies insufficient evidence to reject it. This finding reflect the complexity of obesity prevention efforts and the limitations of existing data that cannot fully capture the complexity of reality related to obesity policies. Government's role through state legislation is only one approach within a web of many other spheres of influence demonstrated in the socio-ecological model. An exploration of the design and implementation of obesity prevention policy also revealed more layers of complexity in obesity prevention through legislation.

There are several policy issues and study limitations to consider, including: needing a longer time horizon to capture the any health outcome for chronic conditions such as obesity; acknowledge that efforts to reduce obesity will be a 'long battle'; using different metrics that are more immediately relevant to the policies to capture a more realistic measure of success; the importance of implementation and enforcement of the law after it has been passed; and the influence of strong leadership, and a need for buy-in from key stakeholders on the success of the law.

The study findings also have several policy implications.

For a law to successfully proceed through each of the three stages, it needs strong leaders to guide it through each stage. At the formulation stage, a law needs strong leadership that aligns with the cause and motivation of the law. This leader, or group of leaders, should have the political will and perseverance to fight for the bill in the face of strong opposition, and even be willing to promote the bill over multiple legislative sessions if the bill does not successfully pass through the first time. Legislators may need to mobilize grassroots support to apply pressure on other voting legislators.

Public health advocates need to convince key stakeholders using terms and data that are relevant to their responsibilities. Until obesity prevention becomes a priority for other stakeholder groups, this responsibility to bridge the gap will fall on public health advocates. Bridging the gap between stakeholders of different substantive fields can start with one party making the effort to understand who the key stakeholders are, and learning what issues are important to them.

Research in obesity prevention has made significant process, but there is still much more work to do for creating effective interventions and translating research into practice. We may know more than before, but it surely is not enough to create effective and sure ways to solve the problem. There is also much more research to be done about translating results into practice and about implementation. Even at the current level of understanding about translational and implementation research, improvements can be made simply by increasing dissemination of existing research. Media and public awareness played an important role putting pressure on legislators to help SB12 move through the legislative process. CCPHA was able to step into the gap between research (by generating studies on the costs and prevalence of obesity) and policy making (by being the sponsor of a bill).