Evidence-Based Planning

The Chronic Disease Priority Setting Decision Toolkit

Health System Strategy Division
Ministry of Health and Long-Term Care

Version 2, October 2008

Ontario

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Chronic disease prevention and management is a topic of high interest for health planning organizations at all levels. This is reflected in both provincial and national reports focusing upon this issue.[1] [2] The Ministry of Health and Long-Term Care (MOHLTC) is currently exploring ways to approach and integrate chronic disease prevention and management (CDPM) so as to maximize the effectiveness of the Ministry's efforts.

The Health System Strategy Division has created a number of products to complement and augment the existing analytical and planning capacity within the MOHLTC and in health sector. Some of the CDPM-related products include:

- *Ontario's CDPM Framework*
- *An Evidence-Based Chronic Disease Priority Setting Decision Tool*
- *A comorbidity analysis of data on commonly prevalent chronic conditions in Ontario*
- *A risk factor analysis of the commonly prevalent behavioural risk factors in Ontario*
- *A web based survey instrument to map CDPM initiatives in the ministry to determine the degree of their alignment with CDPM Framework*

This work supports a number of current government priorities related to health system transformation. It will set out future strategic CDPM priorities that align with many of our current focus areas, such as *Keeping People Healthier* and *Increased Access to Health Care Services*. The project team is also working in concert with Ministry analysts to ensure that the LHINs are provided with the analytic support they need for their related local health system planning activities.

For additional context and background about evidence-based planning, as well as data definitions and sources, readers are referred to the following MOHLTC reports:

- Evidence-Based Planning: The Health Planner's Toolkit. HSIP, 2006. http://www.health.gov.on.ca/transformation/providers/information/resources/health_planner/module_3.pdf
- The Health Analyst's Toolkit. HSIP, 2006. http://www.health.gov.on.ca/transformation/providers/information/resources/analyst_toolkit.pdf
- The Selection of Indicators in Health Impact Assessment Literature. CEHIP and V. Robinson, September 1998 http://www.healthinformation.on.ca/ce.html

Report Author:
Meera Jain,[3] Health System Strategy Division, Ontario MOHLTC.

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[1] Public Health Agency of Canada. Backgrounder: A Public Health System for the 21st Century. May 2004 [monograph on the Internet]. Ottawa (ON): Public Health Agency of Canada; 2004 [cited 2004 Sep 19]. Website: http://www.phac-aspc.gc.ca/media/nr-rp/2004/2004_01bk1_e.html.

[2] Ontario Health Quality Council. First Yearly Report. http://www.ohqc.ca/en/yearlyreport.asp 2006

[3] Email: Meera.jain@Ontario.ca; Phone: 416-327-8320;

1. Introduction

A significant portion of health care is directed to the care of individuals with chronic conditions. As a result, both provincial and national reports have stressed the importance of focusing upon the prevention and management of chronic diseases.[4] [5]

Setting priorities is critical if we are to meet the needs of a growing and aging population.[6] Participants in the policy-making process need to be able to determine what diseases or health conditions to focus upon in order to maximize the efficiency of available resources and achieve desirable outcomes.

The Chronic Disease Priority Setting Decision Toolkit is specifically designed for health planners, analysts and epidemiologists working for Ontario's LHINs, public health and other health organizations. A key goal of this document is to provide a methodology for objectively ranking the impact of chronic diseases utilizing available evidence.

The Chronic Disease Priority Setting Decision Toolkit describes:

- a variety of important health and economic data
- methods to assess comorbidity and the impact of risk factors.

The resources presented in this document are the:

- Chronic Disease Priority Setting Decision Tool (Section 2)
- Chronic Disease Comorbidity Assessment Tool (Section 3)
- Chronic Disease Risk Factors Impact Assessment Tool (Section 4)

The methodology described here is a model which can be adapted to suit planning needs through the selection of prioritized variables of diseases and indicators. Utilizing the resources described in this Toolkit enables the identification of evidence-based chronic disease priorities and helps to support planning. This resource has been developed through the experience and knowledge of the author of the available Ontario data, appropriate methodologies, and health-planning needs.

Background

Priority setting is part science and part politics.[7] Epidemiological analysis provides the scientific basis and contributes to the science of policy making. At the same time, other factors such as the

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[4] Commission on the Future of Health Care in Canada; Romanow, RJ. Building on Values: The Future of Health Care in Canada – Final Report. Regina (SK): Commission on the Future of Health Care in Canada; 2002.
[5] Dault M, Lomas J, Barer M. Listening for Direction II: Final Report. Ottawa (ON): Canadian Health Services Research Foundation; 2004. Website: http://www.chsrf.ca/other_documents/listening/pdf/LfD_II_Final_Report_e.pdf.
[6] Local Health System Integration Act, 2006. Ontario, Mar 2006. Website: http://www.e-laws.gov.on.ca/DBLaws/Statutes/English/06l04_e.htm
[7] Spasoff R. Epidemiologic methods for health policy. New York, Oxford;1999.

agency mission, political climate and feasibility also play important roles. A systematic priority-setting process involves:[8] [9] [10]

1. The assessment of health data to provide an evidence base that can be used to prioritize:
    - the disease burden of specific diseases or health conditions
    - the impact of risk factors, and
    - the population health and economic impact of interventions.

2. Public discussion, advice and input (e.g., surveys, open forums, key informants, focus groups etc).

3. A group decision-making process that looks at the data and public input, attempts to resolve conflicts, and considers other, broader issues such as short or long term focus, efficiency and equity.[9] [10]

Prioritization has been identified as an important issue in various other jurisdictions although few methodologies to support this process have been identified.[11] [12]

This document outlines methods of identifying chronic disease priorities by employing some easy to use tools. Working with Ontario-specific health and other data, these methods will enable health-planners and policy makers to describe, measure, and compare the burden of illness of chronics diseases for their jurisdictions.

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[8] Ontario Ministry of Health and LTC. Needs/Impact-Based Planning Committee, Community Health Division, MOHLTC, Ontario; 1996.
[9] Spasoff R. Epidemiologic methods for health policy. New York, Oxford;1999.
[10] Mahapatra P. Priority-setting in the health sector and summary measures of population health. In: Summary Measure of Population Health, pp 89-89, World Health Organization; 2002.
[11] Baltussen R, Niessen L. Priority setting of health interventions: the need for multi-criteria decision analysis. Cost Effectiveness and Resource Allocation 2006, 4:14. http://www.resource-allocation.com/content/pdf/1478-7547-4-14.pdf
[12] Hanlon JJ, Pickett GE. Public Health: Administration and Practice, 8th ed. St. Louis: Times Mirror/Mosby College Publishing, 1984. http://www.uic.edu/sph/prepare/courses/ph440/mods/bpr.htm

2. Chronic Disease Priority Setting Decision Tool

The Chronic Disease Priority Setting Decision Tool makes it possible to compare and prioritize chronic conditions in Ontario. To begin, we'll describe two approaches or methods:

1) Sum of Ranking Approach (SRA), and

2) Product of Value Approach (PVA).

This paper also describes a number of qualitative indicators that may be helpful in completing the priority-setting process.

Selection of diseases

What diseases should be prioritized? The answer will depend upon needs within the jurisdiction. However, the MOHLTC has drawn up a list of 32 chronic diseases that are both significant and for which there are available data. These include:

- diseases that are included in the Canadian Community Health Survey (CCHS)[13]
- others considered important through an analysis of mortality and hospitalization data.[14]

The final list of diseases included the following:

[13] Statistics Canada. Canadian Community Health Survey, Ottawa; 2001; 2003; 2005

[14] Ontario Ministry of Health and Long-Term Care. Ontario's Provincial Health Planning Database. Ontario; 2005.

1	Alzheimer's + Dementia	17	Congestive Heart failure
2	Arthritis/Rheumatism	18	Hypertension
3	Asthma	19	Hyperlipidemia
4	Atherosclerosis	20	Multiple sclerosis
5	Back problems	21	Obesity BMI >=25
6	Cancer, all	22	Osteoporosis
7	Breast ca	23	Parkinson's disease
8	Colorectal ca	24	Stroke (CVD including stroke)
9	Lung ca	25	Urinary incontinence
10	Prostate ca	26	Bowel disorder
11	Pulmonary disease (COPD)	27	Chronic fatigue syndrome
12	Mood dis /Depression >=2wks	28	Fibromyalgia
13	Diabetes M or type 2	29	Stomach/intestinal ulcers
14	Epilepsy	30	Chronic bronchitis
15	Heart disease, all	31	Emphysema
16	IHD (Angina AMI)	32	Chronic Respiratory Disease (CRD)

Diseases excluded from the list were those for which data were not available through hospitalization or death files, or were not clearly identified as a chronic condition. These included: cataracts, food allergies, glaucoma, HIV/AIDS, injuries from accidents, mental illness (other than depression), migraine headaches, multiple chemical sensitivities, non-food allergies, and thyroid condition.

Selection of indicators

In selecting indicators, there are a number of criteria to consider (Appendix Table 1).

The burden of illness can be estimated using seven health and health cost data.

Health data:

- Prevalence
- Prevalence as a comorbid condition
- Mortality, PYLL
- Hospitalization rates (most responsible/primary cause)
- Ambulatory Emergency visits
- Ambulatory Non-Emergency visits
- Physician: number of services

Costs:

- Direct costs to the health care system, including resource utilization data (PAC wt, CACS wt)
- Indirect costs – e.g. premature mortality and lost productivity (PYLL)

Although they cannot be used to calculate ranking, a number of additional indicators are important when you are involved in policy making. These indicators may be more difficult to quantify and include such things as:

- whether there is potential for intervention for the disease (e.g., by addressing known care gaps)
- evidence of modifiable risk factors and of effective interventions for addressing them,
- if stakeholder interest was expressed or known, and
- if the disease is currently the object of a strategy or initiative and is receiving funding or is a priority.

Other indicators that one may want to consider but were not part of the priority-setting process (to keep the tool simple) include the following:

- socio-demographic indicators such as population-based Inequities by age, gender, aboriginal ancestry/ethnicity, income and education
- change over time for the burden of illness indicators
- quality of life and other composite indicators of population health status such as the Disability Adjusted Life Years (DALYs)[15] (no disease-specific data for Ontario were available).

Inclusion of these in the tool would depend on whether reliable data are available for these indicators. In addition, the qualitative type of variables would need to be converted into quantitative variables e.g. by assigning a numeric value to them.

If data are available and are of sufficient size to meet the minimum sample size requirement, it may be possible to examine the selected indicators by gender, ethnicity, region, etc. in order to prioritize health concerns for a population.

Data Sources

Data sources for the priority-setting process used were:

- Canadian Community Health Survey (Cycle 3.1, 2005) for population prevalence and comorbidity prevalence (See Appendix Table 2a for variable codes)
- Ontario's Provincial Health Planning Database (PHPDB) for counts of hospitalizations, deaths, and ambulatory emergency and non-emergency visits, OHIP, PYLL, and resource utilization data[16] (See Appendix Table 2b for ICD codes)
- For direct and indirect costs of diseases, estimates in the Economic Burden of Illness in Canada Report [17]

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[15] Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL. 4. Comparative Quantification of Mortality and Burden of Disease Attributable to Selected Risk Factors. In: Global Burden of Disease and Risk Factors. Worldbank, 2006, pp 241-396. http://www.dcp2.org/pubs/GBD

[16] Ontario Ministry of Health and Long-Term Care. Ontario's Provincial Health Planning Database. Ontario; 2005.

Other sources of data that can be consulted include:

- For osteoporosis-related fractures, number and costs of hospitalizations and emergency visits as described in the 2004 report from the Institute for Clinical Evaluative Sciences (ICES)[18]
- Information on softer indicators such as care gaps, modifiable risk factors, evidence for effective management, and stakeholder interest may be found in the research literature, strategies, initiatives, or background documents on various diseases. Such data can be helpful when considering the results of a priority-setting process but were not used in the actual calculations.

Indicator	Measure	Source
Prevalence	% of the population with the target disease	CCHS, 2005 data
Comorbidity*	% of target condition among persons with different chronic conditions	CCHS using *Chronic Disease Comorbidity Assessment Tool* (Section 3), 2005 data
Hospitalization	Hospitalization rate per 100,000 for which the target disease was the most responsible diagnosis	PHPDB – Inpatient acute F2006
Emergency room visits	Number of emergency room visits caused by the target disease	PHPDB – NACRS, F2006
Ambulatory non-emergency visits	Number of emergency room visits caused by the target disease	PHPDB – NACRS, F2006
OHIP	Number of services billed	PHPDB, F2006
Mortality	Death rate per 100,000 population for the target disease (most responsible diagnosis)	PHPDB, C2004
PYLL	Person years of life lost	PHPDB, C2004
PAC weight	Prospective complexity adjustment weight for hospitalization based resource intensity	PHPDB, F2006
CACS weight	for ambulatory emergency and non-emergency visits resource intensity	PHPDB, F2006
Direct costs**	$ million per year in direct costs	Economic Burden of Illness in Canada (EBIC)
Indirect costs**	$ million per year in indirect costs	Economic Burden of Illness in Canada

*See details of calculations of comorbidity in Section 3

**Although data were obtained from EBIC, dollar figures are not reported in this version because of data being old from 1998. Only PAC and CACS weight are reported as a proxy measure of costs from hospitalization and emergency visits

CCHS = Canadian Community Health Survey PHPDB = Ontario's Provincial Health Planning Database

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[17] Statistics Canada. Economic Burden of illness in Canada. Ottawa; 2002.

[18] Mamdani M, Kopp A. Osteoporosis-related health services utilization: Supplementary analyses for the Ontario Ministry of Health Osteoporosis Strategy. Institute for Clinical Evaluative Sciences, Toronto; August 2004.

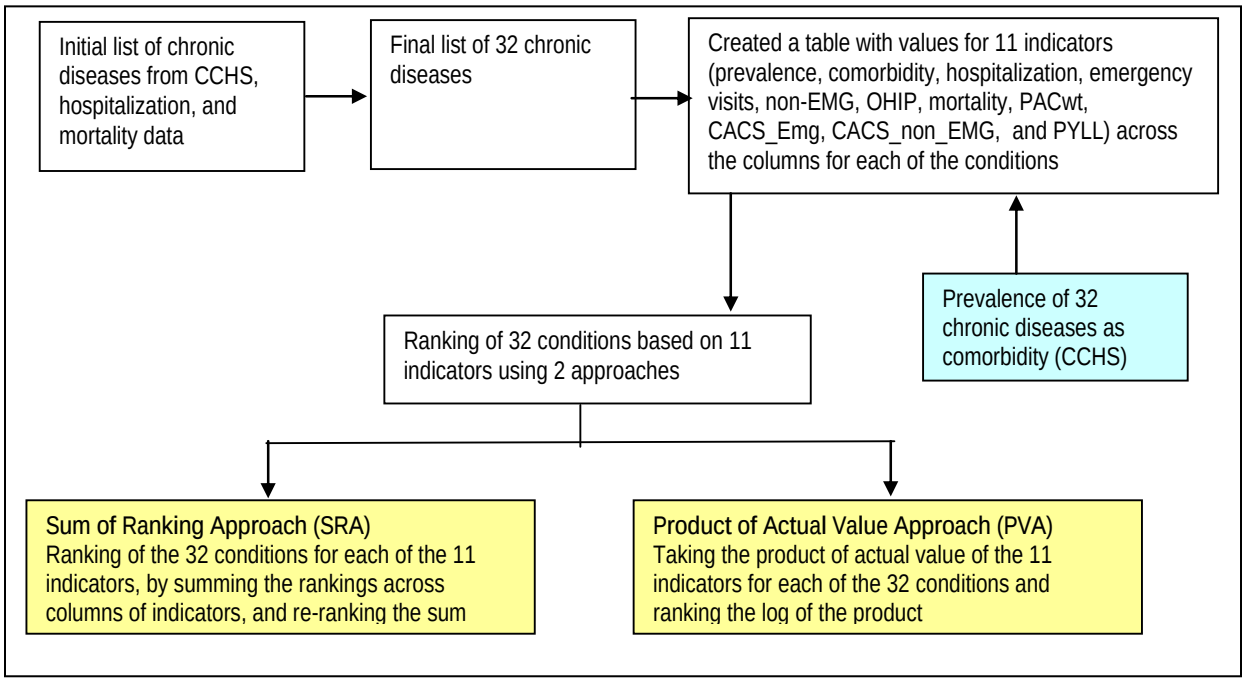
Priority setting approaches

The use of two different approaches for establishing disease priority were developed and compared: the Sum of Rankings (SRA) and the Product of Actual Values (PVA). Both approaches utilize the same 11 indicators:

- prevalence
- comorbidity
- hospitalization
- ambulatory emergency department visits
- ambulatory non-emergency visits
- OHIP billings
- mortality
- direct costs from proxy measures of PAC wt, CACS_EMG, CACS_ non-EMG
- indirect costs as measured by PYLL

Figure 1 shows the process and approach used to assemble and analyze data for the SRA and the PVA approaches.

Figure 1: Summary of process for the two analytic approaches



1. Sum of Rankings Approach (SRA)

Calculation of the SRA involves:

1. ranking the 32 chronic diseases for each of the 11 indictors (e.g. highest prevalence as number 1 and lowest as number 32),
2. summing the ranking across the 11 indicators, and
3. re-ranking the sums.

The lowest summed ranking score receives the highest ranking for priority and the one with the highest score is ranked as 32nd.

The model can be summarized as:

$Y = ar + br + cr + dr + er + fr + gr$

where Y is the sum of ranking and *ar*, *br*, *cr*, etc., are the rankings of each indicator.

Step 1: Choose diseases to be prioritized

To begin, we need to choose which of the chronic diseases or conditions need to be prioritized - all 32 or those necessary to address a specific planning issue.

Step 2: Gather indicator data

The eleven indicator data should be collected for all of the diseases to be prioritized (i.e. prevalence, comorbidity, hospitalization, emergency visits, non-EMG, OHIP, mortality, PACwt, CACS_Emg, CACS_non_EMG, and PYLL). The *Chronic Disease Comorbidity Assessment tool* (Section 3) can be used to calculate comorbidities.

Step 3: Chart the indicator data for each disease

The simplest way to perform this task is to create a table or spreadsheet, with the diseases as rows and the indicators as columns. For each disease, record the indicator data.

The following example shows two of the eleven indicators (prevalence and mortality) for three diseases/conditions. These numbers are taken from a table that examined 32 diseases and conditions for all Ontario (See Appendix Table 3). Values may vary for regions within Ontario, or for other provinces or geographical units.

Disease	Prevalence (% of population among Ontarians age 12+, CCHS 2005)	Mortality (Counts, PHPDB, F2003)
Obesity (BMI≥25)	49.8	86
Heart disease	4.8	19,000
Cancer	1.5	21,971

An actual table would have columns for all eleven indicators and rows for all of the diseases and conditions to be ranked.

Step 4: Rank each indicator for each disease

For each indicator, the diseases are ranked in descending order, starting with one (1) for the highest value. Even within the same disease, different indicators may rank very differently. In our example, taken from a provincial list of 32 diseases and conditions, obesity ranks first in terms of prevalence but 24th of 32 in terms of mortality. Cancer ranks 19th in terms of prevalence but first in mortality.

Disease	Prevalence (% of population among Ontarians age 12+, CCHS 2005)	Rank	Mortality (Rate per 100,000, PHPDB)	Ranking
Obesity (BMI≥25)	49.8	1	86	24
Heart disease	4.8	8	19,000	2
Cancer	1.5	19	21,971	1

If data points are missing, imputed values will be required for missing cases, based on best available information. This may be guided by published literature or through actual analysis of available sources.

Step 5: Sum the rankings

To proceed, all available indicators must be ranked for all diseases and conditions to be prioritized. The rank scores for all indicators for each disease are summed, producing a total rank score for each disease. The logic is shown in the formula:

$Y = ar + br + cr + dr + er + fr + gr$

where Y is the sum of ranking and *ar*, *br*, *cr*, etc., are the rankings of each indicator.

The following example shows the rankings for a short list of three of the 32 diseases and conditions in Ontario. Rankings are:

Disease	Rankings for											
	Prevalence	Comorbidity	Hospitalization	Emergency	Non-Emergency	Mortality	OHIP	PAC wt	CACS wt EMG	CACS wt non-EMG	PYLL	SUM of Rankings
Cancer	19	20	2	17	1	1	7	2	2	16	1	88
Heart disease	8	5	1	8	4	2	3	1	1	1	2	36
Obesity	1	1	28	30	19	24	13	29	29	30	23	227

Total sum of the rankings are therefore:

For cancer: 88
For heart disease: 36
For obesity: 227

Remember that the lower the sum of rankings, the higher the ranking for that condition.

Step 6: Rank the summed ranks

Once the indicator rankings for each disease have been summed, the overall ranking of the diseases can be done. Remember – the smaller the sum, the higher the ranking of the disease.

For example, in the brief example shown below, the sum of ranking for cancer is 88, the sum for heart disease is 36 and the sum for obesity is 227. The smaller the sum of ranking, the higher the ranking for the condition. This suggests that heart disease has a greater SRA ranking than cancer. Cancer, in turn, has a greater SRA ranking than obesity.

Disease	Rankings for												
	Prevalence	Comorbidity	Hospitalization	Emergency	Non-Emergency	Mortality	OHIP	PAC wt	CACS wt EMG	CACS wt non-EMG	PYLL	SUM of Rankings	Overall Ranking
Cancer	19	20	2	17	1	1	7	2	2	16	1	88	2
Heart disease	8	5	1	8	4	2	3	1	1	1	2	36	1
Obesity	1	1	28	30	19	24	13	29	29	30	23	227	3

Step 7: Present data

Because SRA calculations produce rankings, these data are best presented as tables or lists. Graphs based on SRA lack the ability to take into account the true magnitude of the difference between diseases or conditions.

2. Product of Actual Values Approach (PVA)

In this approach, one begins by calculating the total burden of the disease. This is done by multiplying the actual values of the seven indicators for each disease state. Once the total values are calculated, the diseases can then be ranked. In the PVA approach, diseases with the highest product score have the highest ranking, while those with the smallest scores have the lowest ranking. Because of the wide range of actual values, to present the data on a graph it is necessary to convert them to a log scale.

The model for this approach is:

$Y = a \times b \times c \times d \times e \times f \times g$

where Y is the product for determining the ranking and *a*, *b*, c, etc., are actual values of indicators.

Step 1: Choose diseases to be prioritized

To begin, choose which chronic diseases or conditions are to be prioritized. One may want to prioritize among all 32 diseases and conditions, or if trying to address a specific planning issue, one may only focus upon specific conditions.

Step 2: Gather indicator data

Data for the seven indicators (i.e. prevalence, comorbidity, hospitalization, emergency visits, non-EMG, OHIP, mortality, PACwt, CACS_EMG, CACS_non_EMG, and PYLL) are collected for all of the diseases to be prioritized. These are the same seven indicators used for the SRA. To calculate comorbidity, use the Chronic Disease Comorbidity Assessment Tool (Section 3).

Step 3: Chart the indicator data for each disease

The simplest way to perform this task is to create a table or spreadsheet, with the diseases as rows and the indicators as columns. For each disease, record the indicator data. For example, the following chart shows provincial data for three of 32 diseases and conditions that were analyzed.

Disease	Prevalence	Comorbidity	Hospitalization	Emergency	Non-Emergency	Mortality	OHIP	PACwt	CACS wt EMG	CACS wt non-EMG	PYLL		
Cancer	1.49	3.9	73,562	15,321	60,643	1,134,273	21,971	147,676	1,362	7,233	1,642,572		
Heart disease	4.83	15.3	79,471	67,675	28,140	2,566,109	19,003	149,370	8,907	10,967	1,431,062		
Obesity	49.84	56.0	821	128	394	399,750	86	821	7	60	6,377		

Missing data points can not be left blank -- imputed values must be added based upon best available information as described earlier.

Step 4: Calculate the total burden of disease

The formula for calculating PVA is: Y = *a* x *b* x *c* x *d* x *e* x *f* x *g*

where Y is the product for determining the ranking and *a*, *b*, c, etc., are actual values of indicators.

For each disease, the values of the indicators are multiplied. For comorbidity, we used the average or mean of the comorbidities values calculated by using the Chronic Disease Comorbidity Assessment Tool (Section 3).

Disease	Prevalence	Comorbidity	Hospitalization	Emergency	Non-Emergency	Mortality	OHIP	PAC wt	CACS wt EMG	CACS wt non-EMG	PYLL	Log (n) PRODUCT of Values	Overall Ranking
Cancer	1.49	3.9	73,562	15,321	60,643	1,134,273	21,971	147,676	1,362	7,233	1,642,572	83.56	2
Heart disease	4.83	15.3	79,471	67,675	28,140	2,566,109	19,003	149,370	8,907	10,967	1,431,062	89.75	1
Obesity	49.84	56.0	821	128	394	399,750	86	821	7	60	6,377	47.96	3

Step 5: Rank the disease by total burden

Once the total disease burden for each disease has been calculated, the diseases can be ranked. The disease or condition with the highest value is ranked number one. Other diseases are usually ranked in descending order.

The following shows results from analysis using provincial data. Heart disease has a larger product than cancer and so is ranked higher. Out of the 3 selected diseases or conditions ranked, obesity was 3rd.

Disease	**Log (n) of Product**	**Ranking**
Cancer	83.56	2
Heart disease	89.75	1
Obesity	47.9	3

Step 6: Present data

One advantage of the PVA is that it shows actual values and thus gives a better idea of the magnitude of the differences in the burden of various diseases and conditions. As a result, it can be helpful to graph the data so the differences can be seen. Because of the large range of values, log transformation on the total product (value) scores should be conducted; this makes it possible to present all data in the same graph. Log transformation can be performed in Excel or on most scientific calculators.

Figure 2 shows the rankings obtained from the PVA when 32 diseases and conditions were prioritized at the provincial level. The PVA ranked heart disease as number one, cancer as number two and obesity as number 14.

See Appendix Table 3 as an example of a detailed Decision Tool for Ontario.

Summary

In this section, two approaches for prioritizing the burden of diseases and conditions have been described: the SRA and the PVA. Both approaches can be performed using the same standard health indicators (prevalence, comorbidity, hospitalization, mortality, emergency visits, direct costs and indirect costs).

Is one approach better than the other? Many times, the two approaches achieve similar results, suggesting that both have good face validity. Figure 2 shows the results of a provincial analysis utilizing the SRA and the PVA approaches. For most diseases, there was good agreement between the two methods. The results are also in line with what we know from the literature.[19]

The SRA is probably closer to the approach traditionally used by analysts, however, the advantage of the PVA approach is that it estimates actual values and thus gives a better idea of the magnitude of the differences in the burdens associated with different diseases.

Obtaining SRA and/or PVA rankings is only the first step in the priority-setting process. At this point, it may be appropriate to look at other, more qualitative indicators, such the potential for intervention or level of public concern. As many conditions have similar risk factors, having modifiable risk factors is generally not very useful in discriminating between priority conditions. More in-depth analysis of the care gaps and opportunities to improve the prevention and management of specific diseases may be needed in order to include these factors in the priority-setting process.

[19] Statistics Canada. Statistical Report on the Health of Canadians. Ottawa; 1999.

Figure 2: Comparison of SRA and PVA analysis using Ontario data

Ranking of 32 chronic diseases using two composite score approaches (Sum of Rankings Approach (SRA) and Product of Value Approach (PVA)) of the priority setting Decision Tool identified major contributors to disease burden and costs in Ontario. Results of two approaches were comparable.

1. SRA: Sum of Ranking of 11 Indicators*

1	**Heart disease, all**
2	IHD (Angina AMI)
3	Arthritis/Rheumatism
4	**Cancer, all**
5	Diabetes
6	COPD+Emphysema+Bronchitis
7	Bowel disorder
8	Stroke
9	Hypertension
10	COPD
11	Asthma
12	Mood disorder/Depression
13	Cong. Heart failure
14	Back problems
15	Lung ca
16	Breast ca
17	Colorectal ca
18	Osteoporosis
19	Prostate ca
20	Stomach/intestinal ulcers
21	Alzheimers + Dementia
22	Chronic bronchitis
23	Obesity BMI >=25
24	Atherosclerosis
25	Urinary incontinence
26	Chronic fatigue syndrome
27	Epilepsy
28	Parkinsons disease
29	Emphysema
30	Multiple sclerosis
31	Hyperlipidemia
32	Fibromyalgia

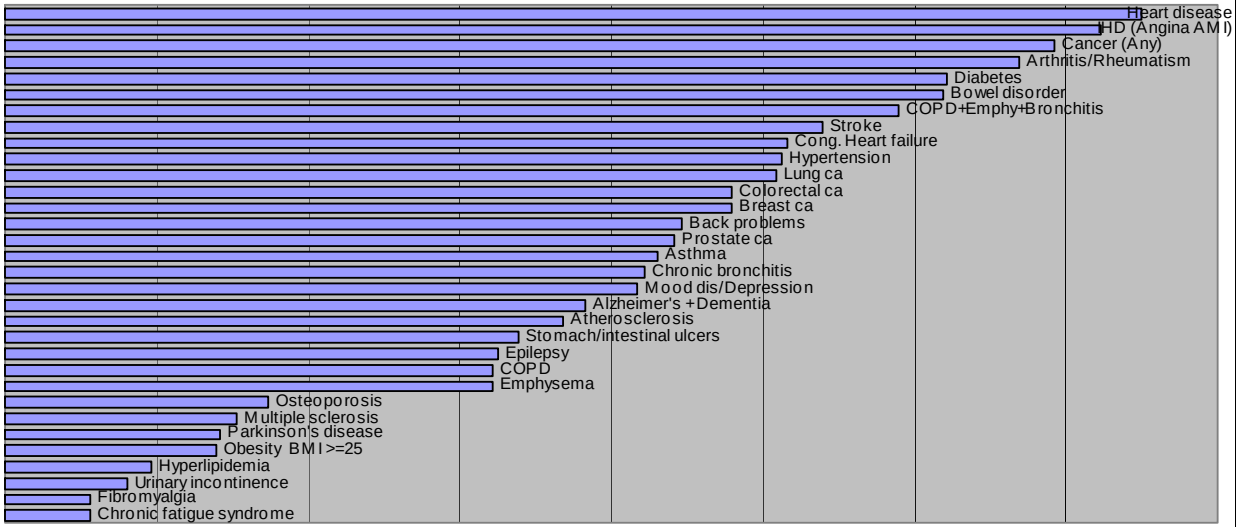
2. PVA: Product of Actual Value of 11 Indicators*

Product of 11 indicators: prevalence, comorbidity, hopitalization, emerg, ambulatory non-emerg, mortality, OHIP #services, PAC wt, CACS wt EMG, CACS wt Non-EMG, PYLL.

Model PVA: Log of Y, where Y = a x b x c …….x j

Model SRA: Y = ar + br + cr ……+ jr

(r = ranking)



Source:
Meera Jain, Chronic Disease Unit, HSSD, MOHLTC
Version 1: October 2005. Version 2: October 2008

Discussion

Results of the two summary ranking approaches, the SRA and the PVA, gave highly comparable rankings and appear to be useful measures for priority setting for chronic diseases policy making. Of the two approaches, using a PVA approach has an additional advantage of giving a measure of the magnitude of the burden and may be useful when comparing differences by local planning areas. The PVA measure gives the same ranking whether one uses rate or count data, as long as the ratio between the diseases remains the same.

The tool described in this paper has utilized an approach that the literature suggests is a means of improving the quality and appearance of selected indicators; namely, presenting data in the form of profiles, with all indicators organized identically (CEHIP 1998). The Canadian Institute for Health Information (CIHI) and the former Toronto District Health Council (TDHC) are two organizations that use summary charts to profile their indicators. Having indicators organized in summary charts adds to the understanding and interpretability of the data presented, giving strength to the overall research. Feedback from the various LHIN areas confirms that they find this a meaningful and easy approach.

One of the earlier priority-setting methods described in the literature is the Hanlon Method (also known as the Basic Priority Rating System or BPRS).[20] Another approach, similar to the one described here, has recently been described in a paper from The Netherlands.[21] It describes a multi-criteria approach to priority setting that incorporates priority weighting for indicators of interest.

A limitation in using any priority setting method is that conditions with missing data for any of the indicators of interest can not be included in the comparison. Missing values do not allow for comparability and ranking. The solution may lie in imputing data if reliable information can be used to base such decisions e.g. use of literature or analysis of any available data such as health costs. The comparison is also more robust if the same source of data for an indicator is used for all conditions. Some data are problematic, e.g. there is no osteoporosis code and one may have to use fracture data as surrogate for hospitalization. (Note: we based our values on a research study on Ontario data). Another challenge is that different coding is used to describe the conditions in different data sets.

In addition to the data bases described in this document, several other health data bases exist which can be used by the planners for chronic disease. These may include Ontario Health Insurance Plan, Ontario Drug Database, Home Care. Access to such databases could be an issue for some.

Use of qualitative data for policy making is important. To translate such qualitative data as 'The disease is a priority for Aboriginals', one may code the data as a numeric value e.g. 'Yes' = 1,

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[20] Hanlon JJ, Pickett GE. Public Health: Administration and Practice, 8th ed. St. Louis: Times Mirror/Mosby College Publishing, 1984. http://www.uic.edu/sph/prepare/courses/ph440/mods/bpr.htm

[21] Baltussen R, Niessen L. Priority setting of health interventions: the need for multi-criteria decision analysis. Cost Effectiveness and Resource Allocation 2006, 4:14. http://www.resource-allocation.com/content/pdf/1478-7547-4-14.pdf

'No' = 0. Use of 'weights' is also helpful when there is a special interest in a certain indicator e.g. the admission rates for hospital services vs. prevalence of diabetes.

One of the challenges decision makers face when attempting to base decisions on various indicators is that some chronic conditions differ in the types and direction of their indicators, making interpretation complex and uncertain. For example, cancer ranks low in terms of prevalence but high in its impact on hospitalization. Another example is obesity, which ranks high in prevalence but low in direct hospitalization. Both prevalence and impact are important when assessing the overall impact of chronic conditions and planning health care services and management. Other investigators have used various approaches to address this issue. Investigators in British Columbia, for example, have categorized chronic conditions by prevalence and impact into quadrants in a 2x2 table, using mid-points to group them into high impact/lower impact and high prevalence/lower prevalence quadrants.[22]

The value of the approaches described here lie in their ability to accommodate variation between indicators and to produce overall rankings of the burden of disease. However, the approach is not without challenges. These include missing data (in some cases, data can be imputed from the best available evidence in the literature) and tied rankings. Tied rankings obtained by the SRA or the PVA may require individual assessment, in which one takes into account the planning needs and the relative importance of the various indicators selected.

The list of chronic disease presented here included a few overlapping categories (e.g. all cancers and specific breast, colorectal, lung and prostate cancers, as well as heart disease and IHD and congestive heart failure). Although this may introduce some duplication and impact the priority ranking of certain diseases, they were retained as separate items due to their importance for program planning. Doing so enables the analyst to look at the subcategories separately or to collapse them.

The approaches described here (the SRA and PVA) are based on aggregated individual indicators and are best suited to 'describe' population health. They make it possible to rank diseases, but cannot be used to explain or analyze the health of a population.[23] To achieve the latter goal, one has to take into consideration dynamic issues such as the capacity of a population to help itself. Indicators of this capacity include such things as risk factor rates (e.g., smoking or obesity), screening and early disease identification programs, and others.[24] Ranking the diseases using the methods described here is really only the beginning of the analytic process. Further in-depth analysis on their risk factors is another, essential part of the policy development process.

In summary, decision tools for priority setting for chronic disease prevention and management in public or population health must include a broad set of indicators that include health measures and costs. The methodology outlined in this section is one way of fulfilling these criteria. In

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[22] Broemeling A, Watson D, Black C. Chronic conditions and co-morbidity among residents of British Columbia. Centre for Health Services and Policy Research, Vancouver; February 2005. Website: http://www.chspr.ubc.ca/research/patterns/chronic

[23] McDowell I, Spasoff RA, Kristjansson B. On classification of population health measurements. Am J Pub Health 2004;94:388-393.

[24] McDowell I, Spasoff RA, Kristjansson B. On classification of population health measurements. Am J Pub Health 2004;94:388-393.

order for a decision tool for policy decision making to be complete, however, other components must also be considered and analyzed, such as the potential for intervention (e.g., risk factor modification), stakeholder interest, and current strategies and funding.

[1] McDowell I, Spasoff RA, Kristjansson B. On classification of population health measurements. Am J Pub Health 2004;94:388-393.

3. Chronic Disease Comorbidity Assessment Tool

The presence of a comorbid condition highlights the need to focus on several conditions at the same time for a holistic, integrated approach to clinical care. The larger the number of comorbid conditions, the more complex care needed and the greater the burden on health care resources. This sort of analysis can help to highlight local needs for planning and resource (including human resource) management.

Comorbidity analysis can be conducted using the prevalence data for Ontario in the Canadian Community Health Survey.

Method

The easiest means to document comorbidity data is to construct a grid, with the target diseases and conditions listed as both columns and as rows. For each disease, CCHS prevalence data can be used to determine the percent of the population in each cell (e.g., for those with heart disease, determine what percent have cancer, hypertension, diabetes, arthritis/rheumatism, etc).

Table 1 is an example of showing comorbidity data for Ontarians with diabetes. Going down the diabetes column, it appears that 53.4% of people with diabetes have high blood pressure, compared to 15.4% for all Ontarians (shown in the *All Ontarians* column on the far right). Similarly, 72.8% of people with diabetes have a body mass index (BMI) $\geq$ 25, compared to 49.8% for all Ontarians. The overall prevalence of diabetes among Ontarians is 4.8%; however, as a comorbid condition, its prevalence ranges from 6.1% in people with asthma to 27.5% in people with colorectal cancer.

The range of comorbidity calculations and average or mean comorbidity are required for estimating both SRA and PVA.

Table 1: Example of diabetes as comorbidity for 32 conditions in Ontario

	Description		CCHS2005 %prev MF age12+	Alzheimer's +	Arthritis/Rheu	Asthma	Cancer (Any	Breast ca	Colorectal ca	Prostate ca	COPD	Depression >=	Diabetes M or
1	Alzheimer's + Demer	CCCE_181	0.40										1.23
2	Arthritis/Rheumatism	CCCE_051	17.23										40.57
3	Asthma	CCCE_031	8.02										10.11
5	Back problems	CCCE_061	19.48										27.53
6	Cancer, all	CCCE_131	1.49										3.80
7	Breast ca	CCCE_13A	0.90										2.42
8	Colorectal ca	CCCE_13C	0.39										2.23
10	Prostate ca	CCCE_13B	0.69										1.96
11	COPD	CCCE_91F	0.75										2.97
12	Mood dis /Depressio	CCCE_280	6.04										9.06
13	Diabetes M or type 2	CCCE_101	4.83	14.83	11.34	6.09	12.29	12.96	27.52	13.68	19.07	7.25	100.00
14	Epilepsy	CCCE_111	0.52										1.04
15	Heart disease, all	CCCE_121	4.83										21.37
18	Hypertension	CCCE_071	15.42										53.42

*Data Source: CCHS 2005
Rows read: Diabetes was reported by 6% of asthma patients, 11% of arthrits patients etc. (data gives range)
Columns read: In those with diabetes, asthma was present in 10.1%, arthritis 40.5% etc.
Data on risk factors is to be used cautiously: it is not causal and is given for people with diseases
See Appendix Table 4 as an example of comorbidity data for Ontario, 2005

Discussion

Comorbidity data are required for calculating SRA and PVA. But there are other ways in which comorbidity data may be utilized. There may, for example, be value in ranking all or some of the comorbidity data, so diseases and conditions can be prioritized (see Appendix Table 5). Another possibility is to look at the number of comorbidities people in a jurisdiction report, and the relationship with health service use (an example is provided in Appendix Table 6).

4. Chronic Disease Risk Factors Impact Assessment Tool

It is well known that various behavioural risk factors are related both directly and indirectly to most chronic conditions (see Appendix Figure 1). How much of the burden of chronic disease in your jurisdiction is due to modifiable chronic disease risk factors? This issue can be explored using the *Chronic Disease Risk Factors Impact Assessment Tool*.

Methods

Population Attributable Fractions (PAFs) refers to the proportion of cases of a disease that could be prevented if a specific risk factor was eliminated. To calculate the PAF two types of information are required:

- an outcome measure for the disease, such as deaths, number of hospitalizations, or Disability Adjusted Life Years (DALY)
- the prevalence of the risk factor in question.

Prevalence data for the most common behavioural risk factors are available for Ontario from the CCHS data as well as most of the chronic diseases.

Appendix Table 5 shows a sample of a table created for all Ontarians. It focuses upon eight risk factors: BMI $\geq$ 25, regular drinking, daily smoking, low fruit and vegetable consumption, smoker in home, physical inactivity, regularly having five or more alcohol drinks at one time, and feeling stressed. Prevalence rates for these risk factors are shown for persons reporting any one of 19 chronic conditions, as well as for all Ontarians. Risk factor prevalences may differ in specific jurisdictions.

To calculate PAFs we also need a measure of the risk associated with the target factor(s). This may involve searching the literature to find relative risk ratios applicable to the population in question. Relative risk ratios in the literature can vary greatly, so in some cases one may want to use an average.

The next step is calculating the PAF values. The formula for calculating PAF is:

$$\frac{Pe\,(RR-1)}{Pe\,(RR-1)+1}$$

Pe = the estimated proportion of the population that is exposed to the risk factor (e.g., as indicated in the CCHS)

RR = the relative risk estimate for disease/condition among persons exposed to the risk factor of interest (identify the best available estimate from the literature)

Table 2 shows a sample of PAF calculations for Ontarians. For example, it shows that obesity is associated with 19% of heart disease among people this age group, 20-31% of stroke and 53% of diabetes, etc. Of the five behavioural risk factors shown in Table 2 (obesity, inactivity, smoking, unhealthy diet and alcohol), the greatest PAF for heart disease is associated with inactivity (50%).

Table 2: Population Attributable Fraction (PAF) for specific risk factors for Ontarians

	Obesity	Inactivity	Smoking	Unhealthy diet	Alcohol
Prevalence of factor in Ontario, % (a)	32.6	49.8	20.1	30.0	19.3
Heart disease	19.2	31.0	23.1	16.9	
Stroke (b)	19.6-30.9	45.8	10.9-42.4	1.8	10.4
Lung cancer			86.1		
Diabetes Type 2	52.7	16.7	11.3	15.0	

a Canadian Community Health Survey 200/01, ages 12 and older.

b From Mills et al, except diet.

It should be noted, however, that risk factor data from the CCHS can suggest associations but are not evidence of causation. In addition, as the data are based on post-diagnosis behaviour (after the fact), they may be more useful for disease management than primary prevention. These data must be interpreted and used cautiously when the intent is primary prevention planning.

See Appendix Table 7 for Ontario data on risk factors among those with selected chronic conditions. Data same as in Appendix Table 4.

Overall Summary of Methods for Decision Tool

Step 1 Select the disease(s) of interest

- To identify disease(s) of interest, utilize available health data and stakeholder opinion

Step 2 Select the indicators of burden of illness, including both health and economic impacts

- Utilize the list of criteria given here or add others for which there are data for all diseases you want to examine/compare or for which reasonable values can be imputed

Step 3 Calculate comorbidities (see Section 3)

Step 4 Calculate disease rankings using the PVA or the SRA, as described in this document

Step 5 Supplement conclusions with information on the softer indicators such potential for intervention, stakeholder interest, and local priorities.

Step 6 Examine comorbidity and risk factors for each of the conditions of interest

Step 7 Examine clusters of conditions by common risk factors and determine the impact of addressing them

Calculate PAF, as described in this document

Abbreviations used

CDPM: Chronic disease prevention and management

SRA: Sum of Ranking Approach

PVA: Product of Value Approach

CCHS: Canadian Community Health Survey

COPD: Chronic obstructive pulmonary disease

IHD: Ischemic heart disease

AMI: Acute myocardial infarction

HIV: Human immuno virus

AIDS: Acute immune deficiency syndrome

BMI: Body mass index

DALY: Disability Adjusted Life Years

QOL: Quality of life: e.g. Quality of Life

DFLE: Disability free life expectancy

HALE: Health adjusted life expectancy

HUI: Health Utility Index

PHPDB: Ontario's Provincial Health Planning Database

PAF: Population Attributable Fraction

PAC wt: Prospective complications adjustment weight as a measure of resource intensity for hospitalization

CACS wt: resource intensity measure for emergency visits

EMG: Emergency

PYLL: Person years of life lost

Appendix

Table 1: Criteria for Setting Chronic Disease Priorities

- Burden of illness: e.g. prevalence, incidence, comorbidity, mortality, hospitalization, emergency visits, physician care, long-term care, other health system burden
- Trends in burden
- Quality of life: e.g. Quality of Life (QOL); Disability free life expectancy (DFLE); Health adjusted life expectancy (HALE); Health Utility Index (HUI)
- Cost:
  - Direct cost to health system, including resource utilization (PAC wt, CACS wt)
  - Indirect cost: mortality and productivity, PYLL
- Potential for intervention
  - Care gaps: extent of care gaps
  - Evidence of modifiable risk factors
  - Evidence of effective best practices for intervention at prevention and management
- Stakeholder interest
- Current MOHLTC priorities and funding

Table 2a: Conditions List and Code Used – CCHS 2005 Data

Condition	Codes
Alzheimer's + Dementia	CCCE_181
Arthritis/Rheumatism	CCCE_051
Asthma	CCCE_031
Back problems	CCCE_061
Cancer, all	CCCE_131
Breast ca	CCCE_13A
Colorectal ca	CCCE_13C
Prostate ca	CCCE_13B
COPD	CCCE_91F
Mood dis /Depression >=2wks	CCCE_280
Diabetes M or type 2	CCCE_101
Epilepsy	CCCE_111
Heart disease (Angina AMI CHF other)	CCCE_121
Hypertension	CCCE_071
Hyperlipidemia	NA
Multiple sclerosis	NA
Obesity BMI >=25	HWTEDISW
Osteoporosis	NA
Parkinson's disease	NA
Stroke	CCCE_151
Urinary incontinence	CCCE_161
Bowel disorder	CCCE_171
Chronic fatigue syndrome	CCCE_251
Fibromyalgia	CCCE_041
Stomach/intestinal ulcers	CCCE_141
Chronic bronchitis	CCCE_91A
Emphysema	CCCE_91E
CRD (Ch Resp Dis)	CCCE_91AEF
Any chronic disease	CCCEF1
Risk factors	
BMI =>25 (codes3-6)	HWTEDISW
BMI=>30 (codes4-6)	HWTEDISW
regular drinker (1)	ALCEDTYP
daily smoker (1)	SMKEDSTY
Fruit and Vegetable <5aday (1)	FVCEGTOT
inactive (code3)	PACEDPAI
5+drinks reg (cd3-6)	ALCE_3
stressed (code4-5)	GENE_07

Table 2b: Diseases and ICD codes used

	Disease	ICD10 codes	ICD9 codes for OHIP	ISHMT codes	Becker codes
1	Alzheimer's disease	G300-G309	331	LCH_30	LCD_29
2	Arthritis *	M0000-M8948 (with certain exclusions**), R262 R294	714 715 716 717 718 719 720 721	LCH_080, 081, 083, 085, 086	LCD_52
3	Asthma	J4500-J4591	493	LCH_055	
4	Atherosclerosis	I700-I709	440	LCH_046	LCD_43
5	Back Pain	M540-M544 M545 M546 M548 M549	-	LCH_087	
6	Bowel Disorder (IBS, Crohn's, colitis)	K580, K589, K500-K522	555 556	LCH_065 066 068	~~LCD_50~~
7	Breast cancer	C5000-C5099	174	LCH_010	LCD_17
8	Cancer, any	ICD10 Chapter 02 (C0000-D489)	153 154 162 172 173 174 185		LCD_08 - LCD_24 66 (include residual; prefer ICD10)
9	Chronic Fatigue, Malaise	R53	-		
10	Chronic Bronchitis	J40, J410, J42, J47	491		
11	Colo-rectal cancer	C18-C21 C26.0	153-154	LCH_007	LCD_10
12	Congestive Heart Failure/HT heart dis w CHF	I500-I509 I110 I130 I132	428	LCH_044	LCD_41
13	COPD	J441-J449	494 496		
14	CRD (COPD +Bronchitis+Emphysema)	J40-J47	490 491492, 494 495 496	LCH_054	LCD_47
15	Depression	F320-F339	311	LCH_028 (exclude F30 F31 F34 F38 F39)	
16	Diabetes type 1 and type 2	E100-E149	250	LCH_022	LCD_26
17	Emphysema	J431, J432, J438, J439	492		
18	Epilepsy	G400-G419	345	LCH_032	LCD_32
19	Falls Non-trauma (slip, fall from chair, bed, in building etc.)	W00, W01, W05-W10, W13, W17-W19	~~805 829~~		
20	Fibromyalgia	M797	-		
21	Fractures	CONTAINS S12 S22 S32 S42 S52 S62 S72 S82 S92 T01 T10 T12	805-829 (Fall related fracture injury codes: E880-E888)		
22	Gastric Ulcer	K250-K286		LCH_060	

	Disease	ICD10 codes	ICD9 codes for OHIP	ISHMT codes	Becker codes
23	Gout	Included in arthritis	274		
24	Heart disease, any (w/o hypertension)	I200-I259 I500-I509 I110 I130 I132	410 411 412 413 414 428	LCH_039 040 041 042 044	LCD_33 36 37 38 40 35 39 41 (include some residual codes)
25	Hyperlipidemia	E780-E784	-		
27	Hypertension/HT heart disease w/o CHF	I10 I110 I120 I119 I129-I132 I139	401-405	LCH_038	LCD_34
28	IHD (Angina, AMI)	I200-I259	410 411 412 413 414	LCH_039 040 041	LCD_35
29	Incontinence	N393, N3930, N3939	-		
30	Lung cancer	C33-C3499	162	LCH_008	LCD_15
31	Migraine headaches	G430, G431, G433, G438, G439	346		
32	Multiple sclerosis	G35	340	LCH_031	
33	Obesity	E65-E669	278		
34	Osteoporosis		733		
35	Parkinson's disease	G20-G22	332		LCD_31
36	Prostate cancer	C61	185	LCH_013	LCD_20
37	Senile/dementia	F00-F03 G310 G311	290	LCH_24	
38	Skin cancer	C43-C449	172-173		
39	Stroke	I600-I698	430 431 432 433 434 435 436 437 438	LCH_045	LCD_42

For Hospitalization, Ambulatory_Emergency and Ambulatory_NonEmergency data: a combination of ICD10 and ISHMT codes.
For Mortality: a combination of ICD10 and Becker codes.
For OHIP: ICD9 based billing codes.
ICD10 codes were used for conditions which did not have a specific ISHMT or Becker code available.
*ICD10 codes for Arthritis: M0000-M1129, M1200-M199, M220-M4059, M45-M461, M4650-M4700, M491-M494, M6000-M7999, M966-M9999
** See paper by Genest J et al CMAJ 2003.
For additional information on data sources, refer to Ontario Health Planning Data Guide, and the Ontario Health Planning Survey Guide, and the Health Analyst's Toolkit

Tables 3, page 1 of 3: An Example of Priority Setting Decision Tool for Ontario*

	Criteria	Prevalence		Comorbidity		Hospitalization		Emergency		AMB Non_Emergency		OHIP		Mortality	
	Condition	CCHS2005 %prevalence age12+	Rank**	% prev as comorbidity w 22other	Rank (based on average of	Counts F2006 icd10	Rank	Counts F2006	Rank	Counts F2006	Rank	Counts	Rank	2004CY Counts	Rank
1	Alzheimer's + Dementia	0.40	28	1.4	25	3,138	20	3,186	19	30	28	912,046	9	3,649	6
2	Arthritis/Rheumatism	17.23	3	40.9	2	44,326	4	77,152	3	28,709	3	2,364,100	4	511	17
3	Asthma	8.02	5	11.7	9	6,801	13	68,382	5	309	20	1,486,039	6	82	25
4	Atherosclerosis	1.70	17	1.0	27	1,425	25	265	29	864	16	80,339	26	422	18
5	Back problems	19.48	2	33.7	3	1,679	24	105,582	1	8,403	8	100	27		30
6	Cancer, All	1.49	19	3.9	20	73,562	2	15,321	17	60,643	1	1,134,273	7	21,971	1
7	Breast ca	0.90	22	2.2	23	4,457	16	783	24	7,571	9	291,225	17	1,952	11
8	Colorectal ca	0.39	30	0.6	30	8,023	12	1,053	22	6,390	10	295,439	16	3,084	9
9	Lung ca	0.40	29	1.0	28	5,933	14	3,167	20	3,925	12	241,447	20	5,970	4
10	Prostate ca	0.69	25	1.5	24	5,061	15	653	25	3,555	13	306,162	15	1,376	13
11	COPD	0.75	23	2.4	22	33,700	6	36,879	10	185	23	371,854	14	2,888	10
12	Mood dis/Depression	6.04	6	14.3	7	3,201	19	35,972	11	5,692	11	1,123,415	8	40	28
13	Diabetes	4.83	7	11.6	10	13,216	11	28,062	13	9,032	7	3,167,744	2	3,117	8
14	Epilepsy	0.52	27	1.2	26	3,247	18	5,100	18	43	27	193,989	21	74	26
15	Heart disease, All	4.83	8	15.3	5	79,471	1	67,675	6	28,140	4	2,566,109	3	19,003	2
16	IHD (Angina AMI)	3.70	11	10.0	11	56,184	3	39,141	8	27,710	5	1,973,438	5	15,593	3
17	Cong. Heart failure	0.70	24	1.0	29	20,288	7	26,113	14	289	21	592,671	12	1,470	12
18	Hypertension	15.42	4	32.7	4	2,499	22	20,237	15	1,141	15	4,098,715	1	719	15
19	Hyperlipidemia	2.42	16	15.0	6	4	32	68	31	15	31	100	28	64	27
20	Multiple sclerosis	0.21	32	0.1	31	497	30	941	23	139	25	103,210	25	133	22
21	Obesity BMI >=25	49.84	1	56.0	1	821	28	128	30	394	19	399,750	13	86	24
22	Osteoporosis	3.90	10	4.0	19	16,510	10	40,934	7	10	32	254,654	19	1,049	14
23	Parkinson's disease	0.22	31	0.1	32	2,166	23	643	26	24	30	124,965	23	637	16
24	Stroke	1.14	21	4.1	18	17,720	9	15,849	16	242	22	768,802	10	5,673	5
25	Urinary incontinence	3.11	13	12.1	8	1,299	26	57	32	10,483	6	100	29	10	31
26	Bowel disorder	4.10	9	9.5	12	18,905	8	104,068	2	36,016	2	283,951	18	405	19
27	Chronic fatigue syndrome	1.29	20	5.4	16	2,979	21	30,395	12	161	24	10	30	12	29
28	Fibromyalgia	1.54	18	4.6	17	39	31	577	27	84	26	10	31	5	32
29	Stomach/intestinal ulcers	3.08	14	7.9	14	3,472	17	1,700	21	3,184	14	10	32	163	21
30	Chronic bronchitis	2.44	15	6.2	15	1,031	27	38,269	9	656	18	118,705	24	94	23
31	Emphysema	0.67	26	2.5	21	624	29	428	28	26	29	129,465	22	219	20
32	COPD+Emphysema+Chr. Bro	3.39	12	9.0	13	35,355	5	74,573	4	851	17	620,024	11	3,284	7
33	Any chronic disease	70.13				332,332		697,870		194,625		19,682,455		61,026	
	Total for Ontario, any cause					1,079,511		5,164,230		4,195,070		198,726,024		82,750	

*Highlighted areas indicate imputed values; * indicate missing data; ** Ranking among the 32 conditions listed;

Tables 3 contd, page 2 of 3: An Example of Priority Setting Decision Tool for Ontario

	Criteria	Resource utilization								Sum 11 Rankings
	Condition	PAC WT Hosp	Rank	CACS WT EMG	Rank	CACS WT NON_EMG	Rank	PYLL	Rank	Priority rank order 1=high 32=low
1	Alzheimer's + Dementia	12,526	14	267	20	1	30	273,700	6	21
2	Arthritis/Rheumatism	78,620	4	2,611	10	4,711	4	38,588	16	3
3	Asthma	4,213	18	3,010	6	12	23	6,115	24	11
4	Atherosclerosis	4,097	20	21	28	195	15	31,743	17	24
5	Back problems	1,671	25	2,674	9	698	9	10	29	14
6	Cancer, All	147,676	2	1,362	16	7,233	3	1,642,572	1	4
7	Breast ca	4,928	16	61	23	1,853	7	145,489	11	16
8	Colorectal ca	20,514	11	92	22	528	10	230,849	9	17
9	Lung ca	13,824	13	300	19	472	11	446,022	4	15
10	Prostate ca	7,024	15	48	26	300	14	103,004	13	19
11	COPD	33,700	7	3,326	5	13	22	216,616	10	10
12	Mood dis/Depression	4,192	19	1,789	13	361	12	2,988	27	12
13	Diabetes	23,645	10	1,534	15	2,406	6	233,914	8	5
14	Epilepsy	3,721	21	361	18	7	25	5,485	25	27
15	Heart disease, All	149,370	1	8,907	1	10,967	1	1,431,062	2	1
16	IHD (Angina AMI)	112,416	3	5,756	2	10,754	2	1,174,453	3	2
17	Cong. Heart failure	32,671	9	2,849	7	187	16	110,364	12	13
18	Hypertension	3,524	22	885	17	59	19	54,341	14	9
19	Hyperlipidemia	4	32	2	32	1	32	4,765	26	31
20	Multiple sclerosis	1,015	28	54	24	7	26	9,863	21	30
21	Obesity BMI >=25	821	29	7	30	60	18	6,377	23	23
22	Osteoporosis	33,000	8	2,709	8	1	31	10	30	18
23	Parkinson's disease	2,166	24	50	25	1	29	47,790	15	28
24	Stroke	46,882	5	2,177	11	41	21	426,685	5	8
25	Urinary incontinence	1,299	26	2	31	1,128	8	1	31	25
26	Bowel disorder	19,342	12	5,061	3	2,872	5	30,351	18	7
27	Chronic fatigue syndrome	2,979	23	1,615	14	9	24	900	28	26
28	Fibromyalgia	39	31	9	29	2	28	1	32	32
29	Stomach/intestinal ulcers	4,236	17	108	21	306	13	12,376	20	20
30	Chronic bronchitis	1,031	27	1,832	12	59	20	7,024	22	22
31	Emphysema	624	30	33	27	2	27	16,561	19	29
32	COPD+Emphysema+Chr. Bro	35,355	6	4,988	4	74	17	246,389	7	6
33	Any chronic disease	580,393		40,405		31,152		4,499,838		
	Total for Ontario, any cause	1,358,045		228,863		323,947		6,215,134		

Tables 3 contd, page 3 of 3: An Example of Priority Setting Decision Tool for Ontario

	Criteria	Potential for Intervention			Stakeholders Interest			MOHLTC Priorities	
	Description	Care gaps exist in ON, know type	Modifiable risk factors known^*	Evidence for effective clinical management	NGOs	in OMA negotiations	Priority of LHINs (TBD)	Strategy & funding $M (05/06)	Initiatives & funding &M (05/06)
1	Alzheimer's + Dementia	X	-	X	X				
2	Arthritis/Rheumatism	X	-	X	X				
3	Asthma	X	X	X	X				
4	Atherosclerosis	*	X	X					
5	Back problems	*	X	X					
6	Cancer (Any)	X	X	X	X	X			
7	Breast ca	X	X	X	X				
8	Colorectal ca	X	X	X	X				
9	Lung ca	*	X	-	X				
10	Prostate ca	X	X	-	X				
11	COPD	X	X	X	X				
12	Mood dis/Depression	X	?	X	X				
13	Diabetes	X	X	X	X	X			
14	Epilepsy	*	*	-					
15	Heart disease, All	X	X	X	X	X			
16	IHD (Angina AMI)	X	X	X	X				
17	Cong. Heart failure	X	*	X					
18	Hypertension	X	X	X	X				
19	Hyperlipidemia	*	X	X					
20	Multiple sclerosis	*	*	*					
21	Obesity BMI >=25	X	X	X	X				
22	Osteoporosis	X	X	X	X				
23	Parkinson's disease	*	-	X					
24	Stroke	X	X	X	X				
25	Urinary incontinence	-	-	X					
26	Bowel disorder	X	X	X	X				
27	Chronic fatigue syndrome	X			X				
28	Fibromyalgia	X			X				
29	Stomach/intestinal ulcers	X	X	X	X				
30	Chronic bronchitis	X	X	X	X				
31	Emphysema	X	X	X	X				
32	COPD+Emphysema+Chr. Brc	X	X	X	X				
33	Any chronic disease								
	Total Ontario, any cause								

Table 4, page 1 of 2: Comorbidity prevalence of 24 chronic conditions and behavioural risk factors in Ontario

	Criteria	CCHS 2005 Prevalence		Comorbidity - Prevalence of other disease and risk factors in those with any one disease										
	Condition	Ontarians age 12+	Those have a CD	Alzheimer's + Dementia	Arthritis/Rheumatis	Asthma	Back problems	Cancer (All)	Breast ca	Colorectal ca	Prostate ca	COPD	Depression >=2wks	Diabetes M or type 2
1	Alzheimer's + Dementia	0.40	0.57	100.00	1.07	0.12	0.56	1.18	1.91	1.89	1.02	6.15	1.35	1.23
2	Arthritis/Rheumatism	17.23	24.67	46.72	100.00	23.11	35.24	41.31	52.58	50.63	39.84	48.08	30.86	40.57
3	Asthma	8.02	11.49	2.51	10.76	100.00	11.66	8.05	11.38	6.22	4.59	22.24	15.15	10.11
5	Back problems	19.48	27.88	27.23	39.76	28.31	100.00	34.49	28.20	25.02	31.14	33.71	37.84	27.53
6	**Cancer, all**	1.49	2.14	4.42	3.58	1.50	2.64	100.00	25.84	32.69	49.66	7.16	2.30	3.80
7	Breast ca	0.90	1.17	4.34	2.76	1.28	1.30	15.82	100.00	0.62		1.07	1.16	2.42
8	Colorectal ca	0.39	0.53	1.86	1.15	0.30	0.50	8.64	0.27	100.00	0.86	1.25	0.24	2.23
10	Prostate ca	0.69	0.89	1.76	1.60	0.39	1.10	22.98	100.00	1.51	100.00	2.24	0.88	1.96
11	COPD	0.75	1.07	11.74	2.09	2.08	1.30	3.60	0.88	2.38	2.44	100.00	1.85	2.97
12	Mood dis /Depression >=	6.04	8.64	20.60	10.79	11.41	11.74	9.29	7.76	3.65	7.66	14.87	100.00	9.06
13	Diabetes M or type 2	4.83	6.92	14.83	11.34	6.09	6.83	12.29	12.96	27.52	13.68	19.07	7.25	100.00
14	Epilepsy	0.52	0.74	3.54	0.98	0.91	0.74	1.22	1.20	0.10	0.11	0.93	1.20	1.04
15	**Heart disease, all**	4.83	6.91	27.02	13.19	5.68	8.19	18.25	13.79	18.59	22.95	40.48	7.81	21.37
18	Hypertension	15.42	22.07	39.64	34.86	17.41	22.82	33.04	39.33	32.68	40.14	42.10	20.53	53.42
21	Obesity BMI >=25	49.84	52.69	50.83	62.97	53.74	56.85	52.62	50.91	43.62	65.81	61.30	55.30	72.88
24	Stroke	1.14	1.63	23.83	3.09	1.15	1.91	4.07	3.25	1.54	5.16	7.35	2.93	6.32
25	Urinary incontinence	3.11	4.46	36.20	9.74	4.74	6.93	14.53	12.85	5.87	24.05	13.41	7.79	8.55
26	Bowel disorder	4.10	5.87	13.97	9.41	8.07	8.29	7.12	10.12	5.15	3.40	11.93	11.55	6.34
27	Chronic fatigue syndrome	1.29	1.85	12.36	3.63	2.93	3.50	3.47	2.63	1.83	2.07	7.43	7.94	3.11
28	Fibromyalgia	1.54	2.21	2.63	5.84	3.66	4.36	3.47	4.56	0.69	0.08	6.06	6.97	3.59
29	Stomach/intestinal ulcers	3.08	4.40	10.93	6.68	5.50	6.45	4.19	2.94	3.41	5.07	7.86	9.12	4.77
30	Chronic bronchitis	2.44	3.50	3.91	5.59	11.54	5.76	6.31	5.40	1.64	2.57	26.13	6.67	4.12
31	Emphysema	0.67	0.95	7.99	1.79	1.81	1.36	3.40	1.93	2.50	4.61	24.13	2.02	1.67
32	CRD (Ch Resp Dis)	3.39	4.85	16.05	8.04	13.44	7.41	10.78	7.61	5.42	7.54	100.00	8.85	7.61
33	Any chronic disease	70.13	100.00	100.00	100.00	100.00	100.00	100.00	90.77	95.50	90.34	100.00	100.00	100.00
	Risk factors													
	BMI =>25 (codes3-6)	49.8	52.7	50.8	63.0	53.7	56.9	52.6	50.9	43.6	65.8	61.2	55.3	72.9
	BMI=>30 (codes4-6)	15.5	17.8	15.5	24.8	20.8	20.4	19.3	19.8	16.6	15.5	24.0	24.9	36.2
	regular drinker (1)	58.8	59.0	34.7	54.7	55.5	61.2	58.5	52.8	55.4	68.6	46.7	52.1	41.0
	daily smoker (1)	15.8	16.6	9.2	17.6	17.0	21.1	13.5	11.0	12.2	7.8	19.2	29.5	15.5
	fruit-veg <5aday (1)	56.6	56.3	58.1	54.5	55.3	57.7	47.9	42.6	39.5	51.1	64.4	62.9	53.8
	inactive (code3)	47.1	48.6	80.7	56.2	44.4	54.0	56.7	57.4	57.3	54.1	61.6	57.1	60.1
	5+drinks reg (cd3-6)	22.2	20.8	15.1	13.5	21.9	21.1	9.7	6.9	5.9	10.4	13.8	22.6	10.9
	stressed (code4-5)	21.7	24.2	30.6	23.9	25.5	31.0	27.1	15.9	9.8	14.6	26.7	44.4	20.5

Table 4 contd.., page 2 of 2: Comorbidity prevalence of 24 chronic conditions and behavioural risk factors in Ontario

	Criteria	CCHS 2005 Prevalence														
	Condition	Ontarians age 12+	Those have a CD	Epilepsy	**Heart dis (Angina AMI**	Hyperten sion	Obesity BMI >=25	Stroke	Urinary incontinence	Bowel disorder	Chronic fatigue	Fibromyalg ia	Stomach/i ntestinal	Chronic bronchitis	Emphysema	CRD
1	Alzheimer's + Dementia	0.40	0.57	2.74	2.24	1.01	0.44	8.30	4.65	1.35	3.82	0.68	1.42	0.63	4.80	1.89
2	Arthritis/Rheumatism	17.23	24.67	32.54	47.07	39.07	24.09	47.08	53.86	39.54	48.52	65.63	37.52	39.45	46.25	40.91
3	Asthma	8.02	11.49	14.18	9.44	9.04	8.20	8.13	12.21	15.76	18.24	19.01	14.36	37.82	21.83	31.82
5	Back problems	19.48	27.88	27.79	33.07	28.84	24.15	32.78	43.33	39.33	52.71	55.04	40.84	45.91	39.98	42.60
6	**Cancer, all**	1.49	2.14	3.55	5.60	3.19	1.79	5.34	6.97	2.59	4.01	3.37	2.03	3.85	7.64	4.76
7	Breast ca	0.90	1.17	2.10	2.58	2.31	1.01	2.58	3.73	2.24	1.84	2.68	0.86	2.00	2.62	2.03
8	Colorectal ca	0.39	0.53	0.07	1.51	0.83	0.39	0.53	0.74	0.49	0.56	0.18	0.43	0.26	1.47	0.63
10	Prostate ca	0.69	0.89	0.15	3.23	1.80	1.03	3.14	5.34	0.57	1.11	0.03	1.14	0.73	4.78	1.54
11	COPD	0.75	1.07	1.35	6.30	2.05	1.05	4.84	3.24	2.18	4.28	2.93	1.91	8.09	27.33	22.16
12	Mood dis /Depression >=	6.04	8.64	14.26	9.77	8.03	7.09	15.65	15.14	16.98	36.98	27.23	17.83	16.52	18.29	15.79
13	Diabetes M or type 2	4.83	6.92	9.72	21.31	16.70	7.83	26.87	13.28	7.46	11.60	11.25	7.50	8.15	12.10	10.86
14	Epilepsy	0.52	0.74	100.00	0.68	0.54	0.57	3.22	2.03	1.26	1.63	1.35	2.14	1.60	1.11	1.37
15	**Heart disease, all**	4.83	6.91	6.34	100.00	15.29	6.54	32.46	19.75	10.97	16.79	11.28	11.52	12.21	24.11	18.08
18	Hypertension	15.42	22.07	16.31	48.82	100.00	23.94	55.46	39.27	20.81	28.82	31.74	23.84	24.91	33.83	28.93
21	Obesity BMI >=25	49.84	52.69	56.00	60.80	69.76	100.00	60.49	59.56	51.14	54.05	58.73	56.11	54.36	46.62	55.18
24	Stroke	1.14	1.63	7.11	7.67	4.07	1.50	100.00	7.84	2.77	7.36	4.42	3.59	2.79	6.44	4.26
25	Urinary incontinence	3.11	4.46	12.31	12.70	7.90	4.08	21.48	100.00	12.12	20.02	13.90	10.44	9.45	13.31	10.13
26	Bowel disorder	4.10	5.87	10.00	9.35	5.55	4.55	9.95	16.07	100.00	20.98	25.90	18.82	9.92	8.58	9.52
27	Chronic fatigue syndrom	1.29	1.85	40.70	4.51	2.38	1.55	8.37	8.32	6.64	100.00	25.78	6.11	5.55	6.09	5.39
28	Fibromyalgia	1.54	2.21	4.04	3.60	3.18	1.99	6.02	6.88	9.73	30.44	100.00	6.01	5.31	5.20	5.21
29	Stomach/intestinal ulcers	3.08	4.40	12.86	7.32	4.74	3.75	9.69	10.33	13.97	14.48	11.97	100.00	10.29	12.46	9.61
30	Chronic bronchitis	2.44	3.50	7.60	6.16	3.94	2.82	5.99	7.43	5.92	10.47	8.39	8.17	100.00	24.45	72.07
31	Emphysema	0.67	0.95	1.44	3.30	1.46	0.67	3.76	2.84	1.39	3.12	2.24	2.60	6.65	100.00	19.66
32	CRD (Ch Resp Dis)	3.39	4.85	9.04	12.64	6.36	4.04	12.69	11.02	7.87	14.09	11.42	10.52	100.00	100.00	100.00
33	Any chronic disease	70.13	100.00	100.00	100.00	100.00	76.52	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
	Risk factors															
	BMI =>25 (codes3-6)	49.8	52.7	56.0	60.8	69.8	100.0	60.5	59.6	51.1	54.1	58.7	56.1	54.4	46.6	55.2
	BMI=>30 (codes4-6)	15.5	17.8	19.7	23.2	29.2	31.1	22.0	24.5	18.2	21.1	24.5	20.8	24.2	15.9	22.9
	regular drinker (1)	58.8	59.0	48.3	52.1	53.8	64.2	38.9	49.3	57.3	43.0	43.6	57.7	53.6	47.0	52.2
	daily smoker (1)	15.8	16.6	22.0	11.9	13.5	16.5	19.2	13.3	18.1	24.5	22.1	26.1	35.4	25.3	30.8
	fruit-veg <5aday (1)	56.6	56.3	51.3	52.8	54.9	59.5	58.4	53.9	56.9	60.3	55.2	62.6	58.8	62.2	59.8
	inactive (code3)	47.1	48.6	21.3	58.1	18.2	52.0	62.9	61.9	52.6	61.4	64.0	53.9	56.5	65.9	58.0
	5+drinks reg (cd3-6)	22.2	20.8	12.2	9.7	14.7	22.5	11.0	7.9	17.2	14.0	12.8	29.0	20.9	18.5	19.5
	stressed (code4-5)	21.7	24.2	23.1	21.1	22.5	24.0	25.0	28.5	71.6	44.7	38.6	36.2	34.2	23.7	31.2

Prevalence of Comorbid Conditions in Ontarians Reporting one of the 12 Selected Chronic Conditions CCHS 2003 data

	Ontario Prevalence	Prevalence as a Comorbid Condition	Rank as a Cormorbid Condition	Top 3 Comorbid Conditions with this disease
	%	Range%		
Arthritis	17.5	23.2 - 52.9	1 high	Back problem, high BP, heart dis
Back problem	20.2	28.0 - 41.5	2	Arthritis, high BP, asthma
High blood pressure	14.8	16.4 - 61.5	3	Arthritis, back, heart dis
Heart disease	5.3	6.3 - 43.9	4	Arthritis, high BP, back
Asthma	8.3	6.2 - 37.2	5	Back problem, arthritis, high BP
Diabetes	4.6	6.0 - 22.6	6	High BP, arthritis, back, heart dis
Chronic bronchitis	2.7	4.4 - 25.7	7	Arthritis, back, asthma
Gastric ulcers	2.8	4.0 - 15.4	8	Back problem, arthritis, high BP
Bowel disorders	2.4	3.7 - 13.4	9	Arthritis, back, high BP
Cancer	1.8	1.3 - 7.8	10	Arthritis, back, high BP
Stroke	1.0	1.3 - 8.3	11	High BP, arthritis, heart dis
COPD	1.0	2.0 - 9.7	12 low	Arthritis, back, heart dis

Among those reporting at least one of these, 53% have one only, 26% have 2 only, and 20% have 3 or more conditions

Number of Chronic Conditions and Selected Health - Related Problems/Needs and Health Services Use (CCHS 2000/01)[13]

	Number of Chronic Conditions			
Selected Health-Related Problems/Needs	None	One	Two	Three+
	%	%	%	%
Activities limited due to a health problem	5	16	30	55
One or more disability days in past two weeks	9	14	18	30
Pain prevents a few, some or most activities	2	6	15	34
Moderate or Severe Pain or Discomfort	2	6	13	31
Consulted a Medical Doctor in past 12 months	73	83	90	95
Average Number of Doctor Consultations in past 12 months	2	4	5	9
Overnight Patient in past 12 months	3	7	8	14
Self-perceived unmet health care needs	7	11	14	20

* MOHLTC

Figure 1: The relationships between chronic disease risk factors

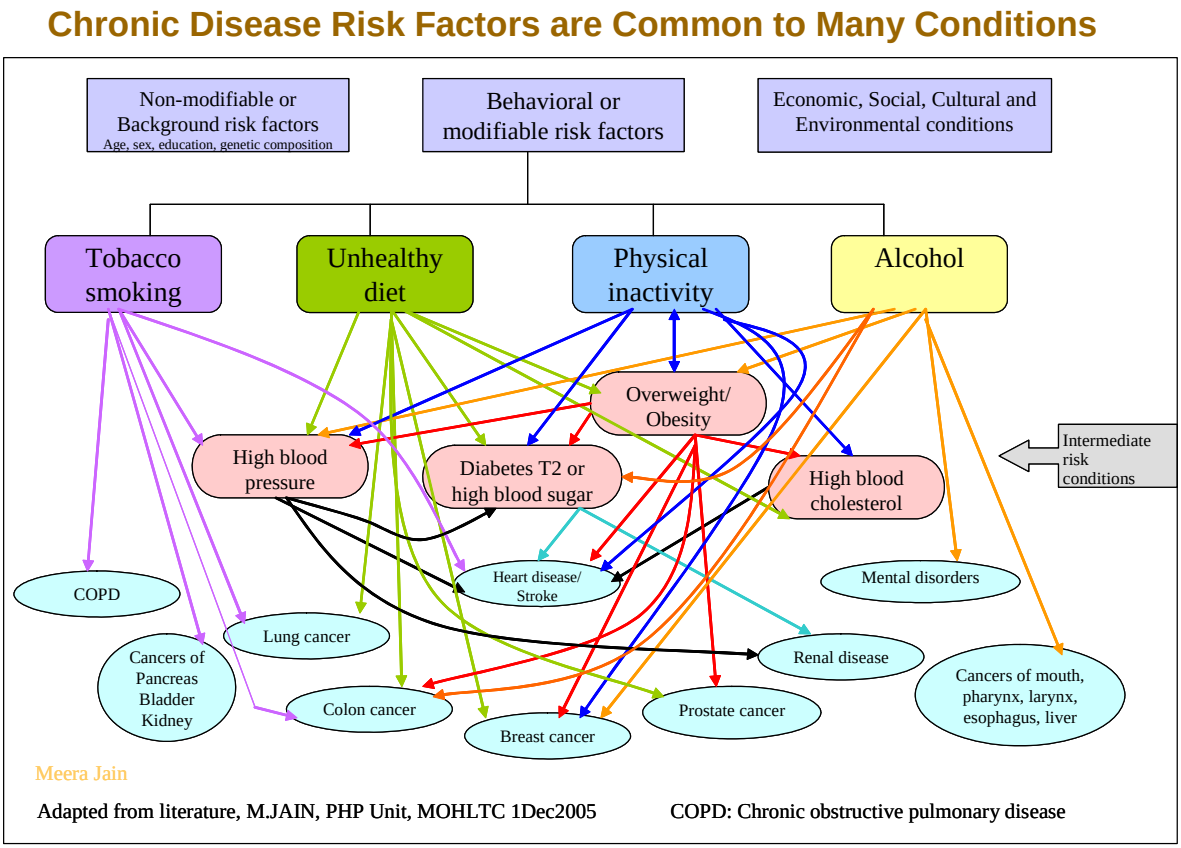

Table 7: Prevalence of behavioural risk factors among Ontarians reporting any of the 24 chronic conditions*

Description		CCHS2005 %prev MF	Alzheimer's +	Arthritis/Rheu	Asthma	Back problem	**Cancer (Any)**	Breast ca	Colorectal	Prostate ca	COPD	Depression >	Diabetes M o
BMI =>25 (codes3-6)	HWTEDISW	49.8	50.83	62.97	53.74	56.85	52.62	50.91	43.62	65.81	61.23	55.30	72.88
BMI=>30 (codes4-6)	HWTEDISW	15.5	15.54	24.83	20.80	20.42	19.27	19.80	16.56	15.45	23.99	24.89	36.21
regular drinker (1)	ALCEDTYP	58.8	34.65	54.70	55.54	61.21	58.50	52.81	55.42	68.56	46.74	52.10	41.02
daily smoker (1)	SMKEDSTY	15.8	9.23	17.55	16.99	21.12	13.47	10.99	12.15	7.84	19.23	29.53	15.49
FV<5aday (1)	FVCEGTOT	56.6	58.10	54.46	55.27	57.66	47.86	42.64	39.48	51.09	64.38	62.87	53.84
inactive (code3)	PACEDPAI	47.1	80.70	56.23	44.35	53.95	56.71	57.37	57.33	54.14	61.57	57.05	60.12
5+drinks reg (cd3-6)	ALCE_3	22.2	15.13	13.51	21.88	21.09	9.67	6.85	5.92	10.38	13.82	22.55	10.94
stressed (code4-5)	GENE_07	21.7	30.57	23.85	25.53	30.96	27.08	15.93	9.83	14.57	26.65	44.40	20.49

Description		CCHS2005 %prev MF	Epilepsy	**Heart dis (Angina AMI**	Hypertension	Obesity BMI	Stroke	Urinary incon	Bowel disorde	Chronic fatigu	Fibromyalgia	Stomach/inte	Chronic bron	Emphysema	CRD
BMI =>25 (codes3-6)	HWTEDISW	49.8	56.00	60.80	69.76	100.00	60.49	59.56	51.14	54.05	58.73	56.14	54.36	46.62	55.18
BMI=>30 (codes4-6)	HWTEDISW	15.5	19.65	23.18	29.15	31.08	22.01	24.46	18.17	21.05	24.46	20.82	24.17	15.87	22.93
regular drinker (1)	ALCEDTYP	58.8	48.25	52.11	53.79	64.23	38.86	49.25	57.34	43.03	43.56	57.74	53.56	46.97	52.18
daily smoker (1)	SMKEDSTY	15.8	21.97	11.85	13.54	16.48	19.16	13.33	18.05	24.50	22.05	26.05	35.44	25.33	30.78
FV<5aday (1)	FVCEGTOT	56.6	51.33	52.77	54.91	59.45	58.39	53.91	56.88	60.33	55.15	62.61	58.76	62.20	59.82
inactive (code3)	PACEDPAI	47.1	21.26	58.13	18.19	52.01	62.88	61.92	52.63	61.40	63.97	53.87	56.45	65.90	57.96
5+drinks reg (cd3-6)	ALCE_3	22.2	12.17	9.68	14.71	22.54	11.01	7.93	17.20	14.02	12.81	28.99	20.85	18.45	19.47
stressed (code4-5)	GENE_07	21.7	23.13	21.09	22.54	24.03	25.00	28.51	71.59	44.65	38.62	36.15	34.17	23.70	31.23

*Data source: CCHS 2005

Note: Data on risk factors is be interpreted cautiously: it is not causal and reflects behaviour in those with a disease