The School Health Action, Planning & Evaluation System (SHAPES)

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Better cancer services every step of the way
Overview

- Background on the current cancer problem in Canada
- Background on the SHAPES data collection system
- Examples of SHAPES research & surveillance activities
- Examples of some research findings
Acknowledgements

- Centre for Behavioural Research and Program Evaluation (CBRPE) of the Canadian Cancer Society (CCS)

- Population Health Research Group, University of Waterloo

- Research collaborators: Dr. Roy Cameron & Dr. Steve Manske
Cancer problem in Canada

- It is estimated that there will be **166,400** new cases of cancer and **73,800** deaths from cancer in Canada in 2006.
  - more new cases than the entire population of PEI
  - more deaths than the populations of Moose Jaw and Prince Albert
Cancer problem in Canada

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  - more new cases than the entire population of PEI
  - more deaths than the populations of Moose Jaw and Prince Albert

<table>
<thead>
<tr>
<th></th>
<th>New Cases</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALL</strong></td>
<td>166,400</td>
<td>73,800</td>
</tr>
<tr>
<td>Lung (men &amp; women)</td>
<td>23,900</td>
<td>20,200</td>
</tr>
<tr>
<td>Breast (women)</td>
<td>22,400</td>
<td>5,400</td>
</tr>
<tr>
<td>Prostate (men)</td>
<td>24,700</td>
<td>4,300</td>
</tr>
<tr>
<td>Colorectal (men &amp; women)</td>
<td>21,500</td>
<td>8,900</td>
</tr>
</tbody>
</table>

CCS, 2008
Increasing cancer burden

Attrition of rise in new cases

Cases (000s)

Year

1971 1984 1997 2010

Risk Behaviour

Population Growth

Age Structure
How expensive is cancer?

- The total cost of cancer in Canada was estimated to be $14.2 billion in 1998.
  - Direct cost of health care services was $2.5 billion
  - Indirect cost due to mortality and lost productivity was $11.7 billion

- Future costs will increase dramatically as a result of the infrastructure demands required for treating cancer (e.g., hospitals, oncologists).
Attribution of rise in new cases

Cases (000s)

Year

1971 1984 1997 2010

170 170 110 140

50 80 50 80 20

$\text{\$\$\$\$\$}$
Conservative estimates suggest....

- Over the next 30 years:
  - the Canadian economy is expected to lose over $540 billion in wage-based productivity due to cancer;
  - The Federal and Provincial governments combined are expected to lose over $248 billion in tax revenues as a result of cancer disability; and,
  - the direct health care costs associated with cancer are expected to exceed $176 billion over the same period.
Major causes of cancer

- Major causes of cancer are:
  1. Smoking
  2. Physical Inactivity
  3. Poor Nutrition

- These three factors account for over 50% of all cancers.

Colditz et al., 1996
Major causes of cancer

- Major causes of cancer are:
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  2. Physical Inactivity
  3. Poor Nutrition

- These three factors account for over 50% of all cancers.

- Conceptually, this means that $\frac{1}{2}$ of all the cancer deaths in Canada are potentially preventable if changes in these risk behaviours were to occur.

- As such, even if only modest population-level improvements in these behaviours were to occur, it could prevent tens of thousands of deaths over the next decade.
The only way to accomplish this goal is to change the risk behaviour profile of the Canadian population.
My attempt to shift the risk profile

- Although individual-based approaches are important, they are likely insufficient for causing the population-level shifts required to dramatically reduce the impending cancer burden.
My attempt to shift the risk profile

- Although individual-based approaches are important, they are likely insufficient for causing the population-level shifts required to dramatically reduce the impending cancer burden.

- The focus of my research is twofold:
  1. understanding the association between environment contexts (both social and physical environments) and cancer risk behaviour; and
  2. developing systems to improve the uptake of evidence-based practices in population-based cancer control prevention programming.
School Health Action, Planning & Evaluation System

- A school-based data collection system designed to inform and guide
  - the development,
  - the evaluation,
  - and targeting

of programs and policies designed to reduce risk behaviours and promote healthy behaviours among youth.
School Health Action, Planning & Evaluation System

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  - the development,
  - the evaluation,
  - and targeting
  of programs and policies designed to reduce risk behaviours and
  promote healthy behaviours among youth.

• Rationale for developing SHAPES
  - facilitate applied research and knowledge exchange within schools
  - minimize burden on school personnel and students yet maximize value to
    schools and stakeholders
  - understand what works, for whom, and in what context.
Conceptual Model

School Health Assessment
Feedback for Planning
“Local” Strategy and Contexts
Evaluation and Adaptation
Action
Underlying Research
Background

- The SHAPES system involves:

1. administration of school-based student questionnaire(s) to assess youth behaviour and correlates of behaviour,

2. school-level administrator surveys to measure the presence and implementation of school policies and programs, and resources related to the behaviour being examined, and,

3. the generation of school-level feedback reports which can be used by schools and local health agencies to plan and evaluate programs and interventions.
School Health Action, Planning & Evaluation System

- Existing SHAPES Modules address:
  - Physical Activity and **Obesity** (*Physical Activity Module*)
  - Eating Behaviour (*Healthy Eating Module*)
  - Tobacco Use (*Tobacco Module*)
  - Mental Fitness (*Scales assessing Needs Satisfaction, Affect, Prosocial Behaviour, Social Responsiveness*)
Student-Level Data

- Research tools have been developed and tested to collect physical activity/obesity and tobacco use data at the **student**-level.
  - For example: Physical Activity Questionnaire
Student-Level Data

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  - For example: Physical Activity Questionnaire

4-Page Questionnaire

Designed to collect data from every student in a school pertaining to:

- physical activity/inactivity patterns,
- height / weight (used to calculate BMI)
- correlates for physical activity,
- enabling factors within the school.

It is machine readable, so data can be scanned directly into a computer.

Also measures smoking behaviour.
School-Level Data

- Research tools have been developed and tested to collect data about school programs, policies and resources related to physical activity and tobacco use at the school-level.

- For example: *School Health Environment Survey (SHES)*
  - 7-page questionnaire
  - Designed to be completed by a school administrator(s).
  - Measures different types of physical activity policies and the different aspects of physical activity programming built into the school curriculum.
  - Also collects data pertaining to the different physical activity resources/equipment that are available within a school.
Knowledge Exchange Tool: **Student-level data**

- Customized school specific feedback reports have been developed to transfer the **student**-level data back to school and public health stakeholders.
Knowledge Exchange Tool: **Student-level data**

- Customized school specific feedback reports have been developed to transfer the **student**-level data back to school and public health stakeholders.

- A computer-generated report provided to school administrators & public health.

- Summarizes school level findings for physical activity.

- Provides evidence-based suggestions for interventions that are designed to increase physical activity levels and decrease sedentary behaviour of **their** student population.

- Facilitate knowledge exchange between the school stakeholders and ‘us’, the researchers.
Knowledge Exchange Tool: School-level data

- Customized school specific feedback reports have been developed to transfer the school-level data back to school stakeholders.
Knowledge Exchange Tool: **School-level data**

- Customized school specific feedback reports have been developed to transfer the **school-level** data back to school stakeholders.
  - A computer-generated report provided to school administrators.
  - Provides schools with feedback on the strengths and weaknesses of their health policies and programs, and facilities and resources based on research evidence.
  - Provides resources to help schools take the next steps in learning how to effectively adopt or revise school health policies and programs to promote PA.
  - Facilitate knowledge exchange between the school stakeholders and ‘us’, the researchers.
Your Physical Activity Capacity Results

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicators</th>
<th>Capacity Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACILITIES</td>
<td>Number of physical education teachers</td>
<td>Excellent</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
<td>B</td>
</tr>
<tr>
<td>PROGRAMS</td>
<td>Number of students participating in physical activity</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Number of students participating in organized sports</td>
<td>B</td>
</tr>
<tr>
<td>EXTRACURRICULAR PHYSICAL ACTIVITY</td>
<td>Number of students participating in extracurricular physical activity</td>
<td>C</td>
</tr>
</tbody>
</table>

Recommendations

1. Facilities
   - Access to community sport and exercise facilities and equipment is limited in participation in physical activity, with a lack of facilities for training in therapeutic movement. It is important to have access to facilities and equipment that encourage physical activity.
   - Activities include: school sport programs, school-based physical education programs, and community sport and exercise facilities.

2. Recommendations
   - Encourage physical education classes and extracurricular physical activity programs.
   - Encourage physical activity programs that include school sport programs and community sport and exercise facilities.
   - Physical activity capacity includes access to facilities and equipment, and participation in physical activity.

3. Physical Activity Capacity
   - Access to community sport and exercise facilities and equipment.
   - Participation in school sport programs and extracurricular physical activity programs.

4. Physical Activity Results
   - Number of students participating in physical activity.
   - Number of students participating in organized sports.
   - Number of students participating in extracurricular physical activity.
Research Activities

- Demand for SHAPES is high.
- Since 2000, SHAPES has been completed by over 550,000 students in more than 2,000 schools in Canada.
- These projects have been initiated by:
  1. Researchers,
  2. Decision makers, and
  3. School stakeholders.
Research Activities *(highlights)*

**SHAPES-Ontario**

- In 2006, the Ontario Ministry of Health Promotion used SHAPES to inform planning activities associated with the Healthy Eating and Active Living (HEAL) Strategy and the Ontario Tobacco Strategy (OTS).

- The Physical Activity and Tobacco Modules were completed by over 69,000 students in grades 9 to 12 attending 81 secondary schools in the Province of Ontario.

- Currently working with Dr. Susan Elliott to incorporate built environment data for the 81 schools.
Research Activities (*highlights*)

**PLAY-Ontario**

- In 2008, the Ontario Heart & Stroke Foundation used SHAPES to inform planning activities associated with their provincial strategy around physical activity and healthy weights (Targeting Obesity).

- Physical Activity Module was completed by:
  - 2,187 students in grades 1 to 4
  - 2,601 students in grades 5 to 8
- attending 30 elementary schools in the Province of Ontario.

- Objectively measured height, weight and waist circumference.
Research Activities *(highlights)*

**SHAPES-New Brunswick**

- In 2007, Health Canada and the New Brunswick Department of Education and Department of Wellness, Culture and Sport used SHAPES to inform their planning activities associated with the New Brunswick Improving Student Wellness Strategy.

- The Physical Activity and Tobacco Modules were completed by over 33,000 students in grades 6 to 12 attending 184 middle and secondary schools in the Province of New Brunswick.
Next Steps
Built Environment

- Parkside High School
- St. Mary's Catholic Secondary School
Adult Populations

The Ontario Health Study

- The OHS is a prospective research project being initiated at Cancer Care Ontario which is designed to:
  - improve our understanding of cancer, coronary heart disease and cerebrovascular disease (CVD), and other chronic diseases, and
  - build more effective prevention and early detection strategies.

- The OHS is being designed to function as a research platform (or legacy project) for chronic disease research within Ontario.
Current Design Features

- **Sample Size**
  - ~150,000 individuals sampled from ~85 Ontario municipalities

- **Age range**
  - 35-69 years

- **Baseline Recruitment**
  - 2008-2013

- **Follow-up timeframe**
  - 20 years
Goals of the OCC

- Serve as a research platform for a wide range of studies
  - cancer, CVD, diabetes, etc.
  - etiology, prevention, biology, and early detection of disease
  - discover and characterize determinants of risk and risk factors
    - including gene-person-environment interactions
  - evaluate changes in risk factors in individuals and communities
  - explore the determinants of risk factors
Primary Research Questions

Among Adults in Ontario:

- what is the contribution of environmental and genetic factors to the development of cancer?

- what are the primary determinants of the major modifiable and non-modifiable risk factors for cancer?
  - what are the causes of the causes......?
  - E.g., what factors are associated with OBESITY?
Individual-level data collection

- **Self-reported data**
  - Socio-demographic information
  - Health status
  - Family medical history
  - Health and lifestyle behaviours
    - including a detailed nutrient profile
  - Environmental characteristics and exposures
  - Occupational and residential history
  - Perceptions of factors within their community environment
Individual-level data collection

- **Physical Measures**
  - **Weight**
  - Height
    - standing & sitting
  - Waist & hip circumference
  - **Bioimpedance**
  - Blood pressure and resting heart rate
  - Skin colour and pigmentation
  - Spirometry
  - Grip strength
  - Sit-to-stand Test
  - Blood, urine, hair, toe nails
Community-level (Ecological) measures
Municipalities in Southern Ontario
Community-level (Ecological) measures

- Research has identified that the characteristics of the communities where people live are associated with their cancer risk behaviours.

- This variability can be a function of:
  - *modifiable* factors, such as policies and programs within a community, or the physical characteristics of a community.
  - *non-modifiable* factors such as the characteristics of the individuals situated within the community or the geographic location of a community.
Primary data sources

- DMTI Spatial
  - CanMap RouteLogistics (CMRL)
  - Enhanced Points of Interest (EPOI)

- Ontario Ministry of Municipal Affairs and Housing

- Census Canada
DMTI Spatial

- A geographic information system (GIS) data resource.

- CanMap RouteLogistics (CMRL)
  - high quality street map data
    - e.g., street road networks and road classifications, trails, bridges and tunnels, land use types (residential, industrial, institutional, parks), and bodies of water.
DMTI Spatial

- A geographic information system (GIS) data resource.

- CanMap RouteLogistics (CMRL)
  - high quality street map data
    - e.g., street road networks and road classifications, trails, bridges and tunnels, land use types (residential, industrial, institutional, parks), and bodies of water.

- Enhanced Points of Interest (EPOI)
  - a database of business and recreational points of interest
    - e.g., education facilities, golf courses, health care facilities, police and fire stations, industrial facilities, food stores, eating and drinking places, and recreation facilities.
Ontario Ministry of Municipal Affairs and Housing

- The OMMAH houses the Financial Information Return (FIR) for all Ontario municipalities.

- The FIR data are updated by each municipality annually.
  - examples of FIR data include:
    - square meters of outdoor recreation space (total / per 1000 persons)
    - crime statistics (violent / property / youth / total)
    - total participant hours for recreation programs per 1000 persons
    - operating cost for police/fire services per person
    - operating costs for parks and recreation facilities per person
    - total kilometres of trails (total / per 1000 persons)
    - square meters of outdoor / indoor recreation space (total / per 1000 persons)
    - municipal transit system (type, cost for users).
The 2006 Census Community Profiles provide municipal-level sociodemographic information from the 2006 Census of population.

- Available data in these community profiles include:
  - age and sex
  - education (including educational attainment)
  - ethnic origin and visible minorities
  - families and households
  - housing and shelter costs
  - income and earnings
  - labour (including labour market activity, industry and occupation)
  - language (including language of work)
  - place of work and commuting to work (including mode of transportation)
  - population and dwelling counts.
Added value of including Ecological measures

- Ability to understand community-level factors that are associated with risk behaviours
  - Does variability in cancer risk behaviours exist across municipalities?
  - What modifiable/non-modifiable ecological characteristics explain a significant portion of that variability?
  - Are there significant contextual interactions?

- Ability to evaluate natural experiments as community-level factors change over time

- Create a knowledge exchange system for municipalities and public health
Thank You

Questions?

scott.leatherdale@cancercare.on.ca
(416) 971-9800 ext 3237
Research Results *(highlights)*

<table>
<thead>
<tr>
<th>Behavioral Category</th>
<th>Overweight boys <em>(n = 205) vs Normal Weight and Underweight</em> Students <em>(n = 1,815), AOR</em> (95% CI)</th>
<th>Overweight girls <em>(n = 229) vs Normal Weight and Underweight</em> Students <em>(n = 1,299)</em>&lt;sup&gt;b&lt;/sup&gt;, AOR&lt;sup&gt;d&lt;/sup&gt; (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High active-low sedentary</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>High active-high sedentary</td>
<td>1.15 (0.71-1.88)</td>
<td>1.91 (1.01-3.61)&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Low active-low sedentary</td>
<td>1.16 (0.58-2.30)</td>
<td>1.53 (0.78-2.99)</td>
</tr>
<tr>
<td>Low active-high sedentary</td>
<td>1.60 (1.01-2.58)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>2.24 (1.23-4.09)&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval.

* Students who were less than the 5th percentile for BMI by sex were classified as underweight, students who were in the 85th percentile or higher for BMI by sex were classified as at risk of overweight/overweight, and students who were in the 5th to less than the 85th percentile for BMI by sex were classified as normal weight.

<sup>a</sup> Odds ratios adjusted for age and clustering by school.

<sup>b</sup> Numbers do not add to total because of missing values.

<sup>c</sup> *P* = .048.

<sup>d</sup> *P* = .045.

<sup>e</sup> *P* = .009.
Table III. Multivariate logistic regression analyses examining sedentary behaviours as a function of physical activity, weight and weight concerns, social influences, smoking and school location among male students (n = 12,806).

<table>
<thead>
<tr>
<th></th>
<th>Adjusted Odds Ratio $^a$ (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Screen Time $\geq$ 2 hours vs. $&lt;1$ hour$^a$</td>
</tr>
<tr>
<td><strong>Physical activity level</strong></td>
<td></td>
</tr>
<tr>
<td>High active</td>
<td>1.00</td>
</tr>
<tr>
<td>Moderately active</td>
<td>0.94 (0.85,1.04)</td>
</tr>
<tr>
<td>Low active</td>
<td>1.35 (1.15,1.58)$^{***}$</td>
</tr>
<tr>
<td><strong>BMI (kg/m$^2$)</strong></td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>1.00</td>
</tr>
<tr>
<td>Underweight</td>
<td>1.23 (1.01,1.50)$^*$</td>
</tr>
<tr>
<td>At risk of overweight</td>
<td>1.11 (0.97,1.26)</td>
</tr>
<tr>
<td><strong>Parent encouragement of physical activity</strong></td>
<td></td>
</tr>
<tr>
<td>Encourage</td>
<td>1.00</td>
</tr>
<tr>
<td>Strongly encourage</td>
<td>0.80 (0.73,0.87)$^{***}$</td>
</tr>
<tr>
<td>Do not encourage</td>
<td>0.99 (0.89,1.11)</td>
</tr>
<tr>
<td><strong>Parent support of physical activity</strong></td>
<td></td>
</tr>
<tr>
<td>Supportive</td>
<td>1.00</td>
</tr>
<tr>
<td>Very supportive</td>
<td>0.88 (0.80,0.96)$^{**}$</td>
</tr>
<tr>
<td>Unsupportive</td>
<td>1.07 (0.90,1.26)</td>
</tr>
<tr>
<td><strong>Number of close friends who are active</strong></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1.00</td>
</tr>
<tr>
<td>1–2</td>
<td>0.96 (0.77,1.21)</td>
</tr>
<tr>
<td>3 or more</td>
<td>0.79 (0.64,0.97)$^*$</td>
</tr>
<tr>
<td><strong>Smoking status</strong></td>
<td></td>
</tr>
<tr>
<td>Non-smoker</td>
<td>1.00</td>
</tr>
<tr>
<td>Occasional smoker</td>
<td>0.97 (0.84,1.11)</td>
</tr>
<tr>
<td>Daily smoker</td>
<td>0.83 (0.72,0.96)$^*$</td>
</tr>
</tbody>
</table>

Leatherdale & Wong, 2008
Table IV. Multivariate logistic regression analyses examining sedentary behaviours as a function of physical activity, weight and weight concerns, social influences, smoking and school location among female students (n =12,254).

<table>
<thead>
<tr>
<th></th>
<th>Adjusted Odds Ratio $^*$ (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Screen Time</td>
</tr>
<tr>
<td></td>
<td>≥2 hours vs.</td>
</tr>
<tr>
<td></td>
<td>&lt;2 hours$^*$</td>
</tr>
<tr>
<td>Physical activity level</td>
<td></td>
</tr>
<tr>
<td>High active</td>
<td>1.00</td>
</tr>
<tr>
<td>Moderately active</td>
<td>0.71 (0.63,0.80)$^{***}$</td>
</tr>
<tr>
<td>Low active</td>
<td>0.85 (0.73,0.96)*</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td></td>
</tr>
<tr>
<td>Normal weight</td>
<td>1.00</td>
</tr>
<tr>
<td>Underweight</td>
<td>1.01 (0.85,1.22)</td>
</tr>
<tr>
<td>At risk of overweight</td>
<td>1.24 (1.10,1.41)$^{***}$</td>
</tr>
<tr>
<td>Parent encouragement of physical activity</td>
<td></td>
</tr>
<tr>
<td>Encourage</td>
<td>1.00</td>
</tr>
<tr>
<td>Strongly encourage</td>
<td>0.76 (0.69,0.83)$^{***}$</td>
</tr>
<tr>
<td>Do not encourage</td>
<td>1.14 (1.03,1.27)$^{*}$</td>
</tr>
<tr>
<td>Parent support of physical activity</td>
<td></td>
</tr>
<tr>
<td>Supportive</td>
<td>1.00</td>
</tr>
<tr>
<td>Very supportive</td>
<td>0.81 (0.75,0.89)$^{***}$</td>
</tr>
<tr>
<td>Unsupportive</td>
<td>0.96 (0.82,1.12)</td>
</tr>
<tr>
<td>Number of close friends who are active</td>
<td></td>
</tr>
<tr>
<td>None</td>
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<tr>
<td>1–2</td>
<td>0.77 (0.63,0.94)$^{*}$</td>
</tr>
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<td>3 or more</td>
<td>0.67 (0.55,0.82)$^{**}$</td>
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<td>Non-smoker</td>
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<td>Daily smoker</td>
<td>0.98 (0.85,1.13)</td>
</tr>
</tbody>
</table>

Leatherdale & Wong, 2008
Research Results (highlights)

Figure 1
Weekly Energy Expenditure Estimates for Playing Inactive (GameCube®) and Active (Wii®) Videogames According to Heart Rate Monitor Data
Research Results *(highlights)*

**Figure 2.**
Model-based estimated odds ratio for a junior student being obese versus a normal weight as a function of the prevalence of obese senior students at a school and physical activity.

Leatherdale et al., 2010
Example from Tobacco Control

Smoking rates in Canada over last 80 years