Port Colborne

Community Health Assessment Project (CHAP)

Protocol "C":

A Comparison of Hospitalization Patterns in Port Colborne to the General Population of Ontario.

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Protocol Synopsis

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TITLE	A Comparison of Hospitalization Patterns in Port Colborne to the General Population of Ontario.
SPONSOR	INCO Corporation.
STUDY SITE	Port Colborne, Ontario.
PRIMARY OBJECTIVE (S)	To determine whether the patterns of hospitalization for respiratory disease in the Port Colborne community are different than expected.
DESIGN AND METHODOLOGY	Using information from the discharge abstract database of the Canadian Institute for Health Information, rates of hospital separations for non-malignant respiratory diseases will be compared among residents of Port Colborne to the Ontario population. Denominator data for the rates will be obtained from population estimates from the Canadian census.
POPULATION	Historical data of residents of Port Colborne and Ontario.
SUBJECT PARTICIPATION	There will be no direct participation of Port Colborne residents, as the occurrence of health outcomes will be identified using existing databases.
OUTCOME MEASURES	Hospital separations for non-malignant respiratory diseases will be compared between Port Colborne and Ontario residents.
DATA COLLECTION & ANALYSES	The hospitalization rate due to non-malignant respiratory diseases will be calculated using data from the discharge abstract database of Canadian Institute of Health Information between 1994-1999 and Canadian census data. These rates will be calculated for both Port Colborne and for the remainder of Ontario. The standardized morbidity ratio is defined as the number of observed hospitalizations by the number of expected events (based on the age- and sex- specific rates for Ontario). Statistically significant differences will be assessed by examining the confidence intervals of the standardized morbidity ratio that assume that the discharges follow a Poisson distribution.

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Abbreviations

CHAP	Community Health Assessment Project
CIHI	Canadian Institute of Health Information
CoCs	Chemicals of Concern
DAD	Discharge Abstract Database
ICD	International Classification of Disease
OHIP	Ontario Health Insurance Plan
SMBR	Standardized Morbidity Ratio

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1.0 Rationale

Respiratory disease represents a significant health burden in Canada with over 10% of Canadians suffering from serious respiratory diseases [1]. These diseases include: chronic obstructive pulmonary disease, influenza and pneumonia, bronchiolitis, tuberculosis, cystic fibrosis and respiratory distress syndrome. Associations between the Chemicals of Concern (CoCs) and many of these diseases have been observed in the scientific literature, although mainly with respect to occupational exposure. These diseases can affect people of all ages.

Respiratory diseases account for a large number of hospitalizations. In 1998, respiratory diseases were the third most common main diagnosis contributing to hospitalization among both men and women in Canada [1].

1.1 Public concern and scientific evidence

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The residents of Port Colborne have been potentially exposed to CoCs, and there is a concern among the residents that these metals may contribute to the incidence of respiratory disease. There is evidence in the scientific literature of possible associations between respiratory illness and the CoCs in the occupational setting and in section 2.0 the results from these studies are summarized.

1.2 Rationale for use of CIHI's Discharge Abstract Database

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The Canadian Institute for Health Information (CIHI) maintains a large administrative database, the Discharge Abstract Database (DAD), which contains hospital discharge

data for Ontario hospitals since 1979. If admitted due to respiratory illness, a diagnosis of respiratory illness will be indicated in the CIHI database under "most responsible diagnosis". Place of residence (postal code) is also available from CIHI, and this will permit the comparison of Port Colborne respiratory illness admission rates with that of Ontario. Additionally, residence can also be identified using regional codes from the Ontario Ministry of Long-term care that are also in the database. These codes are, for purposes of this study, complete for data between 1994 and 1999. Other variables available include demographic characteristics of the patient, date of admission, and the diagnosis most responsible for admission. Secondary diagnoses are also available in the database; however, they are not regarded as being as reliable.

2.0 Relationship Between CoCs and Respiratory Disease

A case of pulmonary fibrosis in a young man who had worked at a steel mill and died of respiratory failure due to interstitial fibrosis was reported by Leem et al. [2]. The levels of nickel and cobalt in the patient's lung tissue were higher relative to the control population. Lubin et al. [3] followed 8,014 male workers who were employed for 12 months or more at a copper smelter. Significantly increased standardized mortality ratios were found for non-malignant respiratory diseases and emphysema. A wide range of chronic diseases including many respiratory diseases, such as, emphysema, chronic obstructive pulmonary disease, and fibrosis also occur after exposure to metal fumes and dusts [4]. In addition, cobalt metal particles, when inhaled in association with other agents such as metallic carbides (hard metals), may produce an interstitial lung disease termed "hard metal disease" or "cobalt lung" [5].

Exposure to cobalt occurs most commonly via the skin, but ingestion and inhalation exposures are also possible. Exposure to cobalt may increase the risk of adverse health effects related to the respiratory organs, hematopoietic tissues, the myocardium, and the thyroid gland [6].

3.0 Objective of Respiratory Illness Study

To compare the incidence rates of hospital separation rates for non-malignant respiratory disease between Port Colborne and Ontario between 1994 and 1999.

4.0 Study Design and Methods

This study makes use of an ecological design, where the unit of analysis is not the individual person, by an aggregate of individuals. The study compares hospitalization separation rates for non-malignant respiratory diseases between Port Colborne and Ontario over the period 1994-1999.

5.0 Study Population

The study population consists of historical data regarding residents of Port Colborne who have been admitted to a hospital with a non-malignant respiratory condition between 1994 and 1999. The Ontario population will be used for comparative purposes.

5.1 Participant selection

Admissions for non-malignant respiratory diseases will be identified using the DAD of CIHI. Individuals admitted for non-malignant respiratory disease based on International Classification of Disease (ICD) codes between 460-519 will be used to generate hospital separation rates. Only hospital separation data from 1994 to 1999 will be used. The quality of the database before this time is compromised with the duplication of Ontario Health Insurance Plan (OHIP) numbers. In addition, there is less complete information regarding location of residence.

5.2 Comparison/Control group

Hospital separation rates for Port Colborne will be compared to hospital separation rates for Ontario.

6.0 Outcome Measures

Hospital admissions rates for non-malignant respiratory disease based on CIHI's DAD will be used to derive rates for both Port Colborne and Ontario. Non-malignant Respiratory disease (ICD 460-519) includes admissions for acute respiratory infections (460-466), diseases of the upper respiratory tract (470-478), pneumonia and influenza (480-487), chronic obstructive pulmonary diseases and allied conditions (490-496), pneumoconiosis and other lung diseases (500-508), and other diseases of the respiratory system (510-519). Although asthma has been linked to several CoCs, we are unable to restrict our analysis specifically to this condition due to an expected small number of cases.

Population data for both Port Colborne and the province of Ontario will be obtained from Canadian census data. These data will be obtained within strata defined by 5-year age-groupings and sex in order to adjust comparisons for differences in these characteristics of the two populations.

7.0 Data Collection and Analysis

7.1 Sample size calculations

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The precision of the Standardized Morbidity Ratio (SMBR) to be derived from these analyses will be based on estimated number of hospital separations due to non-malignant respiratory disease. Using age-specific published values for non-malignant respiratory hospitalization rates from CIHI, and the population counts obtained from the 1991 Canadian census, a weighted rate for Port Colborne was calculated. This weighted rate adjusts for differences in the age and sex distribution of the city relative to Ontario. This age and sex adjusted hospital separation rate for non-malignant respiratory disease in Port Colborne was calculated to be 1223.8 per 100,000. Therefore, over a period of 6-years (1994-1999), an estimated 1,469 hospital separations should occur from non-malignant respiratory disease. It is important to note that these are not independent events, as some individuals with chronic respiratory problems will be admitted multiple times. Nonetheless, based on tables below, this number will provide sufficient power to make meaningful comparison to Ontario rates.

Table 7.1 5% and 1% points of the Poisson distribution for different values of the mean. The numbers tabulated are the smallest integers for which the probability of being equaled or exceeded is less than 5% and 1% [designated C(E, 0.05) and C (E,0.01)], respectively.

Mean of Poisson distribution, E	C(E,0.05)	C(E,0.01)	Mean E	C(E,0.05)	C(E,0.01)
1	4	5	20	29	32
2	8	7	25	34	38
3	7	9	30	40	44
4	9	10	35	46	50
5	10	12	40	52	56
6	11	13	45	57	62
7	13	15	50	63	68
8	14	16	60	74	80
9	15	18	70	65	91
10	16	19	80	96	103
11	18	20	90	107	114
12	19	22	100	118	125
13	20	23			
14	21	24			
15	23	26			

Source: Breslow and Day. Statistical Methods in Cancer Research. The Design and Analyses of Cohort Studies (1987)

Table 7.3 Comparison with an external standard
True value of the relative risk required to have given power of achieving a result significant at the 5% level (one-sided), for varying values of the expected value E assuming no excess risk (R=1)

Expected cases	Probability of detecting significance[p<0.05] difference				
(R=1)	0.50	0.80	0.90	0.95	0.99
1.0	3.67	5.52	6.68	7.75	10.05
2.0	2.84	3.95	4.64	5.26	6.55
3.0	2.22	3.03	3.51	3.95	4.86
4.0	2.17	2.84	3.25	3.61	4.36
5.0	1.93	2.50	2.84	3.14	3.76
6.0	1.78	2.28	2.57	2.83	3.36
7.0	1.81	2.27	2.64	2.78	3.26
8.0	1.71	2.13	2.37	2.58	3.02
9.0	1.63	2.01	2.24	2.43	2.83
10.0	1.57	1.92	2.13	2.31	2.67
11.0	1.61	1.95	2.15	2.32	2.66
12.0	1.56	1.88	2.06	2.22	2.55
13.0	1.51	1.82	1.99	2.14	2.46
14.0	1.48	1.77	1.83	2.08	2.36
15.0	1.51	1.79	1.95	2.09	2.37
20.0	1.43	1.67	1.80	1.92	2.15
25.0	1.36	1.55	1.67	1.77	1.96
30.0	1.32	1.51	1.61	1.70	1.87
35.0	1.30	1.47	1.57	1.65	1.81
40.0	1.29	1.45	1.54	1.61	1.76
45.0	1.26	1.41	1.49	1.55	1.69
50.0	1.25	1.39	1.47	1.53	1.66
60.0	1.23	1.36	1.42	1.48	1.59
70.0	1.21	1.32	1.39	1.44	1.54
80.0	1.20	1.30	1.36	1.41	1.50
90.0	1.19	1.28	1.34	1.38	1.47
100.0	1.18	1.27	1.32	1.36	1.45

Source: Breslow and Day. Statistical Methods in Cancer Research. The Design and Analyses of Cohort Studies (1987)

7.2 Data analysis

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Hospital admission rates will be compared using the SMBR. The statistic is calculated by dividing the observed number of hospital admissions in Port Colborne by the expected

number. Ontario age-sex specific non-malignant respiratory hospitalization rates are applied to the Port Colborne population estimates in order to calculate the expected number. The 95% confidence interval for the SMBR will be calculated assuming that the number of events follows a Poisson distributed variable.

8.0 Data Storage and Transfer

Health Canada personnel, who have access to the DAD database of CIHI, will calculate summary tables of rates for Port Colborne and Ontario. These tables will then be provided to Ventana Clinical Research Corporation. This data will be stored in electronic and hard form for five years. Hard data will be maintained in a secure document storage facility.

9.0 Limitations of Study

The relatively small size of Port Colborne limits the power of this study. Given that a relatively small number of individuals are hospitalized for asthma, we are unable to directly evaluate asthma as an outcome. Specifically, the prevalence of childhood asthma based on data from the National Population Health Survey is approximately 10%, while only 5.3% of those diagnosed with asthma in Canada require hospitalization each year [8]. For example, within all of Ontario, 28,646 children with diagnoses of asthma were identified from April 1, 1989, to March 31, 1992 using CIHI discharge data [9]. Also, the hospitalization for asthma may be the result of a poorly controlled medical condition, rather than an indicator of environmental exposure [1]. These regional variations in the

treatment of asthma may bias ecological comparisons of hospital admission rates between different regions of the province.

The ecologic nature of the study does not enable differences in individual risk factor behaviors to be controlled for. For example, this comparison will not be able to adjust for regional difference in daily levels of air pollution which are predictors of hospital admissions in Ontario [10]. Moreover, given that cigarette smoking is a major determinant of many respiratory diseases, an inability to control for differences in smoking behaviors between Port Colborne and Ontario residents could lead to observed difference in the SMBR. To some extent, the Self-Reported Health Questionnaire, another study, will collect information on community smoking prevalence rates; these can then be compared to provincial rates to determine whether there appears to be differential rates of smoking in the two populations.

Stratified analysis will be undertaken to determine whether or not SMBR values differ appreciably between men and women to evaluate whether differences may be explained by occupational or other risk factors such as smoking, rather than environmental exposures per se.

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