Actuarially adjusted OHIP contributions in Ontario based on body mass index and socio-economic status: evaluating the financial feasibility of an alternative “fat tax”

CAHSPR Conference 2013

Matt Machina, PhD Student
IHPME, University of Toronto

PREFACE

- This is a controversial topic
- No examination of policy implications
- No examination of feasibility of implementation
- I am not necessarily advocating for this fat tax, but rather, this is a could-it-work type of thought experiment, and is intended to stimulate thought and discussion

Overweight/Obesity in Canada

- As of 2008, the combined prevalence of overweight and obesity in Canada was 51% when self-reported (62% when measured)[1]
- Overweight and obesity are associated with numerous diseases (cardiovascular diseases, cancers, diabetes, asthma, osteoarthritis, etc.)[1]
- CIHI estimates the costs of obesity rose from $3.9 to $4.6B (CAD) from 2000→'08 based on 8 diseases (15% cost increase)[2]
- Looking at 18 diseases, the estimated cost burden of obesity was estimated at $7.1B (CAD in 2006)[2]

Rising Canadian Healthcare Spending

- Healthcare costs, as a percent of GDP, have been steadily increasing (currently approx. 11 - 12% GDP)[3,4]
- As of 2010, the total Canadian health related expenditures were approximately $191B (CAD)
- Public sector healthcare expenditures account for approx. 70% of expenditures (~8% of GDP) or approximately $121B (CAD) as of 2008

The Ontario Context

- Publically funded health insurance in Ontario (OHIP)
  - Funded through federal transfers and taxes
  - Accounts for approximately 70% of Ontario health expenditures (30% private expenditures)
  - Not risk-rated (individuals "purchase" said insurance only through their tax contributions)

- Ontario's overweight and obesity rates are virtually identical to the Canadian rates

The Carrot or the Stick?

- Carrot:
  - Provide incentives to encourage a desired behaviour
- Stick:
  - Provide disincentives to discourage an undesirable behaviour
- Real-world examples:
  - Ontario Children's Activity Tax Credit (up to $526 eligible expenses → $52.60 extra tax return)
  - 10% tax increase on cigarettes → 4% reduction in purchase of cigarettes/smoking

Fat Taxes on Unhealthy Foods

- Pros:
  - Target selected foods believed to significantly contribute to overweight/obesity (or other health risks and concerns)
  - Tax all purchasers of said foods indiscriminately to raise funds through tax revenues
- Cons:
  - This is a regressive tax, and would likely affect the lowest SES groups most harshly[5,6]
  - Taxes all purchasers of said foods, unnecessarily taxing individuals of “healthy” body weights
  - No guarantee tax revenues spent on healthcare costs or to subsidize “healthy” food options

Fat Taxes – A Real World Case Study

- In 2011, Denmark implemented a Fat Tax on foods/products with > 2.3% saturated fat (eg: pizza, butter, cheese, milk, etc.)
- Results:
  - The Fat Tax raised over $200M in tax revenue
  - Increased local companies' admin costs
  - Danish citizens increased their out of country shopping (decreasing local sales, risking local jobs)
  - After 1 year, with no change in Danes' eating habits, the tax was abolished

The Question

Is it financially feasible to add a “fat tax” to Ontario Income Taxes to partially offset the added financial burden placed on OHIP by the rising proportion of overweight and obese Ontarians?

The Precedent

- Evaluate a theoretical “Fat Tax” on annual Ontario income taxes
- Similar to an existing policy in Japan (implemented in 2008), though not a tax:
  - Applies to all individuals 40-75 years old
  - Must have waist circumference measured during mandatory annual check-up
  - If waist circumference >33.5 inches for men, or >35.4 inches for women, that individual receives compulsory diet advice & follow-up visits for 3-6 months
- Of Note: Japan’s prevalence of obesity: 3%

Methodology

- Model current financial burden of overweight and obesity in Ontario, and forecast results for the next 5 years
- Use census, NPHS, CCHS, CHMS, other data to model population size, disease burden, SES, etc.
- Data will be drawn from as far back as the 1971 census and 1978 Canada Health Survey to determine population & obesity trends

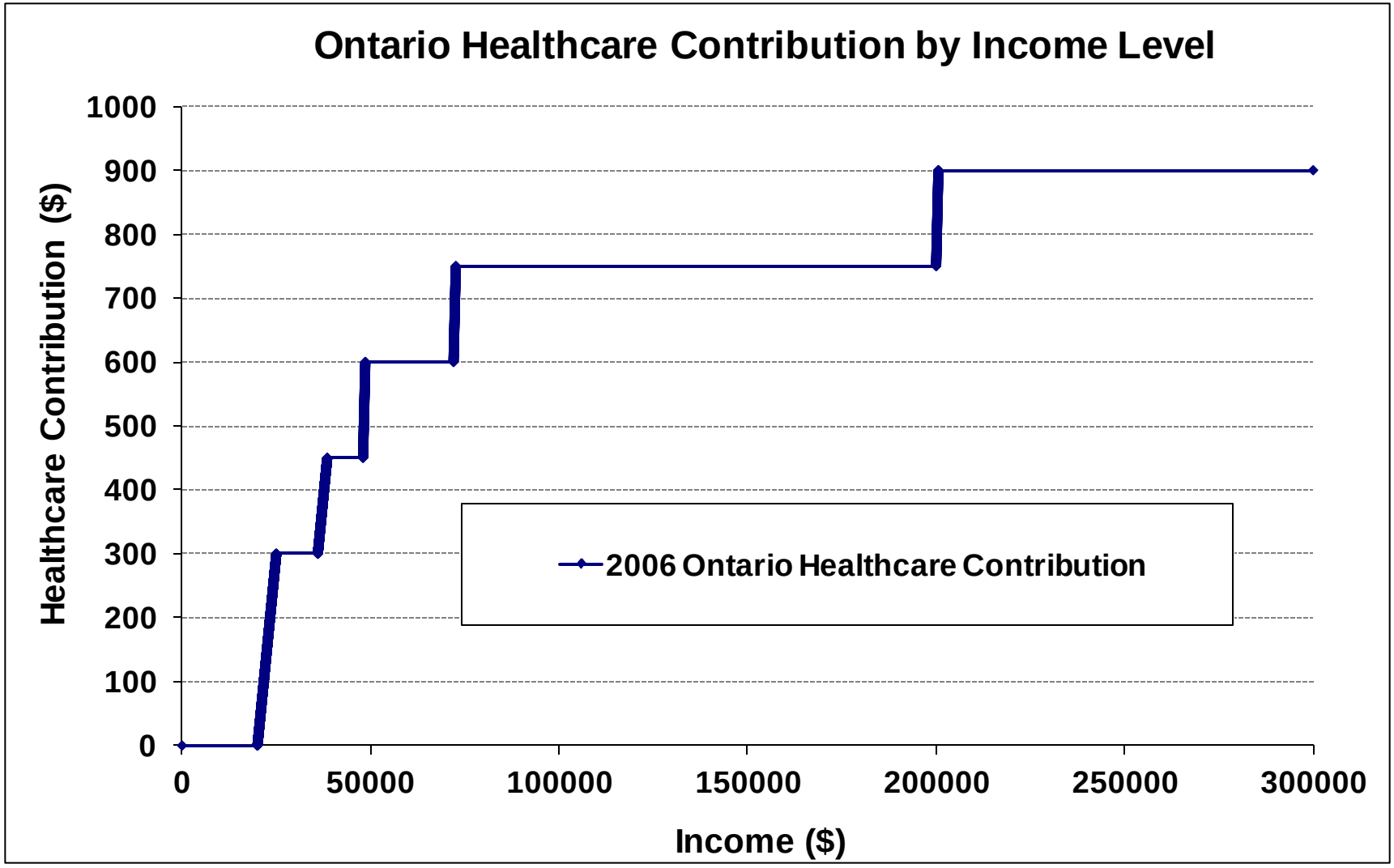
Methodology

- Cardiovascular disease (manifesting as myocardial infarcts) was used to model the disease/cost burden among adults (18+)
- Clinically accepted BMI ranges of 25-29.9 for overweight and ≥30 for obese were used (healthy, or nominal risk, BMI was considered to be between 22.5 and 24.9, consistent with literature[7], for any data extracted from studies)

Population Size

- Obtained from census
- Combined with Ontario Ministry of Finance population growth projections
- Currently, Ontario population is approximately 13.5M
- Expected to grow at a rate of 1.2% per year
- By 2018, Ontario population expected to be 14.5M

Income Distribution & Taxation



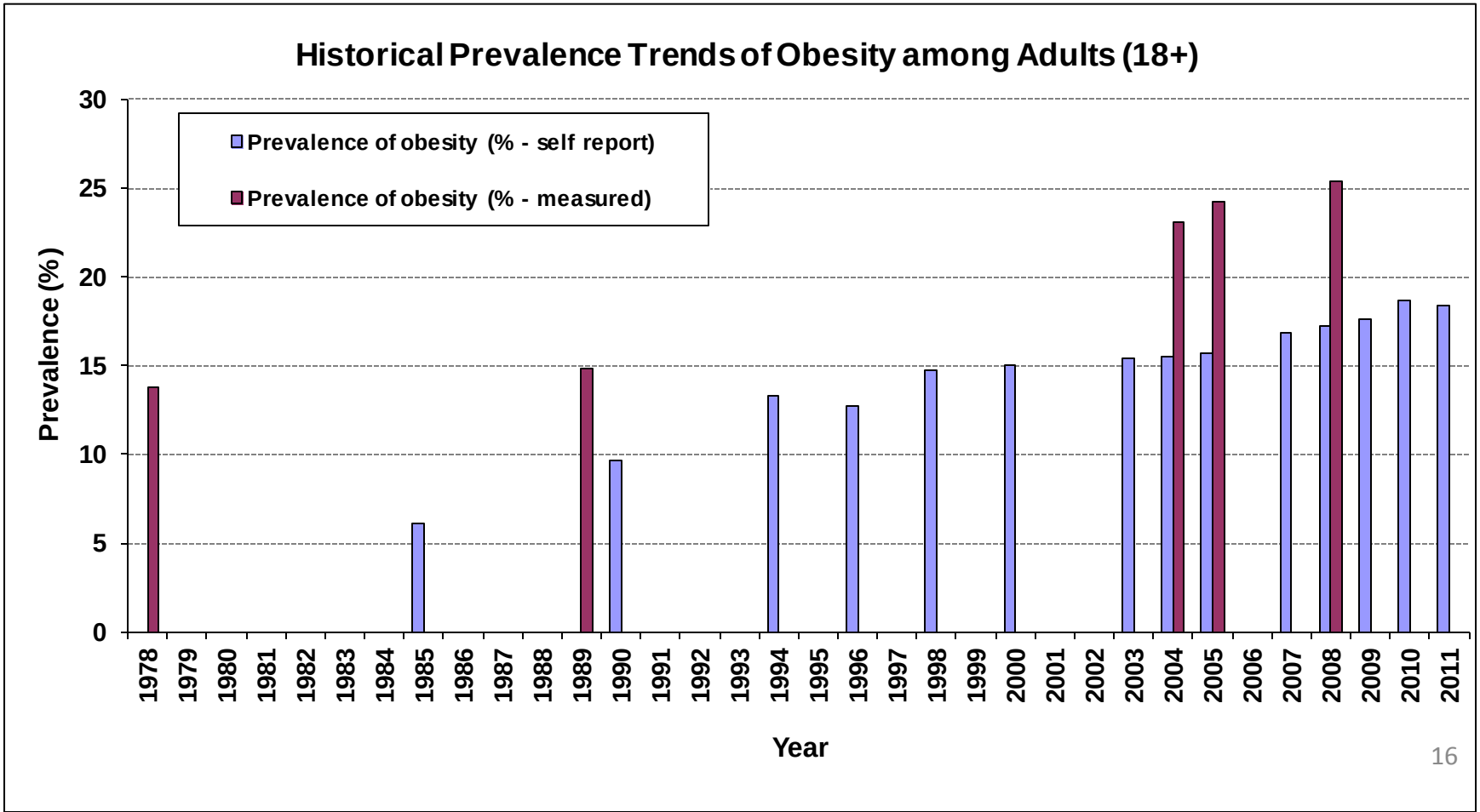
Income Distribution & Taxation

- Simplified income ranges and healthcare contributions according to the table below:

Simplified Income Range	Simplified Healthcare Contribution	HC Contribution as % of Income Range (upper)	Percent of Ontario Population in Income Range (from Census)
$0 - $25,000	$0	0.0%	11
$25,000 - $36,000	$300	0.8%	7
$36,000 - $48,000	$450	0.9%	13
$48,000 - $72,000	$600	0.8%	20
$72,000 - $200,000	$750	0.4%	44
$200,000 + ($300,000)	$900	0.3%	5

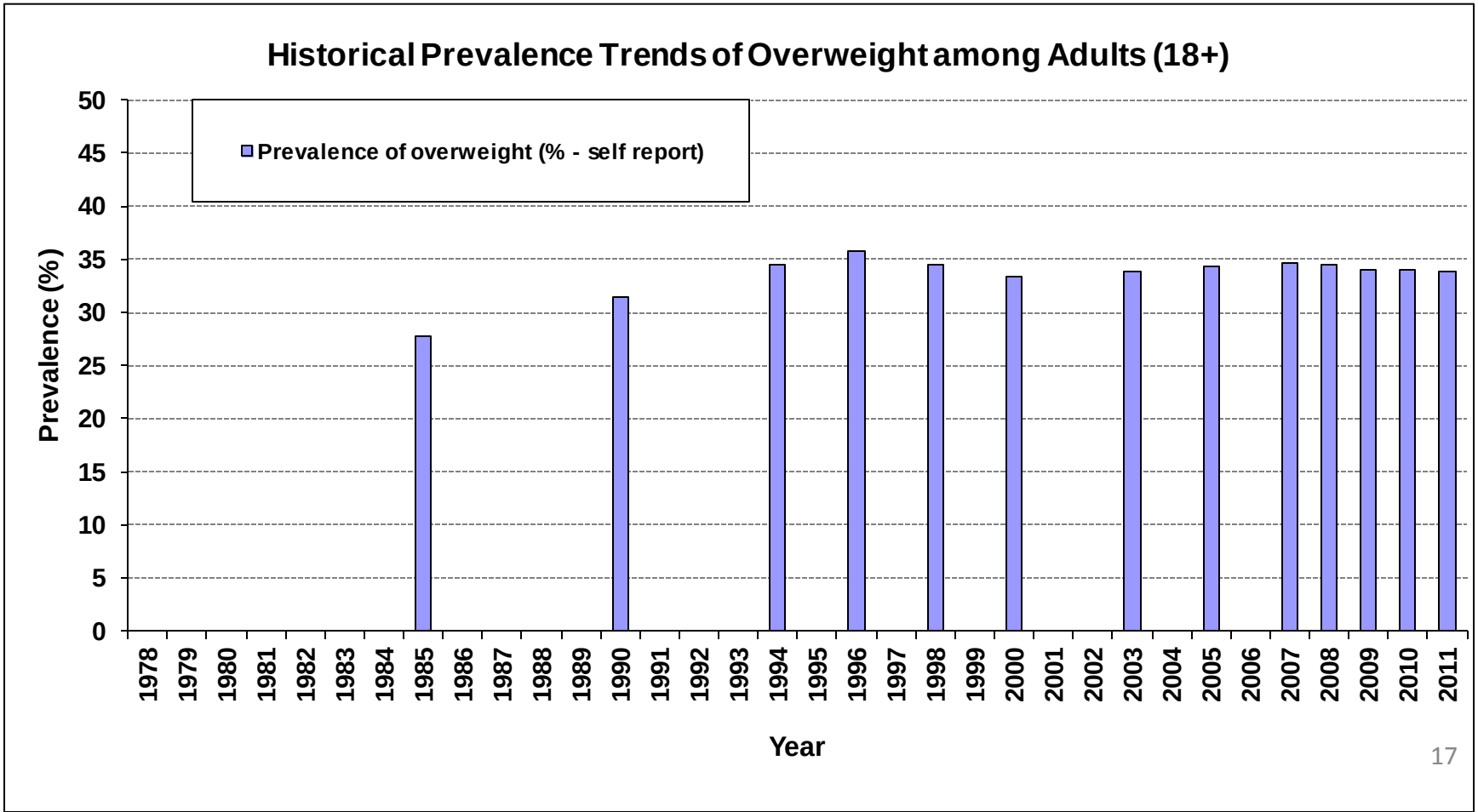
Prevalence of Obesity

- Systematic difference between self-report and measured obesity prevalence of approx. 8%



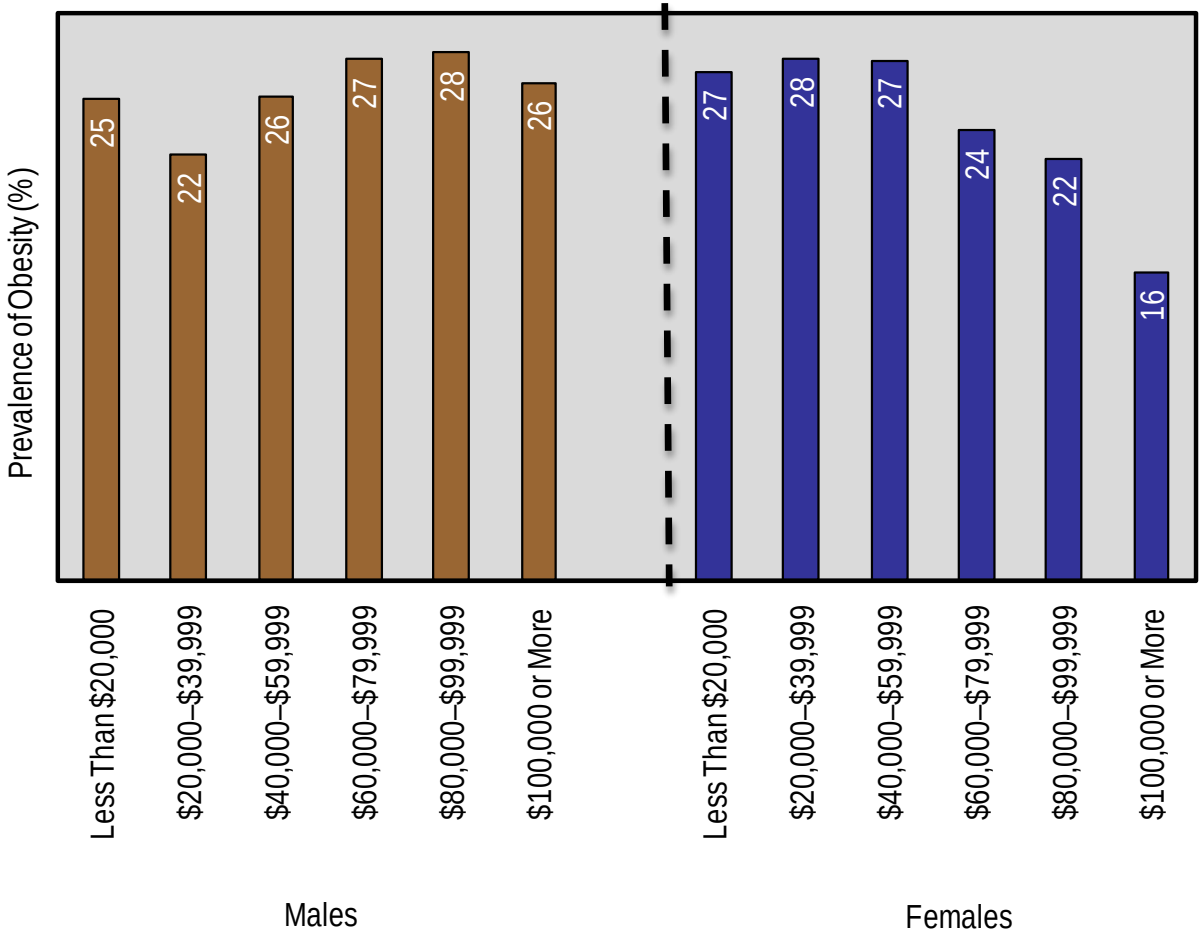
Prevalence of Overweight

- Limited measured prevalence of overweight adults available (one data point in 2008 at 36.7% - not shown)



Canadian BMI Distribution by SES

- For males, there may be some influence of SES on obesity, though there is no obvious pattern[2]
- For females, lower income and education levels are risk factors for obesity[2]
- For this study, uniform obesity distribution across all income levels, irrespective of gender, was a simplifying assumption



Disease Burden: Myocardial Infarcts

- Myocardial infarcts (MIs) selected because:
  - Most patients with MIs present to hospital for treatment[8] (unlike diabetes, which may go months, or years, prior to detection/treatment)
  - ICD codes for MIs have high diagnostic accuracy (90-96%)[9]
  - Studies have assessed association of BMI to MIs
  - MIs are expensive to treat, providing an extreme illustration of the cost burden of disease to be distributed among the overweight/obese population of interest

Myocardial Infarcts by the Numbers

- A 2007 meta-analysis[10] showed that individuals with overweight BMI had RR of 1.32 of having CVD event, while obese BMI had RR of 1.81
- A 2009 study[7] found similar results:
  - BMI association with ischemic heart disease (RR of 1.36 and 1.73)
  - Yearly incidence rates of 3.0/1000 person years (py) (basal), compared to 4.1/1000py (overweight) and 5.1/1000py (obese) were also reported
- The "burden" associated with overweight/obesity was the added incidence above basal incidence (1.1/1000py for overweight, and 2.1/1000py for obese, individual)

Myocardial Infarcts Costs

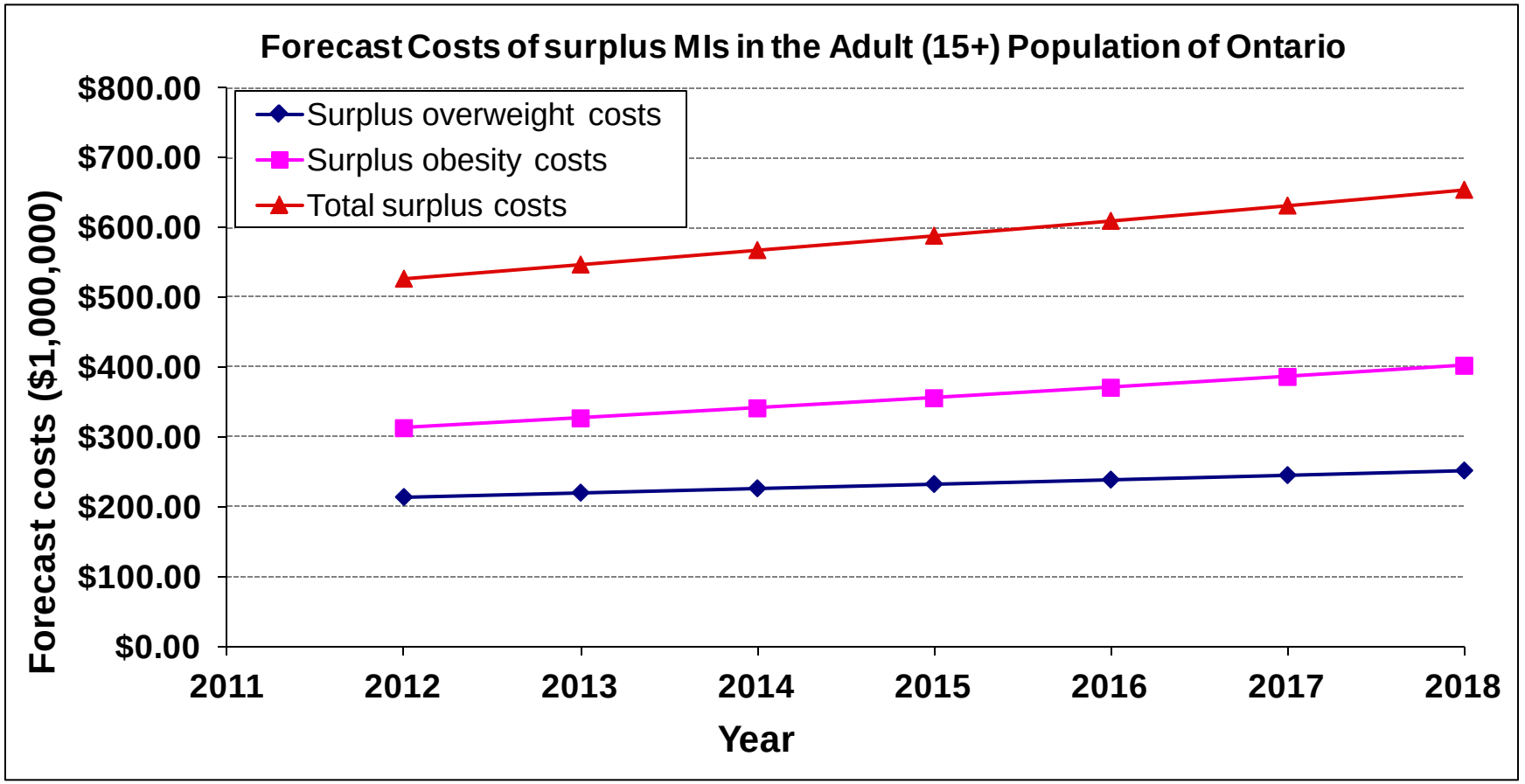
- Two studies evaluated the 1-year cost of treating an MI
  - In 1995[12] USD, 1-year cost reported at $24,782
  - In 2002[11] USD, 1-year cost reported as $23,177
- These costs were converted to CAD, and brought to present value using historical CPI data
- Resulting in a first-year cost of treating an MI of $45, 845 in CAD (2012)

The Model – Forecasting Costs

- The model calculates the surplus MI costs:
  - Proportion of overweight/obese population
  - Multiplied by the surplus incidence rates (1.1/1000py and 2.1/1000py)
  - Multiplied by yearly MI treatment costs (inflated each year)

Forecast Surplus MI costs

In 2012, surplus MI costs attributable to the obese population are just over $300M and those attributable to the overweight population are just over $200M



The Model – Calculating "Fat Taxes"

- The surplus MI costs were then distributed:
  - By income, and
  - By BMI (overweight or obese)
  - Among the proportion of overweight/obese individuals
  - Model includes a weighting factor to offset the regressive nature of the healthcare contribution values

Obesity Results

Obese Adults		Additional "Fat Tax" by simplified income ranges					
Weighting factors	**Fat Tax constant**	**$0 - $25,000**	**$25,000 - $36,000**	**$36,000 - $48,000**	**$48,000 - $72,000**	**$72,000 - $200,000**	**$200,000 +**
HC Contribution		**0**	**300**	**450**	**600**	**750**	**900**
0, 1, 1, 1, 1, 1	0.17761	$0.00	$53.28	$79.92	$106.56	$133.20	$159.85
0, 1, 1, 2, 2, 3	0.09155	$0.00	$27.47	$41.20	$109.86	$137.33	$247.19
0, 1, 2, 3, 4, 5	0.04994	$0.00	$14.98	$44.95	$89.90	$149.83	$224.75
0, 2, 4, 6, 8, 10	0.02497	$0.00	$14.98	$44.95	$89.90	$149.83	$224.75

Overweight Results

Overweight Adults		Additional "Fat Tax" by simplified income ranges					
Weighting factors	**Fat Tax constant**	**$0 - $25,000**	**$25,000 - $36,000**	**$36,000 - $48,000**	**$48,000 - $72,000**	**$72,000 - $200,000**	**$200,000 +**
HC Contribution		**0**	**300**	**450**	**600**	**750**	**900**
0, 1, 1, 1, 1, 1	0.09009	$0.00	$27.03	$40.54	$54.06	$67.57	$81.08
0, 1, 1, 2, 2, 3	0.04622	$0.00	$13.87	$20.80	$55.47	$69.33	$124.80
0, 1, 2, 3, 4, 5	0.02516	$0.00	$7.55	$22.64	$45.28	$75.47	$113.21
0, 2, 4, 6, 8, 10	0.01263	$0.00	$7.58	$22.73	$45.45	$75.76	$113.64

Conclusion

- Based on the results to date, and the working definition of “financially feasible”, it appears that a “fat tax”, based on BMI and SES, could be incorporated into the Ontario Provincial Taxes to offset some of the economic burden associated with the rising prevalence of overweight/obesity

Limitations

- This study does not discuss policy implications, nor does it discuss feasibility of implementation
- There were limited values of historical BMI data, and its accuracy may limit reliability of results
- BMI is not a perfect indicator of overweight or obese status (eg: elite athletes), but there is less historical data on waist circumference, or hip-to-waist ratio (other measures of obesity)
- Does not account for childhood/youth overweight and obesity

Limitations

- Only one indicator disease/burden (myocardial infarcts) was selected, but to truly evaluate the feasibility, other diseases affected by overweight/obesity should be included in the burden
- Limited years of data for the Ontario Healthcare Contribution values (2004 – present) used as the “feasibility” criteria, and they did not change over time (unable to forecast future changes to these values?)

Possible Future Work/Directions

- Future work on this study:
  - Additional scenario analysis
  - Sensitivity analysis on all key variables (cost, disease prevalence, population growth/distribution, etc…)

- Other possible future studies:
  - Policy analysis/paper examining the potential implications of implementing this type of fat tax
  - A feasibility/logistics study from an operations management perspective

Acknowledgement

Invaluable feedback and suggestions from:

- Dr. Audrey Laporte
- The IHPME Health Economics Seminar Group

Funding support:

- Matthew Machina is supported by a CIHR Frederick Banting and Charles Best Canada Graduate Scholarship – Doctoral Award

References

1. Katzmarzyk PT, Mason C. Prevalence of class I, II and III obesity in Canada. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2006;174(2):156-7.

2. Obesity in Canada. A joint report from the Public Health Agency of Canada and the Canadian Institute for Health Information. 2011.

3. Canadian Institute for Health Information. National Health Expenditure Trends , 1975 to 2010 (Ottawa, Ont.: CIHI, 2010). 2010:172.

4. Canadian Institute for Health Information. Health Care Cost Drivers: The Facts . (Ottawa, Ont.: CIHI, 2011). 2011:48.

5. Laurance J. Time for a fat tax? Lancet. 2009;373(9675):1597.

6. Creighton R. Fat taxes: the newest manifestation of the age-old excise tax. The Journal of legal medicine. 2010;31(1):123-36.

7. Whitlock G, Lewington S, Sherliker P, et al. Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies. Lancet. 2009;373(9669):1083-96

8. Magid DJ, Koepsell TD, Every NR, et al. Absence of association between insurance copayments and delays in seeking emergency care among patients with myocardial infarction. The New England journal of medicine. 1997;336(24):1722-9.

9. Hackam DG, Mamdani M, Li P, Redelmeier D a. Statins and sepsis in patients with cardiovascular disease: a population-based cohort analysis. Lancet. 2006;367(9508):413-8

10. Bogers RP, Bemelmans WJ, Hoogenveen RT, et al. Association of Overweight With Increased Risk of Coronary Heart Disease Partly Independent of Blood Pressure and Cholesterol Levels.

11. Mahoney EM, Jurkovitz CT, Becker ER, et al. Cost and Cost-effectiveness of an Early Invasive vs Conservative Strategy for the Treatment of Unstable Angina and Non-ST-Segment Elevation Myocardial Infarction. Journal of the American Medical Association. 2002;288(15):1851-1858.

12. Mark DB, Hlatky MA, Califf RM, et al. Cost Effectiveness of Thrombolytic Therapy with Tissue Plasminogen Activator as Compared with Steptokinase for Acute Myocardial Infarction. The New England journal of medicine. 1995;332:1418-1424.

Thank you!

The Model

- Understanding the weighting factor:
  - Individual A with income $5000
  - Individual B with income $10,000
  - A surplus tax of $30 to be divided among them
  - Equal weighting: 1, 1 for A, B
    - $30 = $5000(1)(x) + $10,000(1)(x)
    - $30 = $15,000(x) → x = 30/15,000
    - Therefore A pays (5000)(30/15,000) = (1/3)($30) = $10
  - Unequal weighting: 1, 2 for A, B
    - $30 = $5000(1)(x) + $10,000(2)(x)
    - $30 = $25,000(x) → x = 30/25,000
    - Therefore A pays (5000)(30/25,000) = (1/5)($30) = $6

Solving the Model (one example)

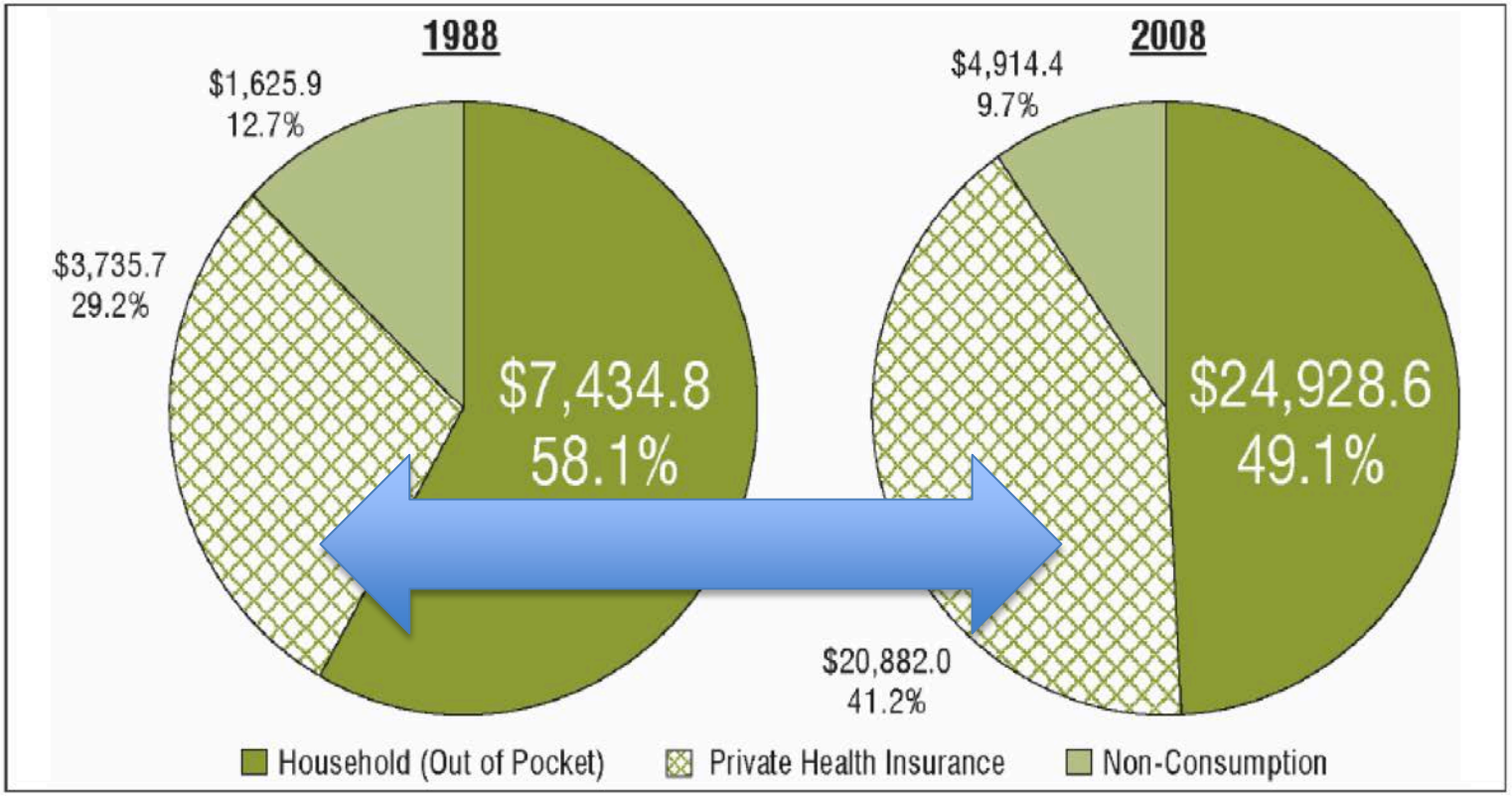
- $312M surplus MI costs attributable to the obese population in 2012
- Distributed among the obese pop in Ontario: 3,062,045
- Using weighting factors of 0, 1, 2, 3, 4, 5
- When solved, the value of x is 0.04994 (irrelevant)
- Yielding "fat taxes" of $0, $14.98, $44.95, $89.90, $149.83, and $224.75 → all "feasible" values

$$
\begin{aligned}
\$312{,}435{,}079.01 = {} & (0.11)*(3{,}062{,}045)*(\$0.00)*(0)*(x) + \\
& (0.07)*(3{,}062{,}045)*(\$300.00)*(1)*(x) + \\
& (0.13)*(3{,}062{,}045)*(\$450.00)*(2)*(x) + \\
& (0.20)*(3{,}062{,}045)*(\$600.00)*(3)*(x) + \\
& (0.44)*(3{,}062{,}045)*(\$750.00)*(4)*(x) + \\
& (0.05)*(3{,}062{,}045)*(\$900.00)*(5)*(x)
\end{aligned}
$$

Background

- Private sector expenditures account for the other 30% of expenditures (~3% of GDP), and as of 2008, this was roughly $51B (CAD)

Figure 9: Distribution of Private-Sector Health Expenditure by Source of Finance, Canada, 1988[v] and 2008 (Millions of Dollars and Percentage Share)



Income Distribution & Taxation