

ECONOMIC INCENTIVES AND DISINCENTIVES FOR LIFESTYLE MODIFICATION

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Outline

- The rational and perhaps not so rational economic agent?
- Literature Review
- My Prior U.S. Studies
- Our Singapore Research Agenda
- Concluding Comments

The Economic Agent

“Singaporeans are not exercising **enough**, and they are not eating **properly**.” **ST** (8 Nov. 2010, p1-4)

No question that Singaporeans are inactive and do not meet dietary guidelines, but WWAES?

The rational economic agent?

Classical Economic Model

- Individuals maximize the present value of expected future utility subject to constraints
 - Max U (physical activity, diet, ...)
 - But health is only one of many things in the utility function, and may be fairly low down?
 - Individuals tend to place a high value on present consumption over future savings
 - Given possible choices, we choose the options that make us best off (i.e., the ones that give us the most utility)
 - Subject to constraints: time, money, biology
- So are we exercising enough and eating properly?

Classical Economic Model (Cont.)

- Does reality fit the classical economic model?
- What would the model predict if:
 - ▣ Food prices decrease, which they have, and more so for energy dense foods?
 - ▣ Technology that promotes a sedentary lifestyle increases, which it has?
- The model would predict higher rates of unhealthy food consumption, less physical activity, and more obesity and chronic disease
 - ▣ Which fits the data exceedingly well
- Although this may not be the whole story

Non-Utility Maximizing Behavior

- Behavioral economists and others have developed alternative models to explain the rise in obesity and chronic diseases
 - Prospect Theory
 - Bounded Rationality
 - Heuristics
 - Anchoring
 - Irrationality
 - Loss Aversion
 - Regret
 - Myopia/Time inconsistent preferences
- Classical model is a tough sell for food consumption
 - Food marketers are well aware they can manipulate behavior

Eating and Irrationality

- Reasons for non-optimizing behavior with respect to food consumption
 - ▣ Invisible and uncertain costs vs. immediate benefits
 - ▣ Long-run best interest vs. short-term temptation
 - ▣ 'Hard-wired' to overconsume

Non-Utility Maximizing Behavior

- My view:
 - Classical model
 - Explanation for past
 - Roadmap for trend reversal
 - Insights from other models will also be helpful
 - Even if utility maximizing, individuals do not bear the full costs of their decisions
 - Provides a financial motivation to address rising rates of obesity for employers and government
 - Non-optimizing behavior and other potential market failures provide additional motivation

Economic-Based Solutions

- Utility Max Answer:
 - Make it cheaper and easier to engage in healthy behaviors
 - Including thoughtfully designed tax/subsidy policy
 - Use incentives and disincentives to change the costs and benefits of behaviors linked to chronic diseases
- But other interventions may also be effective that would not be if all were utility maximizers
 - Examples:
 - Changing order of food presentation
 - Changing the size of the plates



Incentives

Evidence



- To date, incentives/disincentives have taken the following forms:
 - Incentives for weight loss or activities that promote weight loss,
 - Effects of price changes on food consumption.

Monetary Incentives in Practice

- Evidence that both traditional and behavioral economic incentives are effective, at least in the short run
 - ▣ Positively affect participation and retention in health promotion programs
 - ▣ Health behaviors and health outcomes, including diet, physical activity, and weight, all improved in the short-term
 - Degree of effectiveness varied greatly across studies, as did the magnitude and type of incentives offered
- Linking incentives directly to weight was more effective than linking incentives to participation in diet or physical activity-related programs

Straight Dollars For Pounds - Example

- We used a randomized design to examine the impact of monetary rewards tied directly to the magnitude of weight loss among overweight and obese employees (body mass index [BMI] > 25) in the absence of a structured weight loss program.
 - ▣ Based on traditional utility maximization theory
- The study employed a three-group, randomized design:
 - Group A participants received no cash incentive
 - Group B participants received \$7 for each percentage point of weight lost from baseline (IBW)
 - Group C participants received \$14 for each percentage point of weight lost.

Straight Dollars For Pounds (cont.)

At 3 months:

- Group A (\$0) participants lost an average of 2 pounds (.91 kg)
- Group B (\$7) participants lost an average of 3 pounds (1.36 kg)
- Group C (\$14) participants lost an average of 4.7 lbs (2.13)
 - ▣ Weight loss differences between Group A and Group B were not statistically significant
 - ▣ \$7 per percentage point of weight loss may be too low
- Odds of achieving 5% weight loss were 5.4 times greater for Group C participants than for Group A participants ($p < .05$).
- **Economic incentives of at least \$14 per percentage point of weight loss were enough to generate clinically significant weight loss, at least over a 3-month time period.**

Straight Dollars For Pounds (cont.)

- Another of our studies showed incentives were very effective at increasing short term step activity as measured by a pedometer
- Long-term effects are less compelling
 - ▣ Meta-analysis of 9 published RCTs that used traditional pay for performance incentives for weight loss with a follow-up of at least 1 year were unable to reject the null hypothesis of no effect (Paul-Ebhohimhen and Avenell)

Behavioral Weight Loss Strategies

- Jeffery and colleagues (1970s and 1980s) tested the impact of behavioral economic incentives on weight outcomes :
 - ▣ Individuals assigned to deposit contracts lost significantly more weight than control subjects.
 - ▣ Larger deposit contracts generated greater weight loss although this difference disappeared over time.
 - ▣ Group contracts were associated with more weight loss than individual contracts.
- More recently, Volpp et al. also showed positive short-term effects for deposit contracts and for lotteries
- Long term weight losses were modest in all cases

Summary of Incentives For Weight Loss

- Both traditional and behavioral incentives have a short term positive effect
 - ▣ Consistent with utility max model
- Little evidence that behavioral economic incentives are better
- Neither produce compelling long term results
 - ▣ But that's the rub for nearly all weight loss interventions
- **Research Question: Can we structure an incentive strategy that encourages long term positive behavior changes?**

Food Pricing

Food Tax/Subsidy Policy

- World's First fat tax recently implemented in Denmark
 - ▣ 16 kroner (\$2.87) levied per kilo of saturated fat
- Utility max model and empirical data suggest this and other tax/subsidy policies will change food purchasing patterns
- But effect on health depends on own and cross price elasticities (i.e., substitutions to alternative products)
 - ▣ It is possible some taxes could have perverse effects on both demand and supply side

Effects of Food Taxes (Examples)

Policy	Change in		Source	Notes
	Weight/BMI/Obesity/Deaths			
20% tax on all salty snacks	Weight loss < 0.25 pounds		Kuchler, Abebayehu, and Harris [38]	Simulation based on elasticities
10% tax on fat (dairy products only)	Negligible. Fat consumption falls about 0.67 grams per day = 6 calories per day		Chouinard et al. [40]	Simulation based on elasticities calculated from scanner data
10% tax on food away from home	Weight gain of 0.372 pounds (men) and 0.322 pounds (women)		Schroeter, Lusk, and Tyner [34]	Simulation based on elasticities
10% tax on soft drinks	Weight loss of 0.189 pounds (men) and 0.122 pounds (women)		Schroeter, Lusk, and Tyner [34]	Simulation based on elasticities; diet drinks exempt from tax
Each 1 percentage point increase in tax on soft drinks	0.003 percentage point decrease in body mass index; 0.01 percentage point decrease in obesity and overweight		Fletcher, Frisvold, and Tefft [36]	Regression; tax has statistically significant effect; bigger effects for low-income persons

- When statistically significant effects were found, the effects were generally small (Powell and Chaloupka)

Food Pricing – Our Past Studies

1. Finkelstein E.A., Zhen C., Nonnemaker J.M., Todd J.E. **Impact of Targeted Beverage Taxes on Higher and Lower Income Households.** *Archives of Internal Medicine*, 2010 Dec 13;170(22), 2028-2034.
2. Epstein L.H., Dearing K.K., Roba L.G. & Finkelstein E.A. **The Influence of Taxes and Subsidies on Energy Purchased in an Experimental Purchasing Study.** *Psychological Science*, 2010 Mar 1;21(3), 406-414.



Study 1: Impact of Targeted Beverage Taxes on Higher and Lower Income Households

Study 2: The Impact of Targeted Beverage Taxes on Higher and Lower Income Households

- In US, SSBs account for 7% of all calories consumed
- Average American consumes 50 gallons of SSBs annually
- Real price of SSBs has declined dramatically relative to other food items
- 40 States and DC have levied small taxes on SSBs.
- Many locations have or are considering larger taxes

Two Concerns

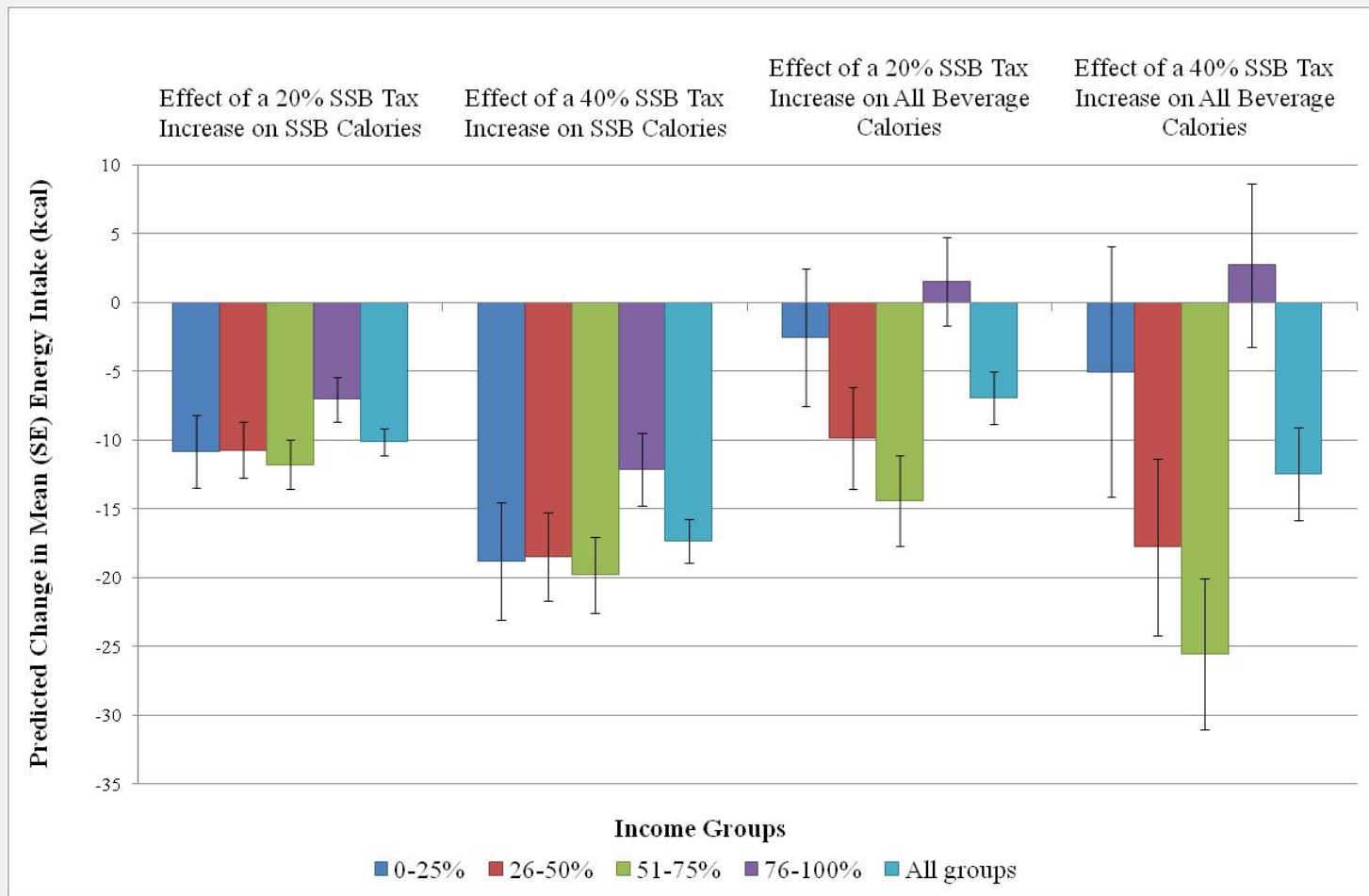
1. Are they effective?
 - ▣ May reduce calories from SSBs, but consumers may switch to other beverages or even foods
 - ▣ Net effect could be less
2. Are they regressive?
 - ▣ Might disproportionately affect lower-income households



Research Questions

- Explore the effects on calories and weight by income strata resulting from a 20% or 40% tax on:
 - Carbonated SSBs only
 - All SSBs
- Estimate the tax revenues generated from a tax that raised market prices by 20% and 40%
- Note – analyses limited only to beverage calories, including carbonated sugar-sweetened beverages (SSBs), fruit drinks, sports/energy drinks, diet carbonated beverages, fruit juices, skim milk and whole milk

Daily Per Capita Effect of 20% or 40% **All** SSB Tax Increases on 1) **All** SSB Calories or 2) All Beverage Calories Purchased



Full results published in Archives of Internal Medicine

Effect on Weight

- An SSB tax that raises prices by 40% results in a weight reduction of at most 0.6 kg per household member per year, nearly all in middle income households.
 - But a 40% tax does not raise prices by 40%.
 - At least part of the decrease may be offset by increases in consumption of other foods.
 - Hold that thought



Tax Implications



- Largest effect of the tax would likely be to **raise revenue**.
 - 20% tax on store-bought SSBs would generate US\$1.5 billion per year
 - 40% tax generates US\$2.52 billion per year
- Even fairly large SSB taxes would have only a **modest effect on food expenditures**.
 - Tax burden is less than US\$30 per household per year on average for a 40% tax.

Ongoing Research: Effect of SSB Taxes: Part II (with same authors)

- Prior study was almost guaranteed to show a reduction in total calories
- Switching occurred from higher calorie per dollar drinks to lower calorie per dollar drinks
- What happens when switching includes products that are higher in calories per dollar than SSBs and viable substitutes?
- Ongoing study testing the effects when expanded to include both food and beverage categories

Take Away Message

- Taxes on a single product line (e.g., SSBs) are unlikely to have a significant effect on calories or weight (supported by several studies)
 - ▣ Too small a percent of total calories consumed
 - ▣ Too easy to substitute to other products
- Suggests tax/subsidy strategy will need to be broad-based to be successful

Study 2 - The Influence of Taxes and Subsidies on Total Energy Purchased

- Research Question – To what extent can modest broad-based taxes and subsidies on less and more healthful foods be used to improve diet quality?
- Key Considerations
 - Substitution effects
 - Could subsidies lead to weight gain?

The Setup:

- Lab experiment in which participants were brought in to ‘shop’ as if it were a real store
- Shoppers faced current prices, subsidies of 12.5% and 25%, and taxes of 12.5% and 25% (but not both together)
 - ▣ Taxes were on high-calorie for nutrient (HCFN) foods
 - ▣ Subsidies on low-calorie for nutrient (LCFN) foods
- Participants were provided with a range of HCFN and LCFN foods and beverages and a fixed budget and asked to purchase food for the family for one week

Experiment: The influence of taxes and subsidies on energy purchased

□ Results

- Subsidy **increased** purchases of both LCFN and HCFN foods
- Tax **reduced** purchases of unhealthy foods and increased purchases of healthy foods, but not enough to generate an increase in calories
 - Results suggest that a 10% tax on HCFN foods would reduce calories by 6.5%, fat by 12.8% and carbohydrates by 6.2%

Take Away Points

- Taxes alone appeared more effective than subsidies alone for improving diet quality (consistent with a few other studies)
- Subsidy resulted in an *increase* in calories, carbohydrates, protein and fat purchased
- Tax resulted in a *decrease* in energy, fat and carbohydrates purchased
- But is this the best tax/subsidy strategy?
 - I doubt it
 - We are currently testing several others, including one based on overall nutritional quality of the foods
 - Have plans to continue this research in Singapore

Singapore Research Agenda (funded projects)

Singapore Research Agenda (Funded Projects)

- An Exploratory Randomized Controlled Trial of a Novel Family-Based Intervention (FIT) to increase Outdoor Time for the Prevention of Myopia and Increase Physical Activity among Singaporean Youth (Funded by NMRC)
- A Blueprint for Identifying Successful Walking Program Targeting Singaporeans Age 50+(Funded by NUS-VISA)
- A Randomized Incentive-Based Weight Loss Trial in Singapore (Funded by GAI-NIHA)
- A Randomized Trial of Economic Incentives to Promote Walking Among Full Time Employees (Funded by MOH)

AN EXPLORATORY RANDOMIZED CONTROLLED TRIAL OF A NOVEL FAMILY-BASED INTERVENTION TO INCREASE OUTDOOR TIME FOR THE PREVENTION OF MYOPIA AND INCREASE PHYSICAL ACTIVITY AMONG SINGAPORE YOUTH

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Motivation

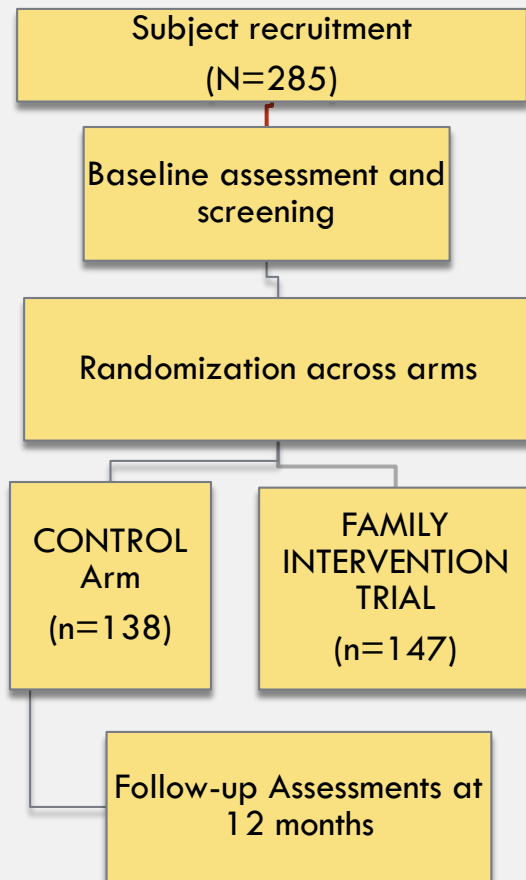
- Myopia and physical inactivity are huge public health problems in Singapore and worldwide
- Studies have shown that successful efforts to increase outdoor time among youth could improve myopia outcomes.
- **The research question:** *Can we develop a strategy to increase outdoor physical activity among Singapore youth?*

Strategy and Research Design

- **Strategy:** Combine incentives for walking (as measured via pedometers) with structured outdoor programs
 - ▣ Incentive – \$30 value per month if a child logs 8,000 steps per day on at least half the days of a month
 - ▣ A structured weekend outdoor program organized in conjunction with National Parks
 - Monthly lottery of roughly \$100 eligible to families who attend park visits
- **Research Design - Randomized Controlled Trial (RCT)** with two arms (incentives and control)

Research Design (con't.)

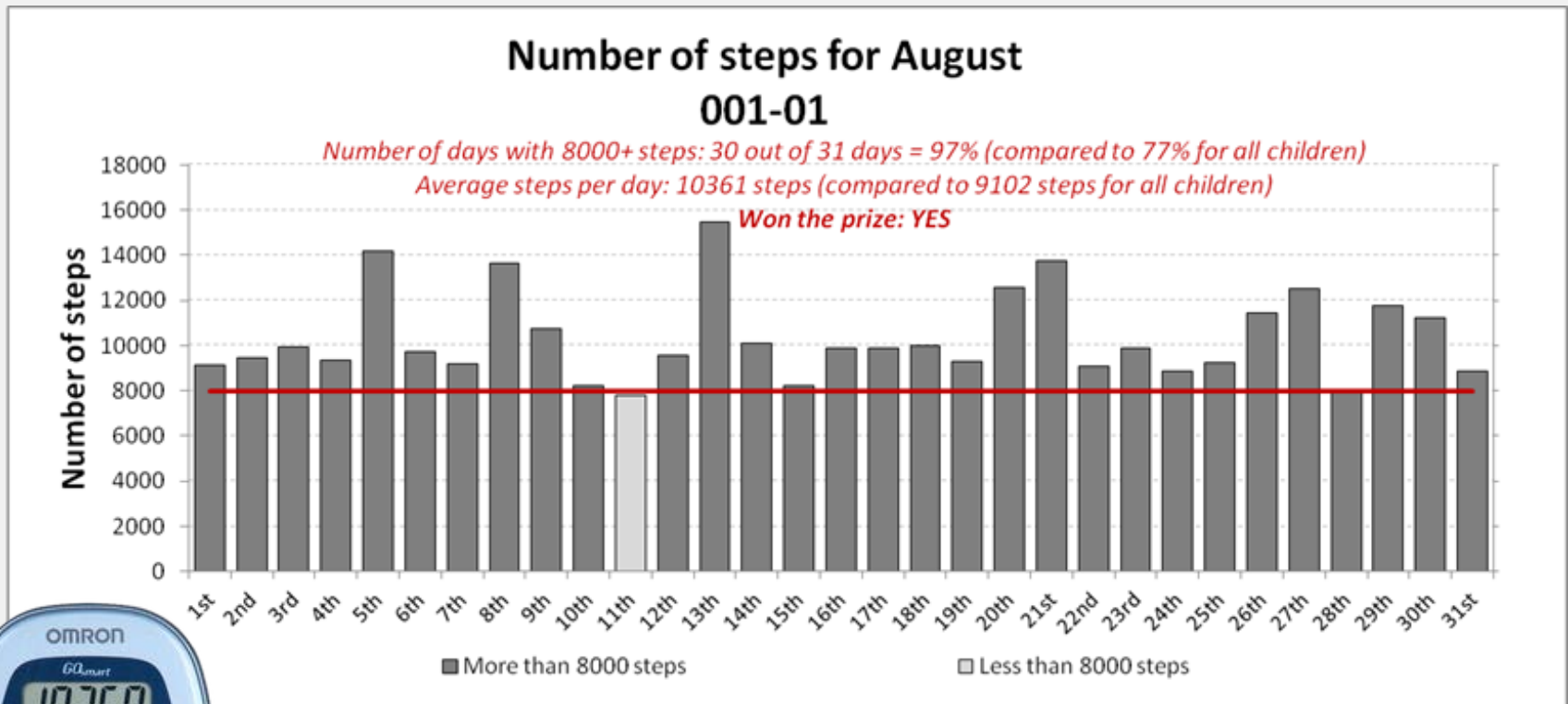
RCT Design



Outcomes

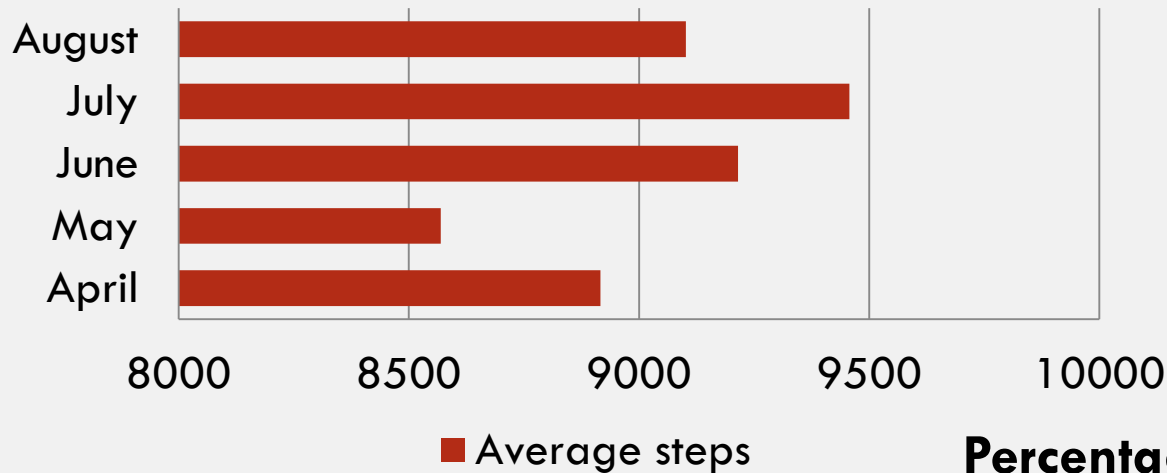
- Primary outcome:
 - 6 min walk test
 - Pedometer steps
 - Time spent outdoors and on physical activity
- Key Secondary outcomes:
 - BMI of family members
 - Assessment of refraction of child
 - Intervention costs and who pays
- Hypothesis is that intervention program will increase step activity and outdoor time

FIT Study results

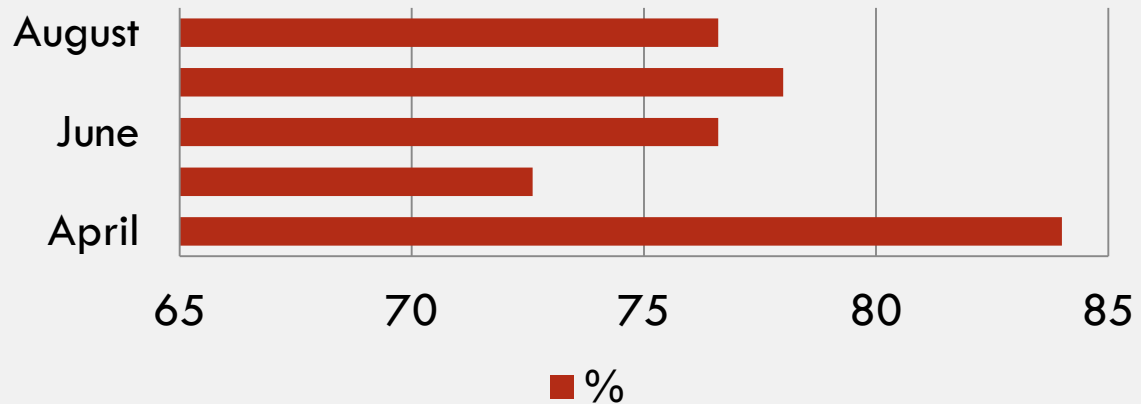


FIT Study Preliminary Results

Average steps



Percentage of children who won award



Status Update

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- Follow-up assessments to be in February, 2012

A BLUEPRINT FOR IDENTIFYING A SUCCESSFUL WALKING PROGRAM TARGETING SINGAPOREANS AGE 50+

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Motivation

- Majority of Singaporean adults do not meet public health recommendations for physical activity
- Older adults age 50+ are of particular interest. Compared to the general population:
 - Higher proportion are inactive or engage in limited physical activity (60+%)
 - Higher prevalence of chronic disease
 - Have significantly higher medical costs
 - May avoid disability through physical activity
 - Retired do not benefit from workplace health promotion
- Overwhelming evidence that many age-related diseases can be prevented through sustained increases in physical activity

Research Design

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- 2 year research study:
 - ▣ Year 1: Focus groups, Stated preference conjoint survey
 - ▣ Year 2: Pilot testing through randomized controlled trial
- Special emphasis on the role of modest financial incentives in influencing participation rates
 - ▣ 4 types of financial incentives: Cash, Medisave dollars, Sporting vouchers and Supermarket vouchers
 - ▣ Hypothesize that participants will value cash above other forms, but by how much
 - ▣ Goal of survey is to identify a cost-effective strategy to increase program uptake, which will be tested in Year 2

Stated Preference Survey:

What is Conjoint Analysis?

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- Quantitative method that is a form of stated preference (SP) research
- First developed in marketing, environmental economics (80s)
- More recently used in public health and health care:
 - ▣ Diabetes prevention program (NCCDPHP)
 - ▣ Newborn screening (NCBDDD)
 - ▣ Vaccination for HPV (NCIRD)
 - ▣ Pharmaceuticals, etc.

What is Conjoint Analysis? (cont.)

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- Method centers around choices and tradeoffs
 - ▣ Which do you prefer: A or B?
 - ▣ Realistic, in theory—we make tradeoffs continually every day
- Tends to be very good at unpacking preferences of what is important to respondents
 - ▣ What matters and how much?
 - ▣ Not as good as predicting uptake (buy/enroll)
- Useful when we seek data on scenarios or choices that
 - ▣ Do not yet exist (potential walking programs)
 - ▣ For which there are no alternatives (1 vaccine)
 - ▣ Cannot directly be purchased in the marketplace (clean air)

Example Conjoint Question 1

(Modified from VISA Grant Focusing on Older Adults)

Which program do you prefer?

Features	Program A	Program B
Average number of sessions required per week (over 6 months)	2	3
Travel time (round trip)	45 minutes	30 minutes
Travel cost (round trip)	S\$5	S\$5
Incentive payment (at 6 months)	S\$450	S\$300
Type of incentive	Cash payment	Credit into your Medisave account
One time Enrollment fee	S\$50	S\$20
Which program do you prefer? (Please check <u>one</u> box.)		

How likely is it that you would join your preferred program if it were offered to you?

Example Conjoint Question 2

Which program do you prefer?

Features	Program A	Program B
Average number of sessions required per week (over 6 months)	2	1
Travel time (round trip)	30 minutes	45 minutes
Travel cost (round trip)	S\$2	None
Incentive payment (at 6 months)	S\$450	S\$300
Type of incentive	Supermarket voucher	Cash payment
One time Enrollment fee	S\$50	None
Which program do you prefer? (Please check <u>one</u> box.)		

How likely is it that you would join your preferred program if it were offered to you?

Status Update

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- Results allow for understanding tradeoffs between attribute levels (such as the value of a cash \$ vs. a Medisave \$) and for identifying the program with the maximum uptake
- Survey is being fielded between Oct. and Dec. 2011
- Pilot study to begin in the spring of 2012

A RANDOMIZED INCENTIVE- BASED WEIGHT LOSS TRIAL IN SINGAPORE

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Motivation

- Obesity is increasingly prevalent and costly in Asia
- Existing weight loss and diet/exercise programs have universally shown limited reach, high attrition, and only short term effectiveness
- **The research question:** *Can we develop a program that addresses these shortcomings and that is within the range of what employers, insurers and governments might would be willing to endorse?*
- **Strategy:** Incorporate economic incentives into existing evidence based weight loss programs to increase their reach and effectiveness

Research Design

- Use a Randomized Controlled Trial (RCT) to test the extent to which traditional or behavioral economic incentives, when combined with an existing evidence-based weight loss program, improve weight loss and weight loss maintenance.
- The program is designed so that:
 - ▣ It is grounded in economic theory
 - ▣ It appeals to potential participants
 - ▣ It appeals to potential funders
 - ▣ It has a strong chance of being effective and cost-effective
 - ▣ It is easily adaptable to other behaviors (e.g., physical activity) and other settings (e.g., worksites, communities,...)

Research Design (cont.)

- Randomize overweight participants into one of 2 Arms
- All participants receive a 14 week intensive weight loss program adapted from the Diabetes Prevention Program for use in Singapore
- Those randomized to Arm 2 receive traditional or behavioral economic incentives for meeting weight loss and step goals
 - ▣ Behavioral incentive options involves receiving a lottery ticket of the same expected value
 - ▣ Theory says lotteries may work better
- All participants pay a fee to access the program such that 3rd party cost sharing is minimized (but not zero)
 - ▣ Provides 'skin in the game'

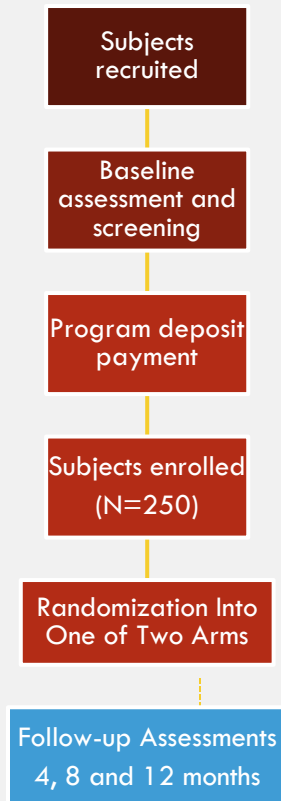
Research Design: Incentive Payouts

Assessment	Timing	Amount
Weekly weight-loss goal (1kg)	Weeks 1, 2, 3, 4 Months 3, 4, 5, 6, 7, 8	\$20 sub-total: \$200
Monthly pedometer goals (10k steps on 20 days/mo)	Months 1-8	\$20 sub-total: \$160
4-mo weight loss goal (5% WL)	Month 4	\$100
8-mo weight loss goal (8% WL)	Month 8	\$100
		Total: \$560

- Participant pay-in:
 - \$235 for Program
 - \$165 for access to the Incentive programs
- Maximum Incentive payout:
 - \$560 per participant.
- Behavioral incentive payouts replace *Amount* with a lottery ticket with a 10% chance of winning 10x the amount and a 90% chance of winning \$0.

Research Design (cont.)

RCT Design



Outcomes

- Primary outcome:
 - weight loss at 12-months
- Key Secondary outcomes:
 - weight loss at 4- and 8-months
 - Intervention costs and who pays
- ▣ Hypothesis is that incentive program will increase weight loss at all time points through month 12 and be good value for money (cost – effective) to funders

Status Update

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- Awaiting IRB approval to begin recruitment

A RANDOMIZED TRIAL OF ECONOMIC INCENTIVES TO PROMOTE WALKING AMONG FULL TIME EMPLOYEES

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Motivation

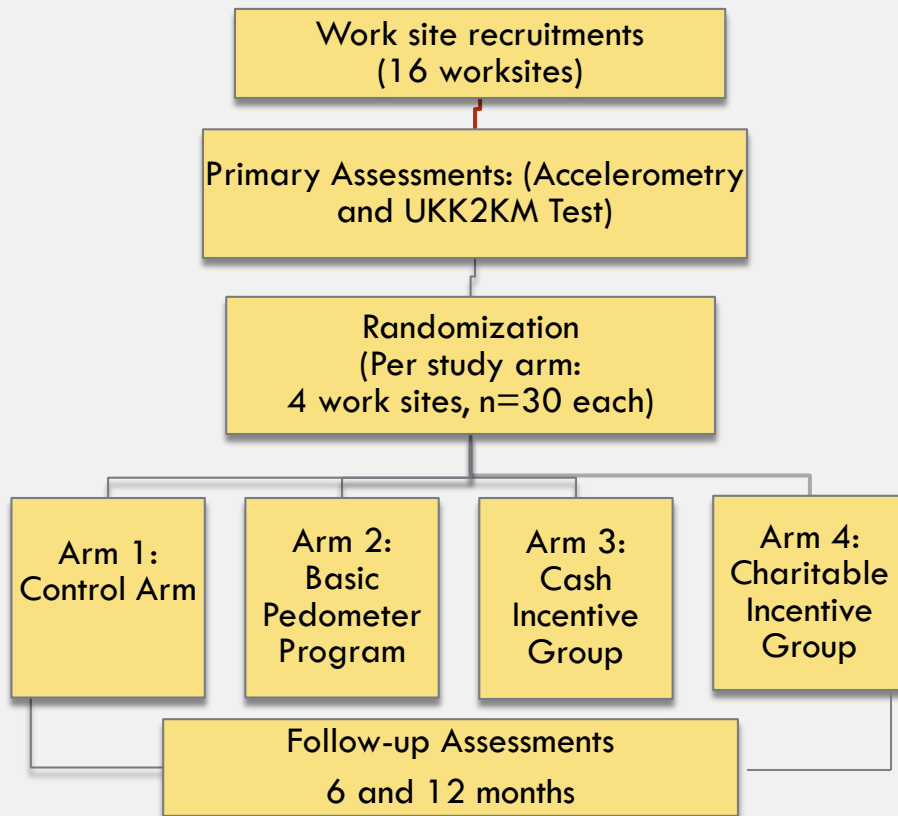
- Focus on worksites:
 - National Health Survey 2010 reveals a large decrease in physical activity levels among employees, especially among those above age 35
 - MOM data reveal that 77% of Singaporeans aged 25-64 participate in the work force in some way;
 - Worksites are a natural and effective setting in which to promote the health and well-being of both employees and management.
 - There are health and financial benefits from implementing effective worksite programs

Motivation

- *The research question: Can we develop a worksite program that is 1) effective, 2) has broad appeal among employees, and 3) is within the range of what employers, insurers and/or governments might would be willing to pay?*
- The strategy:
 - Focus on walking/jogging and build the intervention around evidence-based programs that include pedometers, goal setting, activity logs and timely feedback.
 - Test direct cash incentives against incentives dedicated to a charity of the participant's choosing

Research Design

RCT Design: 6 Month Program with Assessments at 6 and 12 months



Outcomes

- **Primary outcome:**
 - MVPA (Moderate to Vigorous Physical Activity) bouts at 6 and 12 months via accelerometry
 - UKK2KM Test Results
- **Key Secondary outcomes:**
 - Cardiovascular fitness: VO_{2Max}
 - Self-reported PA : CHAMPS questionnaire
 - Health and Health-Related Quality of Life: SF36
 - Others tbd
- **Hypothesis:**

MVPA bouts and fitness scores will be lowest in the control group, followed by group with basic pedometer program and will be highest in the incentive arms.

Research Design: Payouts

Assessment	Timing	Amount
Baseline and follow-ups	Month 1, 6 and 12	\$15, \$25, \$25 Sub-total: <u>\$65</u>
Monthly pedometer goals (10k steps on 20 days/month)	Weekly	\$0 for clocking < 60 minutes for aerobic activity a week \$15 for clocking between 60 and 150 aerobic minutes \$30 for >150 aerobic minutes during the week Sub-total: <u>\$780</u>
		Total: <u>\$845</u>

- Maximum incentive payout is \$780.

Status Update

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- Awaiting IRB approval

Concluding Comments

Concluding Comments

- Rising rates of diabetes and other chronic diseases per se do not suggest individuals are making ‘bad’ choices
 - But that is little consolation to payers
- WWAES
 - Government interventions are justified to address market (or govt.) failures
 - Saving money may be a goal but cost-saving interventions remain elusive
 - Better to look for good value for money
 - Successful interventions will need to make it cheaper and easier to engage in healthy behaviors if they are to be sustained
- More research is needed to find effective, sustainable interventions