

# USING EXPERIMENTAL RESEARCH TO IMPROVE DIET QUALITY

Eric Finkelstein, Ph.D., MHA

Professor, Health Services and Systems Research  
Program

Duke-NUS Medical School, Singapore

[eric.finkelstein@duke-nus.edu.sg](mailto:eric.finkelstein@duke-nus.edu.sg)

- Background
- Introduction to NUSMart
- Current NUSMart studies
- Upcoming studies

- Poor diet quality is a well-established risk factor for obesity and chronic disease.
- Policy-makers are searching for strategies to improve diet quality.
- They largely boil down to **pricing, labelling,** and education strategies
- Typically evaluated using two approaches
  - Ex post observational/econometric studies
  - Ex ante experimental studies (RCTs)
    - Each has pros and cons.

# Background

**A few examples of my  
observational Studies**

[Arch Intern Med.](#) 2010 Dec 13

**Impact of targeted beverage taxes on higher- and lower-income households.**

[Finkelstein EA](#)<sup>1</sup>, [Zhen C](#), [Nonnemaker J](#), [Todd JE](#).

**BACKGROUND:** We sought to investigate the differential impact of targeted beverage taxes on higher- and lower-income households.

**METHODS:** This analysis relied on data from the 2006 Nielsen Homescan panel to assess **associations** among beverage prices, energy intake, and weight using multivariate regression models.

**RESULTS:** A 20% and 40% tax on carbonated SSBs only would reduce beverage purchases by a mean (SE) of 4.2 (1.6) and 7.8 (2.8) kcal/d per person, respectively. Extending the tax to all SSBs generates mean (SE) reductions of 7.0 (1.9) and 12.4 (3.4) kcal/d per person, respectively. Estimated mean (SE) weight losses resulting from a 20% and 40% tax on all SSBs are 0.32 (0.09) and 0.59 (0.16) kg/y per person, respectively.

**CONCLUSIONS:** Large taxes on SSBs have the potential to positively influence weight outcomes, especially for middle-income households.

- Limited to assessing associations so had to temper conclusions

[J Health Econ.](#) 2013 Jan;32(1):219-39

**Implications of a sugar-sweetened beverage (SSB) tax when substitutions to non-beverage items are considered.**

[Finkelstein EA](#)<sup>1</sup>, [Zhen C](#), [Bilger M](#), [Nonnemaker J](#), [Farooqui AM](#), [Todd JE](#).

Using the 2006 Homescan pane and an instrumental variables approach, we estimate the changes in energy, fat and sodium purchases resulting from a tax that increases the price of sugar-sweetened beverages (SSBs) by 20% and the effect of such a tax on body weight. In addition to substitutions that may arise with other beverages, we account for substitutions between SSBs and 12 major food categories. **Our main findings are that the tax would result in a decrease in store-bought energy of 24.3kcal per day per person, which would translate into an average weight loss of 1.6 pounds during the first year and a cumulated weight loss of 2.9 pounds in the long run.** We do not find evidence of substitution to sugary foods and show that complementary foods could contribute to decreasing energy purchases. Despite their significantly lower price elasticity, the tax has a similar effect on calories for the largest purchasers of SSBs.

- Better econometrics (IV) but still open to criticisms as real price variation in the data was limited

[Am J Prev Med.](#) 2011 Feb;40(2)

**Mandatory menu labeling in one fast-food chain in King County, Wash.**

[Finkelstein EA](#)<sup>1</sup>, [Strombotne KL](#), [Chan NL](#), [Krieger J](#).

**BACKGROUND:** King County, Washington, enforced a mandatory menu-labeling regulation requiring all restaurant chains with 15 or more locations to disclose calorie information at the point of purchase beginning in January 2009.

**PURPOSE:** The purpose of this study is to quantify the impact of the King County regulation on transactions and purchasing behavior at one Mexican fast-food chain with locations within and adjacent to King County.

**METHODS:** A difference-in-difference approach was used to compare average calories per transaction between seven King County restaurants and seven control locations. Analyses were conducted in 2010.

**RESULTS:** Trends in transactions and calories per transaction did not vary between control and intervention locations after the law was enacted.

**CONCLUSIONS:** **In this setting, mandatory menu labeling did not promote healthier food-purchasing behavior.**

- Results may be unlikely to generalize



[Am J Clin Nutr.](#) 2018 Apr 1.

**Identifying the effect of shelf nutrition labels on consumer purchases: results of a natural experiment and consumer survey.**

[Finkelstein EA](#)<sup>1</sup>, [Li W](#)<sup>2</sup>, [Melo G](#)<sup>2</sup>, [Strombotne K](#)<sup>3</sup>, [Zhen C](#)<sup>2</sup>.

**OBJECTIVE:** The objective of this study was to explore the impact of the NuVal labels on food-purchasing patterns.

**DESIGN:** In 2014, NuVal updated its nutrient profiling system, which changed the NuVal score on many foods. We took advantage of this "natural experiment" to assess the extent to which a change in the NuVal score influenced purchases of yogurts. We supplemented these data with a survey of consumers in stores using NuVal labels to obtain their experience with the labels and the extent to which they state that the labels influence their purchases.

**RESULTS:** Results suggested that a 1-point increase in the NuVal score is associated with a 0.49% increase in sales. Because only 8% of survey respondents reported using NuVal to influence dairy purchases, the impact of a change in the score among users may be >10 times the average effect.

**CONCLUSION:** Results suggest that front-of-package nutrition labels are likely to influence purchasing patterns.

- Neat identification strategy but a one-off



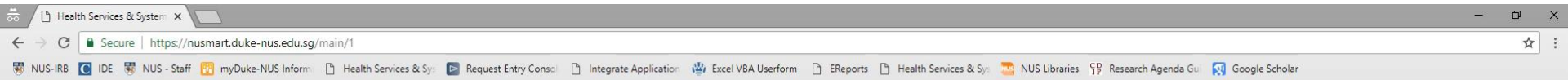
# Summary

- Limitations of secondary data analyses got me interested to do experimental diet-related studies in Singapore
- NUSMart was developed for just this purpose

A fully functional web-based grocery store with over 4,000 F&B products, including NFP info., that allows for manipulations on:

- ✓ Prices
- ✓ Labels
- ✓ Defaults
- ✓ Ordering
- ✓ Peer effects
- ✓ Feedback
- ✓ Others

A partnership with an on-line grocery store (RedMart) that delivers foods bought on NUSMart allows for testing effects on real purchases



## Welcome to NUSMart

NUSMart is an experimental grocery store designed by Duke-NUS Medical School.  
We aim to understand shopping patterns of consumers who shop online.



Best viewed in desktop browsers

- Background
- Introduction to NUSMart
- **NUSMart studies**
- Discussion on future studies that would be cool to do

# Pilot Randomized Trial Testing the Influence of Front-of-Pack Sugar Warning Labels on Food Demand (Pilot-DIET)

## Question

Which negative warning label is best?


## Results

- The proportion of high-in-sugar products was 20% in the control arm.
- The proportion was 2 percentage points lower ( $P = 0.146$ ) for the stop-sign label arm and 4 percent points lower ( $P < 0.05$ ) in the warning label with deterrent text arm.
- We could not reject the hypothesis of equal effectiveness of the two warning labels ( $P = 0.231$ ).

## Conclusions

- Labels have the potential to reduce demand for high in sugar products.
- **An “effective” label may not generate a reduction in sugar or calories purchased, which is the actual goal.**

Ang FLJ, Agarwal S, Finkelstein E.A., (2019) Pilot randomized controlled trial testing the influence of front-of-pack sugar warning labels on food demand. *BMC Public Health* 2019 Feb 7; 19(1):164



YUMMY EARTH SUPER SOUR LOLLIPOP \$5.50

YUMMY EARTH SUPER SOUR LOLLIPOP \$5.50

YUMMY EARTH SUPER SOUR LOLLIPOP \$5.50

ADD TO CART

ADD TO CART

ADD TO CART

Arm 1 Arm 2 Arm 3



**HEALTH WARNING: Consuming products with added sugar(s) contributes to obesity, diabetes, and tooth decay.**

## Question

Which is better, within category or across category food labelling?



## Methods

- RCT following a 3×3 crossover design with 146 participants exposed to three shopping conditions in random order.
- Labelled the 20% of products *within* or *across each food category* (excluding fresh fruits and vegetables which were not included for this study) that are lowest in terms of **calories per average serving size** for products within that category.

## Results

- pending



PACIFIC NATURAL FOODS SOY BARISTA...

\$5.70



MEIJI LOWFAT CHOCOLATE MILK

\$5.85



# Which is better: Nutri-Score or MTL ?




KELLOGG'S RICE KRISPIES CEREAL  
130g

**\$2.70**



COWHEAD BABY OATS INSTANT ORGA...  
500g

**\$3.10**




KELLOGG'S RICE KRISPIES CEREAL  
130g

Each 30g serving contains

kCal	Sugar	Fat	Sat Fat	Sodium
114	3g	0.3g	0.1g	290mg
6%	4%	2%	0%	13%

of an adult's reference intake

**\$2.70**




COWHEAD BABY OATS INSTANT ORGA...  
500g

Each 50g serving contains

kCal	Sugar	Fat	Sat Fat	Sodium
171	3.1g	3.1g	0.7g	2mg
9%	4%	16%	1%	0%

of an adult's reference intake


**\$3.10**



KELLOGG'S RICE KRISPIES CEREAL  
130g

**NUTRI-SCORE**  
**A B C D E**

**\$2.70**



COWHEAD BABY OATS INSTANT ORGA...  
500g

**NUTRI-SCORE**  
**A B C D E**

**\$3.10**

**Arm 1:** Control condition without label

**Arm 2:** MTL

**Arm 3:** Nutri-Score

## Results

- pending

# Encouraging Healthy Nutrition Purchases in an Online Grocery Setting using Experimental Economics: Implicit versus Explicit Taxes (IMPEX)

## Background

- The way taxes are implemented can influence consumer behavior
- Highly salient and clearly delineated taxes provide a signal to consumers that gov. considers the taxed foods to be less healthy.
- **Suggests taxes could be effective even if suppliers absorb 100% of the tax.**



GINA MANGO NECTAR  
240ml

ADD TO CART \$1.50

**Control**



GINA MANGO NECTAR  
240ml

ADD TO CART \$1.80

**Implicit**



GINA MANGO NECTAR  
240ml

**\$1.50**  
*Final Price includes a 20% tax on products high in calories*

ADD TO CART \$1.80

**Explicit**



GINA MANGO NECTAR  
240ml

*Final Price includes a 20% tax on products high in calories*

ADD TO CART \$1.50

**Fake**



# Multiphase Evaluation of Healthier Choice Symbol Plus other Logos (HCS Plus)

## Background

- To date, no published studies have assessed the role of the HCS logos in influencing food choices.

## Arms

- A control arm that mirrors a traditional web-grocery store with no HCS or other FOP labels.
- Similar to Arm 1 except select foods will also be displayed with the new HCS logos, as would currently occur in stores in Singapore.
- Similar to Arm 2 with additional information displaying Physical Activity Equivalents (PAEs) *for all products*.

## Results Forthcoming

- But I am doubtful



Lower in Sugar



Lower in Sodium



Lower in Saturated Fat



Higher in Whole-Grains



Trans Fat Free



Higher in Calcium

~~Healthy?~~

Healthier



# Upcoming Study

# Using the Multiphase Optimization Strategy to Improve Diet Quality (MOSTDQ)

**Investigators:** Eric Finkelstein (PI), Rob van Dam, Bibhas Chakraborty (Co-Is)

## Background

Many governments, including Singapore, are looking for strategies to improve diet quality. These strategies can be grouped into four primary approaches:

1. Price manipulations, including taxes and subsidies,
2. Food labelling, including identifying foods/nutrients to consume (positively-framed labels) and those to avoid (negatively-framed labels),
3. Targeted messaging aimed to improve diet quality, including positively-framed messages and negatively-framed messages, and
4. Behavioral nudges, including changing the ordering of foods, the use of defaults to promote healthier choices, and through messaging aimed to influence social norms.

***No studies have addressed how different interventions can and should be combined in efforts to cost effectively improve diet quality.***

## Intervention Components to be analysed:

Intervention Component	Levels to be tested	
Price Manipulations	No price manipulation	20% tax of the 20% of products highest in calories per serving within specific product categories
Food labelling	Positive labelling	Negative labelling
Positively-framed messages (gain-framing)	No message	<a href="#">"My Healthy Plate" video</a>
Negatively-framed messages (loss-framing)	No message	<a href="#">Agarra Dato Come Sano "Hamburguesa" video</a>
Ordering	No ordering	Ordering foods within categories with HCS appearing first, then no label, then negative label products
"Default" options	No default	Default baskets to reflect My Healthy plate & HCS programmes: 50% Fruits & Veg, 25% whole grains, 25% meats/proteins
Influencing Social Norms via Normative Messaging	No normative message	Visual display of calorie per serving in real-time, compared to average shopper

# Concluding Comments

- When it comes to diet quality, need to be sure we are asking the right questions
- Response to labels is not sufficient if diet quality does not improve
- We also need to be influencing the right sub-population
- Finding an effective strategy is trickier than it seems
- Evaluation is critical and RCTs can help...
- ...But at some point we need to 'advance' beyond RCTs?

# *Collaborators*

## **Lead Investigator:**

Eric Finkelstein

## **Co-Investigators:**

Rob van Dam

Bibhas Chakraborty

Marcel Bilger

Brett Doble

## **Health Promotion Board:**

Eunice Pang

Terence Ng

## **Research Assistants:**

Robyn Lim Su May

Sagun Agrawal

Naina Verghese

Felicia Ang

Janice Tan

Janessa Tan

Tian Yubing

Keith Tong

Melvin Wong

Kanchi Kalimuthu (programmer)