EVALUATION OF A COMMUNITY BASED OUT-PATIENT TREATMENT PROGRAM FOR TUBERCULAR PATIENTS RESIDENT IN DOWNTOWN DISTRICTS OF VANCOUVER

By

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B.Sc., The University of British Columbia, 1976.

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE (HEALTH SERVICES PLANNING AND ADMINISTRATION) in

THE FACULTY OF GRADUATE STUDIES
(Department of Health Care and Epidemiology)

We accept this thesis as conforming to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

May, 1986

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ABSTRACT

This study is an evaluation (in terms of attendance compliance) of the community based tuberculosis out-patient program at the Downtown Community Health Clinic (DCHC) in Vancouver. Treatment compliance is a measure of the degree of adherence to a treatment regime established by care givers whereas attendance compliance is concerned only with attendance to clinic appointments. Because treatment at the DCHC is supervised, attendance compliance can be closely associated with treatment compliance.

The DCHC was established in Vancouver's Downtown-Eastside district in 1980 in an effort to reduce tuberculosis rates among the skid-row population. Prior to 1980, skid-row patients were required to attend the Willow Chest Clinic (WCC), located outside the downtown area. Prior to 1979, hospital-based out-patient therapy at the WCC lasted 18-24 months and was unsupervised. Community-based treatment at the DCHC generally lasts 9 months. Treatment is supervised by a tuberculosis nurse at the DCHC who plays a key role in promoting compliance. The evaluation is based on a comparison of attendance to appointments at both these clinics.

As background for the evaluation, a model of tuberculosis epidemiology in developed countries in general and Canada in particular is described. The model shows that as tuberculosis rates have fallen, three main groups at high-risk for the disease have emerged; aboriginal people, immigrants from countries with high rates, and non-Native residents of urban skid-row districts. These three groups are well represented in Vancouver's skid-row
districts and account for most of the patient population at the DCHC.

The study outlines how tuberculosis treatment strategies have evolved in relation to technological developments and the changing epidemiology of tuberculosis in developed countries. The adaptation of modern tuberculosis treatment methods in B.C. and Vancouver is traced, culminating with the development of hospital based out-patient treatment at the WCC and community based out-patient treatment at the DCHC.

The tuberculosis epidemiology of Vancouver's skid-row is then described in relation to the socio-demographic conditions of the area. The well known association between tuberculosis and poverty is discussed. Socio-demographic upheavals in the area related to Vancouver's 1986 Worlds Fair are described and their possible effects on the skid-row tuberculosis problem outlined.

This background, which outlines the socio-demography of the tubercular population and shows the rationale behind their treatment system (at the DCHC), sets the stage for a discussion on compliance. Tubercular patients must take drugs regularly for a long period of time. This requires a lengthy and disciplined interaction with the treatment system. For the generally poor and often alienated tubercular population on skid-row, this may pose particular difficulties. Attendance to clinic appointments in order to receive drugs may be the single most important factor in a successful treatment outcome.

With the pivotal role of attendance compliance established, major socio-demographic factors predictive for attendance
compliance at the DCHC are determined and the DCHC is evaluated by comparing its ability to promote attendance compliance with the WCC. A retrospective case control study design is used in the evaluation comparing the DCHC clients for the years 1981-83 with matched controls who attended the WCC in the years 1977-79.

Results of the evaluation indicate attendance compliance of patients at the DCHC was significantly better than at the WCC. Furthermore, four major factors predictive for compliance were identified. These were, in order of importance, patient's address in relation to the clinic, patient's age, severity of diagnosis and race.
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ACKNOWLEDGEMENTS

I want to acknowledge the cooperation help and support of key people and organizations in the preparation and development of this thesis. I am grateful to the Ministry of Health and the Division of Tuberculosis Control for giving their approval for this study. In this regard I would particularly like to thank the Director of T.B. Control, Dr. E. Allen.

Everyone at the Division of T.B. Control was very helpful and quick to provide assistance and information. I would particularly like to thank Dr. C. Chao and Ms. P. Lenti the T.B. nurse on-site at the Downtown Community Clinic.

Last, but not least, I want to thank my thesis committee consisting of Dr. D. Enarson, Dr. R. Mathias and Dr. N. Morrison. My committee was efficient and supportive. Most importantly for me, I learned a lot and developed new skills from their effective tutelage. Finally, I want to give special thanks to Dr. Morrison for her perceptive teaching and sustained support which went beyond the call of duty.
CHAPTER 1.
INTRODUCTION

1.1 OVERVIEW:

Over the past fifty years the prevalence and incidence of tuberculosis in developed countries has declined drastically. Tuberculosis, once a wide-spread disease in industrialized countries, has been limited to well defined high-risk groups often located in urban centres. Although the disease has been localized and contained in developed countries, tuberculosis incidence and prevalence rates can reach levels found in developing countries among these high-risk groups.

Some of the groups most at risk in developed nations are immigrants from countries with high T.B. rates and socially marginal often alcoholic men living in "skid-row" areas of cities. In Canada, there is a third high-risk group, that is aboriginal peoples.

In Vancouver, all three high-risk groups are present. Moreover, in the Downtown Core, Downtown-Eastside and Strathcona* districts which are contiguous with census tracts 57, 58 and 59 parts of these communities overlap and co-exist. The Study Area is among the poorest in Vancouver and according to Dr. J. Blatherwick of the City Health Department, "This area has the highest incidence of tuberculosis in B.C."

A mass screening program in the Study Area carried out in the spring of 1985 underscored the magnitude of the tuberculosis problem in the area. Eight new-active cases of tuberculosis were detected after screening 1276 Downtown residents. This means *From now on this area is referred to as the 'Study Area'.
the prevalence rate among the screened population was 627 per hundred thousand.

Although this area has high tuberculosis rates compared to the rest of B.C. the high risk group, skid-row residents, have yet to be studied in Vancouver and the tuberculosis epidemiology of the area remains relatively unexplored. This thesis is partially an attempt to contribute understanding to the epidemiology of tuberculosis among this high risk group.

In 1980, in an effort to reduce tuberculosis rates specifically among the skid-row population, the B.C. Division of Tuberculosis Control established a community based tuberculosis out-patient treatment program at the Downtown Community Health Clinic. Prior to 1980, skid row tuberculosis patients attended a hospital-based treatment program at the Willow Chest Centre at Vancouver General Hospital (VGH) which is situated about 5 kilometers from the heart of the Study Area.

The evolution of community-based out-patient clinics like the DCHC represent a new trend in tuberculosis treatment research. Traditionally, tuberculosis out-patient chemotherapy is hospital-based, prolonged (18-24 months), unsupervised, and requires the ingestion of two or three drugs on a daily basis. However, at the DCHC, treatment length is shorter (usually 9 months), community-based, supervised, and for most patients chemotherapy occurs twice weekly rather than daily. (Supervised differs from unsupervised treatment mainly because in the former case the care-giver watches the patient ingest the drugs so that there is absolute certainty that the patient has successfully taken
Shortening length of treatment, basing the clinic in the
community, and supervising medications are treatment factors
geared primarily to improving compliance to the drug regime. This
is particularly important for patients such as skid-row residents
who may be alcoholic, poor and alienated. For these patients
ensuring follow-up and attendance compliance may be the most
important factor in successful treatment outcome.

It must be stressed that in this thesis, the dependant
variable is attendance compliance as opposed to treatment
compliance. For the DCHC, because treatment is supervised,
attendance to appointments can be closely linked to successful
injection of drugs. However, for the WCC, where treatment is not
supervised, attendance to appointments is only an indication that
drugs have been picked-up. There is no way to determine whether
WCC patients actually take the medications once they go home.

A major objective of this thesis is to evaluate the DCHC in
terms of attendance compliance because with high rates of
tuberculosis among residents of skid-row it is imperative that
effective treatment is available.

1.2 THE QUESTIONS:

Three primary questions are addressed in this thesis: 1) Is the
new out-patient treatment at the DCHC better than the old out-
patient treatment at the WCC in terms of compliance? 2) Which
socio-demographic and treatment factors predict compliance at the
DCHC? and; 3) Who benefits and who doesn't benefit from the new
treatment system? The answers to these questions will determine
whether the DCHC is effective in terms of compliance and if so
they will provide direction on how to further improve compliance to treatment.

1.3 THESIS STRUCTURE:

Chapter 2 is an introductory discussion of tuberculosis pathogenesis, and general tuberculosis epidemiology. The discussion is focused on tuberculosis epidemiology in developed countries.

Chapter 3 is a discussion of tuberculosis treatment. The history of tuberculosis treatment is outlined to show the evolution away from in-patient care towards out-patient treatment. The development of community-based and hospital-based out-patient treatment systems for tuberculosis is outlined. Chapter 4 focuses the general treatment discussion from chapter 2 onto B.C. and culminates with a description of the WCC and DCHC.

In Chapter 5, the epidemiology and socio-demography of the Study Area is described. Against this background a profile of the high-risk group living in the Study Area is sketched. Chapter 6 looks at compliance and describes the rationale behind selection of dependent variables used in the study. Chapter 7 is the Methodology Section. Results and discussion are presented in Chapter 8. Conclusions and recommendations are in Chapter 9.

In order to orient the reader and as part of the thesis outline, the geographic and temporal context of the study will be explained. The Study Area lies within the North Health Unit of the City of Vancouver. The Study Area was chosen because it encompasses Vancouver's skid-row. The boundaries were chosen because they are contiguous with three census tracts (Tracts 57,
58 and 59) so that T.B. rates within the Study Area could be calculated. Finally the Study Area contains the DCHC's target population. A map of the North Health Unit of the City Vancouver is enclosed showing the Study Area. Within the Study Area census tracts 57 (Strathcona) 58 (Downtown-Eastside) and 59 (Downtown-Core) are delimited. (Appendix A)

Data were gathered for the years 1977-79 and 1981-83. No data were gathered for 1980 because this was the 'start-up' year for the DCHC. It was felt that the evaluation would be fairer and more representative by excluding the clinic's first year of operation. Throughout this thesis, the term 'Study Period' refers to the six years for which data were gathered. That is, 1977-79 and 1981-83.
CHAPTER 2.

TUBERCULOSIS EPIDEMIOLOGY

2.1 TUBERCULOSIS PATHOGENESIS:

Pulmonary tuberculosis is caused by *Mycobacterium tuberculosis* which is usually transmitted by airborne droplet nuclei. Infectious persons produce droplets, through coughing, containing the bacterium. These dry and the resulting droplet nuclei can remain suspended in air for long periods of time. The *M. tuberculosis* is killed by ultra-violet light including daylight so the bacterium survives best in dark, poorly ventilated environments. Often such conditions are associated with poverty and crowded living conditions and thus, not surprisingly tuberculosis has been associated with slums, poverty and deprivation.

Primary tuberculosis infection follows the inhalation of tubercle bacilli into the pulmonary air spaces. The bacteria are ingested by macrophages and transported to regional lymph nodes. Two to ten weeks after primary infection the host develops cellular hypersensitivity to *M. tuberculosis* antigens. This hypersensitivity may be observed when tuberculoprotein is injected intradermally into the host producing a skin reaction.

The primary tuberculosis lesions in the lung and local lymph nodes usually heal. However, these healed lesions may contain viable *M. tuberculosis* organisms for many years. These lesions may provide inoculum for spread to other body sites through the lymph and circulatory systems and/or be the source for reactivation of the disease.
When primary tuberculosis infection occurs the lesions usually heal and remain healed over the life of the infected individual. If however, the primary inoculum is large and/or if the host is undernourished or otherwise lacks resistance, the primary infection may become reactivated. Clinical tuberculosis is usually a reactivation of the primary infection which may follow within weeks of primary infection but more often occurs after a period of years.

The risk of primary infection is determined entirely by exposure which is determined by environmental factors. Thus, people who have household contact with active tuberculosis cases are at highest risk for primary infection. However, the risk factors for reactivating tuberculosis depends on many factors.

Some of the known factors influencing reactivation are malnutrition, renal failure, labile diabetes, silicosis, administration of immunosuppressive drugs. Genetic predisposition to reactivation disease has been demonstrated in twins. Age is a major factor with infants and young adults least resistant. Deprived socio-economic conditions are also associated with reactivation.

2.2 TUBERCULOSIS EPIDEMIOLOGY in DEVELOPED NATIONS:

Tuberculosis epidemiology varies in different countries. Figure 1 is a simple model outlining the general principles of tuberculosis epidemiology.

Approximately half the world's population are uninfected persons identifiable by their negative tuberculin reactions. In developed countries, the majority of persons of all ages are uninfected. In developing countries often the majority of adults
are infected so that the uninfected group consists of children who are "not yet infected."

FIGURE 1
A GENERAL MODEL OF T.B. EPIDEMIOLOGY.

TUBERCULOSIS

INFECTED
Tuberculin Positive.

NOT INFECTED
Tuberculin Negative.


Infected persons arise from the uninfected group. As stated in Section 2.1 the risk for primary infection depends on exposure. Once exposure has occurred reactivation risk depends on host factors often linked with poverty, malnutrition and poor living conditions. A portion in the infected pool goes on to develop tuberculosis. In the United States, studies indicate that approximately 5% of infected persons subsequently develop reactivation tuberculosis.

In developing countries where incidence rates can be high, the risk of exposure is high. Risk of reactivation may also be high for the poor in developing nations. These factors in combination with poorly organized health services pose difficulties for the control and eradication of the disease particularly as a higher
percentage of tuberculosis cases may be infectious under conditions where the disease is untreated, inadequately treated or remains untreated until it reaches an advanced state.

In developed countries the epidemiology is quite different. "There is reliable evidence that irrespective of its magnitude, the tuberculosis problem in developed countries has been decreasing from at least the turn of this century." Reliable figures from the Netherlands indicate that between the two world wars, mortality rates and infection rates were decreasing at a rate of approximately 5% per year. These decreases were likely due to improvements in socio-economic conditions rather than institution of specific control measures.

The downward trend in tuberculosis infection rates prior to the era of chemotherapy was about 5%. This rate has increased since the introduction of chemotherapy so that infection rates in developed countries have declined at a rate of 12-13% annually. It is likely that the difference between the pre-chemotherapy and post-chemotherapy infection rates is due to enhanced case-finding and chemotherapy in these countries.

High living standards, good case-finding and treatment have reduced the risk of exogenous infection in developed countries so the main contribution to tuberculosis in developed countries arises through endogenous exacerbation of the disease in cohorts which are already infected. In Canada, these cohorts consist mainly of older people, immigrants and aboriginal people.
2.3 THE COHORT EFFECT:

One of the most intriguing facets of tuberculosis epidemiology (particularly in developed countries) is the 'cohort effect'. People in developed countries born in those countries in an era of higher T.B. rates were at greater risk of exposure to the bacterium and subsequent primary infection. This was shown in a Saskatchewan study using mass tuberculin testing starting in 1955 to develop a tuberculin registry of positive reactors in the province. In the mid-60's this registry showed positive reactions increased with increasing age. For ages 0-14, 1% showed positive reactions. For ages 15-19, 4.4% were positive and for ages 20-29, 11.5% were positive reactors. The increase was steady reaching a maximum of 55% for those aged 60 and over.

Clearly, the proportion of infected cases increased with the age of the cohort. From the model in Figure 1 it is also clear that the larger the pool of infected people the greater the probability for reactivations to occur. It is therefore no surprise that in developed countries (where the role of exogenous re-infection has been reduced) tuberculosis is primarily seen as reactivation disease in older segments of the population born in that country.

The risk of endogenous reactivation for older cohorts is a result of high exposure to primary infection in youth. When immigrants from countries with high T.B. rates move to developed countries with low rates a similar phenomenon is observed. If these immigrants had high exposure to primary infection in their youth even after they move to a country with low rates they tend
to exhibit high rates of endogenous reactivation.

This was shown rather elegantly in a study by Enarson, Sjogren, and Grzybowski of Finnish immigrants to Canada. They calculated the 1970-72 incidence rates of Finnish immigrants living in Canada and compared them with 1970-72 rates in Finland. (Finland has historically had higher rates than Canada. In 1970-72 T.B. rates in Finland were about 7 times Canadian rates.)

The study showed that Finnish immigrants who had lived in Canada an average of 40 years had rates similar to those in Finland. The authors of this study concluded that higher rates among Finnish immigrants to Canada compared to the Canadian-born population were due to increased exposure during their youth in Finland and subsequent endogenous reactivation at a higher rate in Canada than the Canadian-born population. (The cohort effect was superimposed on this, as rates among the Finnish immigrants increased steadily with age of the cohort.)

In Canada, aboriginal peoples constitute another major high-risk group. Because mortality and incidence rates were much higher for aboriginal people than the non-aboriginal Canadian-born population, there is a proportionately larger infected group in the aboriginal population compared to the non-aboriginal population. Also, because rates for the aboriginal population were high so recently, the level of primary infection is high in younger age cohorts. Thus, tuberculosis among Canadian aborigines tends to occur in younger age-groups than for the non-aboriginal Canadian-born population.

In Canada, older members of the Canadian-born population, aboriginal peoples and immigrants from countries with high T.B.
rates are some of the major socio-demographically identifiable high-risk groups for tuberculosis. Endogenous reactivation is likely the major mechanism of tuberculosis presentation in these groups. Therefore any factors which increase host susceptibility for reactivation (like poverty) will likely increase the number of cases within these high-risk groups.
CHAPTER 3.
THE EVOLUTION OF TUBERCULOSIS TREATMENT

3.1 INTRODUCTION:
The purpose of this chapter is to place the DCHC and WCC in broad historical context. That is, to describe the developments in tuberculosis treatment which have led to out-patient services based at hospitals (like the WCC) or in local communities. (like the DCHC)

3.2 THE PRE-MODERN ERA AND TUBERCULOSIS TREATMENT:
Tuberculosis is a disease of great antiquity. According to Moorman, "The serious study of history justifies the belief that T.B. may have been the first born of the mother of pestilence and disease."

Tuberculosis was therefore well known to pre-modern peoples. Physicians in different cultures of the ancient world used widely varying treatments to cure the disease. The Indo-Aryans used a hygienic-dietetic treatment to improve the general condition of patients. The Romans practiced climotherapeutic treatments so that "in Imperial Rome it became the custom to send people afflicted with pulmonary maladies to Sicily and Egypt as it was well known they would often return cured."

A varying mixture of dietetic, climatic and occult cures were advocated by the physicians of antiquity and Europe in the Middle Ages. During the Renaissance in Europe, the concept that tuberculosis might be contagious began to gain credence.

In 1546 a Florentine physician Hyeronymus Fracastorius clearly expressed a theory on the infectivity and contagiousness of
tuberculosis in his book De Morbis Contagiosis. This theory was generally accepted in Southern Europe and attained widespread belief so that in parts of Italy and Spain laws were promulgated making tuberculosis a reportable disease and encouraging disinfectant procedures for handling tuberculosis corpses and live patients. These public health laws were rigorously enforced in Spain and Italy. However, Northern European physicians tended to regard tuberculosis as a hereditary-familial disease and scorned the contagion theory. These physicians believed that "rest, balmy air and sunny skies could arrest the destruction of lung tissue and the sapping of strength that otherwise drove the consumptive to certain death in the space of a few years."

The identification of the tubercule bacilli in 1882 by Robert Koch, demolished the hereditary theory of tuberculosis origin. Once people realized tuberculosis was caused by a germ, sanatorium based treatment methods began to develop. In fact, sanatorium based treatment dominated the first period of the modern era of tuberculosis treatment.

3.3 THE MODERN ERA OF TUBERCULOSIS TREATMENT:

The modern era in tuberculosis treatment can be divided into two periods. The first period lasted from 1882 until 1945 and saw the development of surgical techniques and the widespread building of sanatoria to treat tuberculosis. The second period started after World War II with the discovery of streptomycin and the subsequent development of tuberculosis chemotherapy.


In 1882, Forlanini first induced artificial pneumothorax or
the surgical collapse of the lung. It took 30 years for this surgical method to gain the medical establishment's support. The rationale behind surgical collapse of the lung was that it allowed time for the tubercular lesions to heal. As sanatoria expanded in the early twentieth century, so did the frequency of pneumothorax surgery. A mixture of sanatorium treatment and surgery was the normal treatment for tuberculosis for the first half of the twentieth century until the widespread use of antibiotics in the mid-1950's.

2. Sanatoria.

The first sanatorium for tuberculosis treatment was started by Hermann Brehmer in Germany in 1854. The demonstration by Koch of tuberculosis infectivity lent enormous impetus to the sanatorium building movement. The motivation for building sanatoria was two pronged after Koch's discovery. Firstly, sanatoria could help cure or arrest the disease and secondly they helped isolate infective people from healthy people.

In North America, sanatoria were modelled on Dr. Trudeau's sanatorium at Saranac Lake, New York which he built in 1884. The first Canadian sanatorium was built shortly thereafter in Muskoka in 1896.

In Canada several phases of sanatoria development are apparent. The first stage saw the building of sanatoria in rural, isolated, often dry and mountainous areas. The Tranquille sanatorium near Kamloops in British Columbia was built during this era (1908).

As the Canadian population urbanized and as tuberculosis epidemiology shifted from a rural to an urban focus the second
stage of sanatorium development unfolded in Canada. In this stage, sanatoria were built nearer centres of population and in larger urban centres began integration with general hospitals. Tuberculosis treatment by this stage was beginning its re-integration with mainstream medicine after nearly a century of relative isolation in remote sanatoriums.

Voluntary societies played a major role in setting up and funding sanatoria in the first twenty years of the century in Canada. As the costs and complexities of running tuberculosis sanatoria increased, provinces began to take over their management relegating voluntary society activities to fund raising and tuberculosis education. By the 1930's, half of Canada's provinces (including B.C.) had established direct provincial government control over tuberculosis treatment.

The building of sanatoria in the first half of the twentieth century was accompanied by the almost messianic educational and organizational zeal of the voluntary anti-tuberculosis societies. These societies raised money for tuberculosis education and facilities. This era also saw the development of mass X-ray programs and the discovery of the BCG vaccine which led to more efficient case finding and prevention measures. The interaction of increased case finding, increased isolation and treatment in sanatoria and increased well-being and resistance of the general population coincided with a decrease in tuberculosis death rates and prevalence.

However, it wasn't until after the war that tuberculosis rates went into dramatic decline.
3. Chemotherapy.

The second era in modern T.B. treatment began with the discovery of streptomycin in 1944. By 1945, the first human treatments were carried out at the Mayo Clinic and by 1947 the drug was available in Canada for tuberculosis chemotherapy.

The discovery of streptomycin was quickly followed (in 1946) by that of para-aminosalicylic acid (PAS) and isoniazid (INH) in 1952. These three drugs became the pharmacological armamentarium of the 1950's and 60's in the world-wide drive to cure tuberculosis.

Streptomycin had disadvantages because it is toxic to the eighth cranial nerve and in some patients caused loss of balance and deafness and because it had to be administered by intramuscular injection on a daily basis. Also, bacterial resistance to the drug became common when the drug was given alone.

Combination regimes using streptomycin, PAS, and INH were developed to reduce occurrence of bacterial resistance. In Canada and most other countries, standard tuberculosis chemotherapy in the 50's and 60's consisted of a daily regime with a combination of these drugs lasting for 18 to 24 months. In the 40's and 50's therapy was mainly carried out within the sanatoria. By the 1960's drugs were increasingly given on an out-patient basis.

Although streptomycin was beginning to become available for medical use just after World War 2 it took nearly a decade to attain generalized use in Canadian sanatoria. In 1947 0.01% of sanatorium patients were receiving streptomycin. By 1954 this
percentage had increased to 81%. By 1954 74% of patients were also receiving PAS. By 1956 50% of sanatorium patients were receiving INH. This went up to 84% by 1959. Canadian and B.C. death rates for tuberculosis responded accordingly. (Table 1)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CANADA</th>
<th>B.C.</th>
</tr>
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</tbody>
</table>

Problems of bacterial resistance and drug toxicity became apparent to clinicians after a few years experience with tuberculosis chemotherapy. These problems gave impetus for research into less-toxic tuberculocidal drugs that would alone or in combinations be powerful enough to preclude drug resistance. In the 1960's, two drugs were found (ethambutol and rifampicin) which met some of these properties. After development of these drugs daily combination treatment using ethambutol, rifampicin and INH became popular.

Rapid introduction of chemotherapy and it's subsequent effect on tuberculosis death rates began to have dramatic effects on the established tuberculosis treatment system. Sanatoria had been expanding prior to chemotherapy for tuberculosis. For example, in 1947 there were 3.32 million patient days spent in Canadian provincially run sanatoria. This figure peaked at 6.22 million patient-days in 1953 and declined to 2.43 million by 1961, a drop of more than 60%.
Although it was cheaper to treat patients in sanatoria than general hospitals, as the occupancy dropped in sanatoria in response to lowered tuberculosis rates so did their fiscal efficiency in relation to general hospitals. Another factor in sanatoria decline was shortened length of stay in institutions because of the new chemotherapy. For example, in 1954 the average length of stay for Canadian tuberculosis first admissions and readmissions was 394 days. By 1961, this had been halved to 199 days.

Clearly, by the mid-50's the impact of chemotherapy and rising standards of living were making themselves felt in Canadian sanatoria. Reduction in the number of patient days and decreases in length of stay reduced occupancy. Also, new drugs rendered patients non-infective rapidly so sanatorium-based advantages of patient isolation were no longer a major concern. These factors speeded the reintegration of tuberculosis treatment services with mainstream medical treatment services offered in general hospitals.

This reintegration process was hastened by the passing of the Canadian Hospital Insurance Act of 1957. This act essentially offered 50% cost sharing for general hospital services. It was in the provinces' best financial interests to integrate tuberculosis services into a general hospital in order to receive financial support from the federal government under this act.

This changing reality was officially recognized by the Royal Commission on Health Services chaired by Mr. Justice Emmett Hall in the Commission's 1965 publication 'Tuberculosis in Canada'. In it's conclusions the authors recommended that tuberculosis
services "should be integrated into community and general medical services where possible" and that "tuberculosis should be included in the plan for hospital services with the Federal Government participation to the same extent as for other diseases."

These general epidemiological and treatment trends were occurring throughout the industrialized 'developed' world. However, most of the innovative research on tuberculosis chemotherapy had shifted to developing countries.

The combination of chemotherapy and increased post-war standards of living in the developed countries rapidly relegated tuberculosis to a disease of poor, marginal, usually urban people. In developing countries, tuberculosis case-finding and treatment had numerous problems because of more generalized poverty and the relative underdevelopment of health services.

Medical interest in tuberculosis in developed countries waned as heart disease and cancer death rates increased relative to those for tuberculosis. This lack of interest was apparent to the Royal Commission on Health Services in 1965. In this report the authors stated: "There is difficulty in maintaining competent medical staff for tuberculosis services. Tuberculosis does not attract young, well-trained medical personnel."

Thus, by the 1950's and 60's the developing countries became the proving ground for tuberculosis chemotherapy. The three major loci of tuberculosis research in the 50's and 60's were India, Kenya and Hong Kong. A 1959 study at the Madras Tuberculosis Chemotherapy Centre compared outcome from standard tuberculosis
chemotherapy administered in a hospital and self-administered at home. The study clearly showed that even with the impoverished home conditions of many of the Madras patients, hospitalization was not necessary to treat pulmonary tuberculosis.

This study established that out-patient based tuberculosis chemotherapy was not only possible but advantageous from a treatment outcome and cost point of view. The Madras study results also highlighted the importance of ensuring out-patient compliance to treatment. Subsequent research efforts at the Madras Centre during the 1960's focused on development of supervised intermittent as opposed to unsupervised daily chemotherapy regimes in an effort to make patients comply more fully. Results of these Madras studies established the therapeutic equality of supervised intermittent treatment with unsupervised daily out-patient treatment. Similar results were obtained in controlled studies at other research centres in the 1960's and 1970's.

In the 1970's the research focus shifted to shortening the traditional length of chemotherapy. The discovery of rifampicin in 1968 and its efficacy against tuberculosis raised the possibility of shortening the traditional length of tuberculosis chemotherapy. Controlled trials under supervision of the British Medical Research Council in Kenya, Tanzania (then Tanganyka) and Hong Kong tested various combinations of anti-tubercular drugs for periods of 6 and 9 months. By the mid-70's, research clearly showed that intermittent supervised out-patient chemotherapy for periods as short as 6 months were effective in
treating tuberculosis in developing countries.

The evolution of shortened intermittent out-patient based treatment systems for tuberculosis highlighted the importance of patient compliance. These treatment methods are only effective if patients took the medication. This realization resulted in a number of studies on compliance to tuberculosis out-patient therapy (See Chapter 6) and emphasis on designing treatment systems that promote compliance.

Even though hard data based on relatively difficult-to-treat populations in developing countries showed that changes in traditional tuberculosis chemotherapy were in order, developed countries were slow to adapt the new findings to their own treatment systems. Thus Czechoslovakia was one of the first industrialized countries to officially adopt intermittent tuberculosis chemotherapy in 1972. In 1976 the British Thoracic Association recommended the use of short-course intermittent chemotherapy in Britain.

The first trial of intermittent supervised chemotherapy in North America occurred in 1967 on 25 mainly alcoholic 'racalcitrant' tuberculosis patients in Denver, Colorado. This small trial, using twice weekly INH and streptomycin, showed no relapses and no treatment failures after median treatment length of 12 months. In 1976 a larger scale study was undertaken in Arkansas to test the efficacy of twice weekly self-administered INH- rifampicin treatment over a 9 month period. The conclusions of this study were that such treatment was safe, effective and economical.
Although some trials have been conducted in North America and Europe, Fox claims that developing nations are using new advanced methods of chemotherapy whereas technically advanced countries are not. One reason he offers for this unusual situation is that the technically advanced countries pay little attention to WHO publications and recommendations (which have been the forum for most developments in T.B. control). Another possible reason is that with the disease confined to relatively powerless often marginal sub-populations in developed countries, the resources are simply not being made available to finally eradicate the disease. (In this light it is interesting to note that although tuberculosis has been a problem in Vancouver's Downtown area for years, it received widespread press attention in 1985 mainly because Ministry of Human Resources workers were getting the disease. That is, tuberculosis is news when middle class people get the disease.)

In summary, tuberculosis is an ancient disease which until the advent of the anti-biotic era was one of the leading causes of death in Europe and North-America. Within a decade after their introduction, the combination of rising living standards, increased well-being of the general population and anti-biotics had revolutionized tuberculosis epidemiology and brought the disease under control in most developed countries. However, the disease remained relatively intractable in the crushing poverty of most developing countries.

Research efforts shifted to the developing nations and by the late 1960's out-patient based chemotherapeutic treatment systems had been tested and the concept of intermittent chemotherapy for
tuberculosis had been established. The development of new drugs in the late 1960's led to establishment of short-course treatment regimes by the mid 1970's.

North-America was relatively slow in introducing these innovations. Slowly as sanatoria closed and tuberculosis treatment came under general hospital control, treatment became more out-patient based. The next chapter traces this evolution in B.C. culminating with a description of the WCC and DCHC.
CHAPTER 4.
TUBERCULOSIS CONTROL IN B.C.

4.1 EARLY YEARS:

Efforts to control tuberculosis in British Columbia began at the turn of the century. In 1904 the B.C. Society for the Prevention and Treatment of Consumption and Other Forms of T.B. was formed. In 1907 the B.C. Anti-T.B. Society was formed by act of legislature. Fund raising was begun and a sanatorium built at Tranquille near Kamloops.

Returning veterans from World War 1 swelled the numbers of T.B. cases needing treatment in the province, straining the voluntary society's financial resources. Accordingly, in 1919 the B.C. government took over operation of Tranquille sanatorium.

Although the Tranquille sanatorium was the focal point of the province's anti-tuberculosis campaign, clinic development was beginning in Vancouver. In 1918 the Rotary Institute for Diseases of the Chest was set up in Vancouver to treat T.B. patients along with Vancouver General Hospital. However, their role was minor compared to that of Tranquille.

By the early 1930's tuberculosis control and treatment was in provincial government control centered in the dry interior of the province. Education had been left largely to the voluntary societies also centered at Tranquille.

4.2 THE DIVISION OF T.B. CONTROL

The Division of Tuberculosis Control was established in 1935 and headquartered at the Willow Street Chest Centre in Vancouver. The Division was set up by the provincial Department of Health.
and received most of it's funding from the provincial government. In 1936, the Tranquille T.B. Society was reorganized and moved from Tranquille to Vancouver to assist the new division in terms of fund raising and public education. Tuberculosis control, treatment and institutions in B.C. were beginning the trek away from rural isolation towards an urban general hospital setting.

In 1949 the B.C. Tuberculosis Institute was opened as part of the WCC. This was followed shortly by the opening of a new sanatorium in 1952 (Pearson Hospital) in Vancouver. At this point, in B.C. and nationally, sanatorium bed capacity was at its peak. It is somewhat ironic that the effects of new antibiotic therapy began to reverberate through the treatment system so that in the B.C. Division of T.B. Control Report for 1953 a surprised sounding director stated: "During the recent months an unusual situation has been perceived at the Division of T.B. Control in that there have been empty beds and all cases except for elective surgical cases could be admitted immediately."

The drop in sanatorium population in B.C. was dramatic as shown in Table II.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TOTAL POPULATION in B.C. SANATORIA.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952</td>
<td>838</td>
</tr>
<tr>
<td>1955</td>
<td>615</td>
</tr>
<tr>
<td>1958</td>
<td>332</td>
</tr>
<tr>
<td>1961</td>
<td>244</td>
</tr>
<tr>
<td>1963</td>
<td>205</td>
</tr>
<tr>
<td>1964</td>
<td>163</td>
</tr>
</tbody>
</table>


Over the 14 year period between 1952 and 1964 (which roughly corresponds to the era of complete introduction of chemotherapy
for T.B.) the B.C. sanatoria population dropped by over 500%. By 1958 Tranquille Sanatorium was closed and tuberculosis beds became centralized in the Vancouver area at the Willow Chest Centre, Pearson Hospital and the Essondale Mental Health Facility.

As the sanatoria emptied, case-finding became the focus of the Division of T.B. Control. In 1957, a provincial X-Ray and examination program was started. This was completed in 1965. Vancouver remained one of the latest areas surveyed under Operation Doorstep in 1964. (Operation Doorstep was a Lower-Mainland drive to find as many tuberculosis cases as possible. The drive was coordinated by the Division of T.B. Control but with great community participation and enthusiasm).

Even with the increased case-finding of the early 1960's tuberculosis facilities were being closed or redirected. In 1964 operating rooms at the Willow Chest Centre were converted from T.B. surgical units to cardiac units and in the same year the full-time tuberculosis specialist stationed at Essondale was removed from his position.

By the mid-60's tuberculosis treatment was centralized in Vancouver and relied mainly on 18 to 24 month daily combination therapy. Patients remained in hospital for most of their treatment. Hospitalized drug therapy remained the treatment of choice for the next decade. In the Division's report for 1971 the philosophy is clearly outlined: "It has become apparent that community surveys are less productive which will necessitate a change in this method of case finding." Although many patients
are treated wholly as out-patients, it is clear that the majority require a period in hospital." Innovations in tuberculosis chemotherapy were not being rapidly transferred to the B.C. tuberculosis control situation.

However, the pace of change picked up in the 1970's as the WCC shifted from a mainly in-patient centre for tuberculosis treatment to a mainly out-patient based treatment system. By 1979 rifampicin-based short course daily chemotherapy had been introduced as the out-patient treatment of choice at the WCC replacing the long-course methods. The 1980's saw even bolder innovation and the application of newer research findings with the establishment of the community-based DCHC.

4.3 THE WILLOW CHEST CENTRE:
In the 1960's the Willow Chest Centre began to treat more cases on an out-patient basis. In the 1970's treatment at the centre was characterized by a growing shift towards out-patient therapy as shown in Table III.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>% OF CASES TREATED AS OUTPATIENTS AT THE WCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>55</td>
</tr>
<tr>
<td>1975</td>
<td>61</td>
</tr>
<tr>
<td>1976</td>
<td>65</td>
</tr>
<tr>
<td>1977</td>
<td>68</td>
</tr>
<tr>
<td>1978</td>
<td>75</td>
</tr>
<tr>
<td>1979</td>
<td>76</td>
</tr>
<tr>
<td>1980</td>
<td>78</td>
</tr>
</tbody>
</table>

Source: The Division of Tuberculosis Control, Province of British Columbia. Annual Report, 1981. (42)

By the late 1970's emphasis was placed more on patient follow up to ensure drug compliance. After a new-active case was located and placed on out-patient treatment, appointments were set up
usually at quarterly intervals (but sometimes monthly or once every 2 months) for the patient to come in for medical checks and to receive his/her drug supply.

Until 1979, treatment consisted of a daily course of INH and PAS or ethambutol administered for 12-24 months. After 1979, Rifampicin, ethambutol and INH short-course therapy administered for an average of 9 months became the standard treatment at the WCC.

While this method of treatment proved feasible for compliant patients, its usefulness for non-compliant patients remained in doubt. Increasingly the idea of supervised, community-based short-course intermittent therapy for the 'difficult-to-treat' group (who were mainly resident in the Study Area) became attractive. Accordingly, in 1980 the Division of T.B. Control requested and received funding for such a project from the Ministry of Health.

4.4 THE DOWNTOWN COMMUNITY HEALTH CLINIC:

The Downtown Community Clinic Tuberculosis Program was set up specifically to tackle the tuberculosis problem in the Study Area.

The DCHC mainly uses the supervised short-course intermittent (twice weekly) out-patient drug regimes which were developed in developing nations. This may be particularly appropriate for the tubercular population of the area which in some ways has characteristics of a developing country's population (poverty, bad living conditions). The DCHC, therefore represents the latest most progressive developments in tuberculosis chemotherapy.

The main financial outlay for the program is the salary of the
T.B. nurse. The T.B. nurse is expected to establish a good supportive rapport with the clients, to directly supervise T.B. treatment, (this means that the T.B. nurse actually watches the patient ingest the drugs) and go out into the community to find patients when they miss clinic appointments. The thrust of the approach is supportive rather than punitive and its success may hinge greatly on the personality of the T.B. nurse.

Generally, treatment is daily or twice weekly using a combination of Rifampicin, INH and Vitamin B6. Treatment is supervised. That is, patients come to the clinic to receive their medication directly in the T.B. nurse's office. The treatment generally lasts 9 months. Out-patient treatment duration varies depending on the amount of treatment received as an in-patient (for hospitalized patients) and the degree of compliance shown by the patient.

Physicians at the WCC select patients for attendance at the DCHC program. According to Dr. Chao at the WCC, selection criteria are residence in the area and potential non-compliance. That is, if staff at the WCC judge a Study Area patient is a non-complier, they will put him/her on the DCHC program. A person deemed as potentially compliant by the WCC staff (even though resident in the Study Area) may be placed on out-patient therapy at the WCC rather than the DCHC. Thus, the most 'difficult-to-treat' tubercular patients resident in the Study Area are treated at the DCHC. The clinic is faced with one the most challenging tubercular patient case-load in the province.

In the next chapter, the tuberculosis epidemiology and socio-
demography of the study area is described.
CHAPTER 5.

THE EPIDEMIOLOGY and SOCIO-DEMOGRAPHY of TUBERCULOSIS in the STUDY AREA.

5.1 INTRODUCTION:

The purpose of this chapter is to describe the major high-risk group living in the Study Area. Up to this point we have described the treatment systems these patients have utilized but in order to comprehend treatment issues (particularly compliance) it is necessary to describe the patient population. Before describing the high risk group the epidemiology (as far as is presently known) and socio-demography of the Study Area are outlined as background.

5.2 EPIDEMIOLOGY of T.B. in the STUDY AREA:

Metropolitan Vancouver has high rates of tuberculosis incidence compared to the provincial average. Metro-Vancouver rates appear "stuck" above the provincial average. Furthermore, rates within the City of Vancouver's North Health Unit and the Study Area are significantly higher than Metro-Vancouver rates. (Table IV)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Rate in B.C.</th>
<th>Rate in Metro Vancouver</th>
<th>Rate in North Unit</th>
<th>Rate in Study Area</th>
<th>Rate in Tract 58</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>14.9</td>
<td>24.2</td>
<td>92.4</td>
<td>186.7</td>
<td>199.0</td>
</tr>
<tr>
<td>1978</td>
<td>16.4</td>
<td>22.3</td>
<td>63.4</td>
<td>228.9</td>
<td>359.0</td>
</tr>
<tr>
<td>1979</td>
<td>15.0</td>
<td>20.0</td>
<td>108.4</td>
<td>(no data)</td>
<td>399.0</td>
</tr>
<tr>
<td>1980</td>
<td>15.1</td>
<td>26.1</td>
<td>(no data)</td>
<td>198.7</td>
<td>399.0</td>
</tr>
<tr>
<td>1981</td>
<td>14.3</td>
<td>27.2</td>
<td>116.9</td>
<td>252.9</td>
<td>399.0</td>
</tr>
<tr>
<td>1982</td>
<td>15.2</td>
<td>28.8</td>
<td>246.9</td>
<td>246.9</td>
<td>479.0</td>
</tr>
<tr>
<td>1983</td>
<td>95.8</td>
<td></td>
<td>295.0</td>
<td>295.0</td>
<td>399.0</td>
</tr>
</tbody>
</table>

*Metropolitan Vancouver includes the municipalities of Vancouver, Richmond, North Vancouver, West Vancouver and Burnaby.
When these rates are averaged out over the Study Period the results are in Table V.

**TABLE V:** Comparison of Average Rates (1977-83) in B.C. Metro-Vancouver, North Health Unit, the Study Area and Census Tract 58.

<table>
<thead>
<tr>
<th>PLACE</th>
<th>B.C</th>
<th>Metro-Van</th>
<th>Nt. Unit</th>
<th>Study Area</th>
<th>Tract 58</th>
</tr>
</thead>
<tbody>
<tr>
<td>RATE</td>
<td>15.2</td>
<td>24.8</td>
<td>97.7</td>
<td>248.4</td>
<td>372.0</td>
</tr>
</tbody>
</table>

Table V indicates that, for the time period of this study, incidence rates within the Study Area were 17 times greater than the provincial average and 10 times greater than the rates in Metropolitan Vancouver. Furthermore, within Census Tract 58, rates averaged 372 per 100,000 which were 50% higher than the rest of the Study Area, 15 times the Metro-Vancouver rates and 25 times the provincial rates.

The rates obtained in this study are similar to those obtained by Enarson in an unpublished survey of tuberculosis rates in Vancouver. He estimated that the new-active rate of disease among Canadian-born white low-income Vancouver slum dwellers was 242 per hundred thousand in 1981. (The rates in Tables IV and V are not limited to the Canadian-born population)

One can use rates when comparing the Study Area with other larger areas to get a useful idea of rate differences among regions. However, when analyzing various groups within the Study Area rates become less meaningful for three reasons: 1), the census data for the Study Area in general and Census Tract 58 in particular may be inaccurate because of the unknown and shifting characteristics of the transient population, 2), there is no...
reliable estimate for the Native population so that rates for Canadian-born Natives and non-Natives are not calculable; 3), the rate of change in the population is unknown.

Between 1961 and 1976 the population in the Study Area decreased by 26% (see section 5.3 for a detailed discussion on the socio-demography of the area). This depopulation of skid-rows was a well documented phenomena in the 1960's and 70's. However, the 1981 population of the Study Area was 12% higher than the 1976 figure (8538 vs. 7623). A 14% increase was recorded for Census Tract 58 for the same time period. Thus, at least over the first part of the Study Period, the population was increasing in the Study Area. (It is interesting that studies during the economic boom of the 60's and 70's show skid-row emptying across North America. This was true in Vancouver too. But, now since the economic downturn of the late 70's Vancouver's skid-row population is increasing.)

If these census figures are accurate, then the rates for the Study Area and Census Tract 58 in Table IV suggest relative stability over the Study Period.

High incidence rates in Metro-Vancouver are reflected by high tuberculosis mortality figures. For the decade 1961-1970 there were 238 tuberculosis deaths in Metro-Vancouver. These were 48.8% of all provincial deaths due to tuberculosis. The mean annual tuberculosis death rate for Metropolitan Vancouver in the decade was 3.5 compared to a provincial rate of 2.7. For the twenty statistical areas in B.C., Metro-Vancouver's death rate was topped only by those in the Cariboo and Skeena districts.

During the Study Period, 42.5% (37) of provincial deaths due to
tuberculosis occurred in the Study Area. The mean annual tuberculosis death rate for the Study Area over the Study Period was 37.1 which like the incidence rate is about 10 times higher than the Metro-Vancouver average death rate from tuberculosis.

The epidemiology of T.B. in Vancouver has been greatly influenced by immigration from countries with high T.B rates, particularly since 1970. Recently (1979-80) the influx of approximately 10,000 South East Asian immigrants into B.C. have also complicated local T.B. epidemiology and may account for much of the high rates in the Metro-Vancouver region.

A comparison of the proportion of Canadian-born versus non-Canadian born cases occurring in the Study Area and Census Tract 58 helps to determine the relative contribution of the high-risk immigrant group to the tuberculosis epidemiology in the area. (Table VI) (It should be pointed out that according to the 1981 census, the Canadian-born and non-Canadian born population of both the Study Area and Census Tract 58 were about equal)

TABLE VI: Percentage of Canadian-born and non-Canadian born Cases in the Study Area and Census Tract 58 during the Study Period.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>STUDY AREA</th>
<th>CENSUS</th>
<th>TRACT 58</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Can-Born</td>
<td>non-CanBorn</td>
<td>Can-Born</td>
</tr>
<tr>
<td>1977</td>
<td>58</td>
<td>42</td>
<td>40</td>
</tr>
<tr>
<td>1978</td>
<td>66</td>
<td>34</td>
<td>67</td>
</tr>
<tr>
<td>1979</td>
<td>58</td>
<td>42</td>
<td>67</td>
</tr>
<tr>
<td>1981</td>
<td>45</td>
<td>55</td>
<td>70</td>
</tr>
<tr>
<td>1982</td>
<td>56</td>
<td>44</td>
<td>25</td>
</tr>
<tr>
<td>1983</td>
<td>78</td>
<td>22</td>
<td>100</td>
</tr>
<tr>
<td>AVERAGE</td>
<td>60</td>
<td>40</td>
<td>61.5</td>
</tr>
</tbody>
</table>

From Table VI, it is clear that the proportion of Canadian versus non-Canadian born persons in both the Study Area and
Census Tract 58 have remained relatively stable from 1977-1982 at respectively 60% and 40%. The proportions for 1983 show a much greater than usual contribution of cases from Canadian-born persons. With this data base there is no way to tell whether this is an aberration or part of a new trend in the T.B. epidemiology of the Study Area. Because the population of Canadian-born and non-Canadian born in both the Study Area and Census Tract 58 are approximately equal these proportions suggest that rates are higher in the Canadian-born population than the non-Canadian born in these areas.

One might expect higher rates in the Canadian-born population if the Native contribution were high because rates for this segment of the Canadian-born population are known to be much higher than rates for non-Native Canadians. A comparison of the contribution of Natives and non-Natives to the Canadian-born case load of the Study Area was made to assess the relative impact of these two groups on Canadian-born rates. (Table VII)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>STUDY AREA</th>
<th>CENSUS TRACT 58</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Native</td>
<td>non-Native</td>
</tr>
<tr>
<td>1977</td>
<td>44</td>
<td>56</td>
</tr>
<tr>
<td>1978</td>
<td>28</td>
<td>72</td>
</tr>
<tr>
<td>1979</td>
<td>47</td>
<td>53</td>
</tr>
<tr>
<td>1981</td>
<td>37</td>
<td>63</td>
</tr>
<tr>
<td>1982</td>
<td>35</td>
<td>65</td>
</tr>
<tr>
<td>1983</td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td>AVE.</td>
<td>40</td>
<td>60</td>
</tr>
</tbody>
</table>

Like Table VI, Table VII shows relative stability in the proportion of cases distributed between the two groups. However,
unlike the comparison of Canadian-born with non-Canadian-born in Table VI, there are differences between the Study Area and Census Tract 58. Census Tract 58 has a 10% higher proportion of Native cases than the Study Area in general.

Table VII also indicates that for the Study Area 60% of cases arising in the Canadian-born population during the Study Period were non-Natives. This means high rates among Canadian-born persons in the Study Area receive a significant contribution from non-Native Canadians.

What do these results mean in terms of T.B. epidemiology of the Study Area? Firstly, they show that there are three main high-risk groups for T.B. in the area: 1) Urban Natives, 2) persons born outside of Canada, and 3) Non-Natives born in Canada.

Secondly, the results show a stability in relation to time. That is, the proportion of cases within each of the three groups has remained fairly constant over the Study Period as have rates. (The year 1977 is an exception. For this year, rates were unusually low compared to the other five years under study. It is not known why the rates were lower in 1977.)

Thirdly, approximately 40% of cases during the Study Period were due to people born outside of Canada and 60% due to Canadian-born persons. The Native contribution to Canadian-born cases was about 40% so that 60% of Canadian-born cases in the Study Area were non-Natives. These proportions remained stable over the study period, except for the year 1983. Whether this year was an anomaly or the beginning of a new trend is unknown and undeterminable based on the data in this study.
5.3 SOCIO-DEMOGRAPHY OF THE STUDY AREA:

The previous section has shown that tuberculosis is a problem within the Study Area and outlines the epidemiology of T.B. in terms of the three main high-risk groups in the area. This section attempts to explain in general terms the socio-demography of the Study Area.

A report on the health status of census tracts 57, 58, and 59 (these 3 census tracts coincide exactly with the Study Area) prepared for the Vancouver Health and Planning Departments in 1978 highlights the socio-economic and socio-demographic situation of residents. (The data from this report are based mainly on the 1976 update of the 1971 federal census report.)

The number of people living in the study area had dropped by 26% between 1961 and 1976 indicating a fairly steady movement of people out of the area. (This trend was reversed between 1976 and 1981 as the Study Area population increased by 12%) In terms of age structure, 27% of study area residents were 65 years of age or older compared to a Vancouver figure of 14%. In the Downtown-Eastside area this figure was particularly pronounced at 36%.

In Vancouver there is an approximately equal ratio of males and females. However, for the study area 69% of the population is male and 31% female. This difference in relation to the rest of Vancouver is even more pronounced in considering the Downtown-Eastside where males represent 85% of the population. In terms of ethnic groups the Study Area has a 37% Chinese population compared to 7% as a whole in Vancouver and a 32% British-born population compared to 53% in the city. It is
difficult to obtain an exact accounting of the native population in the area. This area also contains a large number of transients. Estimates of this population are 3,000 of which half are probably native.

Education, income and employment levels are low compared to city averages. The unemployment rate in the Downtown districts is 41% compared to 11% in Vancouver and almost 70% of the study area population had incomes less than $3,000 per year compared to 36% in Vancouver. For education, 62% of study area residents had only elementary school education compared to 33% in Vancouver.

These socio-economic conditions are associated with general ill health in the Study Area population. Thus, the Study Area has high rates of alcohol and drug abuse partially reflected in very high rates of cirrhosis of the liver.

In looking at causes of death by area in Vancouver in the year 1977 some facts are highlighted. For example, 22% of male and 23% of female deaths in the Study Area are from respiratory disease compared to respective figures of 8% and 5% in Vancouver. (However, it should be borne in mind that greater age of residents in the Study Area may be a contributing factor.) The difference in death rates from respiratory disease comprise the single biggest difference in mortality patterns between the Study Area and Vancouver. Effectively, death rates from respiratory disease in the Study Area are 350% higher than the Vancouver average. (Again, age standardization would have to be carried out on the death rates to reflect the true difference).

In summary the report stated: "The Study Area may be described, in comparison to Vancouver, as an area with a decreasing number
of residents. In comparison to Vancouver it has a high proportion of older single males, lower levels of education and income and higher levels of unemployment. It is ethnically a more diverse area than Vancouver and has a high proportion of transients."

It must be re-emphasized that between 1976 and 1981 the population of the Study Area increased by 12% reversing the skid-row depopulation trend of the 60's and early 70's. In the previous section it was shown that tuberculosis rates in the Study Area and the Downtown-Eastside are the highest in the Metro-Vancouver region. In this section it has been shown that the population of the study area is older, poorer and more ethnically diverse than the rest of Vancouver's population.

Because the Study Area houses an older population and a large proportion of immigrants, the Area itself is likely to produce more tuberculosis cases than other districts in Vancouver. Groups at high-risk for T.B. are concentrated in the Study Area. However, this may not be the only factor operating in T.B. epidemiology of the area.

The poverty, and poor living conditions of most area residents are a risk factor in the endogenous exacerbation of tuberculosis. Older residents who are alcoholic and malnourished run a higher risk of reactivation than older well-off residents of Vancouver. Natives and immigrants may run a greater risk of reactivation in the difficult living conditions in the Study Area. Any factors which make these living conditions worse may increase the risk of endogenous exacerbation for the high-risk groups.

With this in mind, recent developments in the Study Area in
relation to Vancouver's World-Fair (Expo-86) may affect the tuberculosis epidemiology of the area. Property developments related to Expo-86 are depopulating and changing the demographic character of the Study Area. Many of the tubercular patients living in the Study Area live in fairly run-down hotels which often turn into permanent homes. Many of these hotels are being renovated to capitalize on the tourist influx expected from Expo-86. According to a survey by the Vancouver Sun in February 1986, average hotel rents in the downtown area will go up by 600% during Expo-86.

According to Vancouver's deputy director of Social Planning, twenty two of the Downtown-Eastside's 26 hotels are planning renovations. A Downtown Eastside Residents Association survey conducted in February 1986 predicted about 1,000 rooms will be affected by the renovations. City housing planner John Jessup also predicted the situation will worsen. Presently (February 1986) at least 300 downtown residents have been dislocated and:"The trend has just started." Clearly, the future socio-demographic structure of the Study Area is uncertain as the area is in a state of flux.

A portion of the tubercular population and the population at high-risk to tuberculosis has been living in these hotels. Because the City of Vancouver does not have enough social housing units to cope with the large efflux of people involved in the evictions two major problems emerge. Firstly, the evictions will likely bring considerable personal hardship and financial stress to evictees which may increase the rate of endogenous exacerbation of the disease. Secondly, the evictions may increase
the tuberculosis rates in the area as a formerly settled population of infected people is essentially pushed out onto the street to mingle with the uninfected population.

Obvious problems are likely in terms of tuberculosis treatment and case-holding in the area. It may be harder to keep track of tuberculosis patients among the evictees. The evictions will likely cause difficulties for the DCHC's T.B. nurse in terms of case-finding and case-holding.

In summary, the Study Area is a depressed area housing a unique population of mainly older male residents. Many residents of the area are alcoholic and on welfare. Rents are increasing in the area forcing a formerly settled group at high-risk for tuberculosis (or already with the disease) out of their homes. The risk for increased rates of endogenous exacerbation of the disease among this group is likely increased as is the risk of spread of tuberculosis to the uninfected population in the area.

5.4 THE HIGH RISK GROUP:

We have described T.B. epidemiology and socio-demography in the Study Area. From this discussion it is clear that high rates are present in the area and the area is a poor district of Vancouver. The purpose of this section is to describe in greater detail the high risk group in the district.

As background the author attempted find information on similar high-risk groups in other urban areas of developed countries. Information was sparse. What follows is a review of the available literature.

A study by Chapman and Dyerly in the early 1960's in the United
States reported that crowding, mode of living and intensity of exposure were important in the intrafamilial transmission of T.B. with severity of disease the most important factor.

In a 1950 study by Comstock of an urban population in Alabama and Georgia, non-whites had much greater rates of tuberculosis infection than whites and men had greater rates than women in for both whites and non-whites. Later, in 1963, Comstock and Kummerer studied urban high-school students in Washington D.C. and found high rates of tuberculin reactivity associated with economically deprived and crowded living conditions, household exposure to T.B., and broken homes.

In a more recent paper (1977) of tuberculin reactor rates among urban adults in the United States, higher rates were associated with non-white racial status, lower income, less education, divorce or separation and more crowded residences.

A 1973 survey of employees (using multivariate analysis) in the New York Education Department found that "tuberculosis infection is significantly associated with race, socio-economic status, age and sex, in that order."

All of these studies are useful because they show clearly that socio-demographic and socio-economic indicators are associated fairly predictably with tuberculosis among urban populations in a developed country. Because these studies show that tuberculosis is associated with poverty, low education, etc. it may come as no surprise that T.B. is likely located in the most deprived urban regions: like skid-row.

Three main studies were found describing facets of socio-demography and epidemiology of skid-row tuberculosis patients. In
a 1960 study in New York City, 9,000 homeless skid-row residents were X-rayed. A total of 144 cases of new-active cases were found among the X-rayed group giving a rate of 1600 per 100,000.

A 1969 survey of a Baltimore chest clinic catering to a skid-row population found a sex and race distribution of 65:35 for respectively men and women and non-whites and whites. Sixty-five percent of the clinic attendees were non-white even though the urban area was 43% non-white. (Note, in our Study Area the white to non-white ratio was 50:50 approximately while the white to non-white ratio at the DCHC was about 60:30.

Finally, a 1971 Danish study based on the national Danish tuberculosis case registry for the years 1960-68 attempted to define the major high-risk groups in Denmark in socio-demographic terms. This study showed that in Copenhagen divorced men over forty years of age had rates which were approximately 200 per 100,000 placing them in a definite high-risk group. Furthermore, the study defined an urban group of "lonely men" between the ages of 40 and 69 who were either single, divorced or widowed. Although this group of urbanized "lonely men" comprised 11% of the adult male population they contributed 33% of the tuberculosis cases. For this group the incidence rate for tuberculosis was 160 per 100,000. The study concluded by stating marital status may be an important risk factor associated with tuberculosis incidence.

Based on these studies it is clear that urban groups (in developed countries) at high risk for T.B. tend to consist of a disproportionate number of male, non-white, single, people of
low socio-economic status.

When the data gathered for all the cases in this study are analysed according to socio-demographic and socio-economic indicators this basic pattern is clearly observable for the Vancouver skid-row tubercular population. (See Table VIII)

From this table a socio-demographic profile of the high-risk group with tuberculosis living in the Study Area can be drawn. Where possible, the proportion of T.B. cases relative to socio-demography of the Study Area is compared.

TABLE VIII. Socio-demographic distribution of Study Area T.B. Cases Registered in the years 1977-79 & 1981-83. (234 Cases)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>T.B CASE %</th>
<th>% in Study Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>RACE</td>
<td>White</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Native</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chinese</td>
<td>22</td>
<td>37</td>
</tr>
<tr>
<td>SEX</td>
<td>Male</td>
<td>78</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>22</td>
<td>34</td>
</tr>
<tr>
<td>AGE</td>
<td>20-59</td>
<td>64</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>60+</td>
<td>36</td>
<td>36</td>
</tr>
<tr>
<td>MARITAL STATUS</td>
<td>Married</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Single</td>
<td>48</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Wid &amp; Div.</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>ALCOHOLIC</td>
<td>Yes</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>OCCUPATION</td>
<td>Employed</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unemployed</td>
<td>62</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Retired</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>BIRTHPL.</td>
<td>Canada</td>
<td>63</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>Not Canada</td>
<td>37</td>
<td>51</td>
</tr>
</tbody>
</table>

Table VIII indicates that compared to the Study Area population, a greater proportion of males, a greater proportion of Canadian-born and a greater proportion of those in age-group 20-59 are found in the tubercular population of the Study Area.
This may indicate that even within this high-risk area of Vancouver, men, people between the ages 20-59 and Canadian-born are at greater risk than the average population for T.B. However, these differences may occur because of the inaccuracy of the census data for this area particularly as it relates to its inability to count the transient population. (And particularly as the transient population is likely between the ages of 20-59, male and Canadian-born.)

In summary, Chapter 5 shows that tuberculosis incidence is high in Vancouver compared to the rest of B.C. and that rates increase in a gradient as we go from the North Health Unit to the Study Area to the Downtown-Eastside. Moreover, conditions of poverty are endemic in the Study Area and may contribute to heightened risk for endogenous reactivation for the high-risk groups living there. The Study Area population increased between 1976 and 1981, so that increases in rates noted for the Study Period may be a reflection of this population shift. If so, then rates were relatively stable throughout the Study Period in the Study Area.

Recent development in the Study Area related to Expo-86 may be of particular concern because of evictions in the area. The stress associated with evictions may weaken the resistance of the infected population leading to a higher rate of reactivation. The evictions may also increase the risk of primary infection for the local uninfected population as a hitherto fairly settled population of hotel residents is mobilized to find alternate accommodation.

Canadian-born persons contribute about 60% of the cases in the
Study Area. In estimating the relative contribution of Native versus non-Native cases to the high Canadian-born contribution, it is clear that non-Native cases occur 1.5 times as often as Native cases. This is an unusual ratio because based on average provincial rates for Native and non-Native Canadian-born persons we would expect the number of Native cases to be at least 17 times the number of non-Native cases assuming an equal population of Natives and non-Natives. (This is based on a B.C. rate of 110/100,000 for Natives and 9.7/100,000 for non-Natives)

Rates have been historically high for Natives and immigrants from countries with high rates. Thus, it is not surprising to find members of these two groups contributing to the T.B. case load in the Study Area. However, rates for non-Native Canadians are generally low (about 10/100,000 in B.C.). Clearly, the non-Native Canadian high-risk group in the Study Area is a unique group.

Although studies of T.B. epidemiology in skid-row areas in developed countries are few and far between, studies in Denmark, and the United States have clearly pointed out the existence of this 'down-and-out' local-born group at high-risk for the disease. This study shows the contribution of non-Native Canadian-born persons in Vancouver. It is highly likely that this group has significant impact to the T.B. epidemiology of most major North American cities.
6.1 COMPLIANCE AND SOCIO-DEMOGRAPHY:

The data in Table VIII show who is diagnosed as tubercular in the Study Area. Prior to establishment of the DCHC most members of this tubercular population would have been treated at the WCC. However, since establishment of the DCHC, clinicians have selected who they feel are the difficult-to-treat sub-group within this skid-row tubercular population for out-patient therapy at the DCHC. It is clear that this group of perceived non-compliers has certain socio-demographic features which differentiate it from the main body of tubercular patients in the Study Area. (Table IX)

<table>
<thead>
<tr>
<th>SOCIO-DEMOGRAPHY</th>
<th>WCC</th>
<th>DCHC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>SEX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>19</td>
<td>61</td>
</tr>
<tr>
<td>Female</td>
<td>12</td>
<td>39</td>
</tr>
<tr>
<td>RACE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>10</td>
<td>32</td>
</tr>
<tr>
<td>Native</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Chinese</td>
<td>15</td>
<td>48</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>BIRTHPLACE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>China</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>S.E. Asia</td>
<td>13</td>
<td>42</td>
</tr>
<tr>
<td>Europe</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALCOHOLIC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>19</td>
<td>61</td>
</tr>
<tr>
<td>Yes</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Unknown</td>
<td>8</td>
<td>26</td>
</tr>
</tbody>
</table>
Table IX shows that compared to the WCC the DCHC treats; a greater proportion of Canadian-born patients (76% vs 29%), natives (33% vs 7%), alcoholics (74% vs 13%), and a greater proportion of males (87% vs 61%). Also, compared to the WCC the DCHC treats a smaller proportion of Chinese and S.E. Asian born patients (9% vs 58%).

These data show that the best perceived compliers in the tubercular population of the Study Area belong to the Chinese or South-East Asian born group. The Canadian-born population, particularly Natives, are perceived as the most non-compliant group.

The point of this data analysis is to show that patients are selected into the DCHC program on the basis of their probable compliance as judged by clinicians at the Division of T.B. Control. According to Dr. Enarson, whether a patient is hospitalized or not and his/her length of hospitalization is often related to perceived compliability of the patient. Thus, both in-patient and out-patient treatment modalities are determined in large part by medical perceptions of individual compliability.

Clinicians may use socio-demographic criteria to select patients or they may use some other criteria. If they select patients into a 'difficult-to-treat' group on the basis of socio-demographics then clinical experience is telling them that socio-demography and compliance are linked. Even if they select their perceived non-compliant group on an other-than socio-demographic basis, the end result is socio-demographically different complier groups. Thus, socio-demographics are somehow linked to perceived
compliance performance of tuberculosis out-patients. While the study data may show a link between socio-demography and compliance - what about the literature?

The literature on compliance is extensive. From this body of literature and his own research Becker developed a model of compliance. (Fig 2)

FIGURE 2: HEALTH BELIEF MODEL

<table>
<thead>
<tr>
<th>Perception about health</th>
<th>Modifying factors</th>
<th>Compliant Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>Demographic Likelihood of</td>
<td></td>
</tr>
<tr>
<td>Perceived Value of Illness threat reduction</td>
<td>Structural compliance to the</td>
<td></td>
</tr>
<tr>
<td>Perception of how well compliance will reduce illness threat</td>
<td>Psychological drug regime.</td>
<td></td>
</tr>
</tbody>
</table>

The model states that readiness to undertake compliant behaviour depends on motivation and belief in how well the compliant behaviour will reduce the illness. Socio-demographic factors are seen as modifying components affecting perceptions about health which in turn determine the likelihood of compliance.

This model is widely accepted and quoted in the compliance literature and provides some theoretical rationale linking compliance and socio-demography.

6.2 ATTENDANCE COMPLIANCE:

There are two types of compliance discussed in the literature: attendance and treatment compliance. Attendance compliance is concerned entirely with attendance to appointments while treatment compliance tackles the issue of patient adherence to a recommended program of treatment.

In this study, the focus is mainly on attendance compliance for two reasons: 1) Attendance compliance measurement is one that
has relatively few problems compared with measurement of treatment compliance; and 2) for the DCHC, where treatment is supervised, attendance compliance is the same as treatment compliance (because when a patient attends the clinic ingestion of drugs is directly monitored).

While attendance compliance is easier to measure than treatment compliance it doesn't reveal as much about treatment outcome as treatment compliance. All that is being measured is attendance to the clinic. For outcomes to be successful, the clinic must function well.

In a clinic evaluation based on attendance compliance as the dependent variable (such as this study) the assumption is made that regular attendance is the minimum prerequisite for successful outcome. (If the patient won't come to the clinic regularly to pick-up medications then even if the clinic is the best tuberculosis clinic in existence, treatment will be a failure.) For the population in the Study Area with it's high proportion of alcoholics and 'difficult-to-treat' patients, ensuring attendance is particularly important.

In summary, although the primacy of socio-demographic variables in determining compliance to treatment is open to interpretation it is clear that clinicians at the Division of T.B. Control select out a group they deem as 'non-compliant' which is socio-demographically different from the rest of the Study Area population. Analysing compliance in relation to socio-demographic characteristics of this population may help determine the effectiveness of the out-patient clinic.
The dependent variable for this study is attendance compliance because it is measurable and because ensuring regular clinic attendance is a prerequisite for clinic success.
CHAPTER 7.
THE EFFECT OF TWO TYPES OF CLINIC SYSTEMS
ON COMPLIANCE TO TUBERCULOSIS CHEMOTHERAPY

METHODS

7.1 OVERVIEW:

The study design is divided into four parts. Parts 1-3 answer the three questions posed in this thesis and part 4 analyses the 'drop-outs' from the DCHC.

Part 1 is the evaluative component of the thesis. It is a retrospective matched case-control study to test the null hypothesis that the rate of compliance for patients attending the DCHC equals the rate of compliance for matched controls who attended the WCC. For this section the control group is the group which attended the WCC in the three year period prior to establishment of the DCHC and the experimental group is the group which attended the DCHC in the three year period after it's establishment.

Part 1 is concerned with a matched comparison of WCC and DCHC patients over two time periods. Parts 2 and 3 are focused entirely on the DCHC.

Part 2 determines which independent variables best explain and predict compliance for patients treated at the DCHC.

In Part 3 the sociodemographic and treatment variables for the 4 compliance quartiles at the DCHC are compared. From this comparison a sociodemographic and treatment profile for least versus most compliant patients is developed.

In Part 4 the number and characteristics of 'drop-outs' from the DCHC program are analyzed. The preceeding analysis is in terms
of attendance compliance gives us no information on the drop-out rate from the DCHC. Part 4 attempts to fill that gap.

With this methodology the DCHC's effectiveness in relation to the WCC is determined; major factors predicting compliance at the DCHC are determined; and, a profile is developed for compliant and non-compliant patients.

7.2 SAMPLE:

1. Sample Selection:

The patients in this study were all the new active tuberculosis cases resident in census tracts 57, 58 and 59 at time of diagnosis in the years 1977, 78, 79, 81, 82 and 1983. Because there is a legal requirement to register all active cases of tuberculosis with the Division of T.B. Control, all known cases in the area are on record with the Division. Cases were found using a master list of Vancouver patients. Each patients' T.B. 'file was pulled to see if the address at time of diagnosis was within the study area. In total, 234 cases were found for the study. The sample was distributed as shown in Table X.

Of the 234 eligible cases, 78% (182) participated in out-patient drug therapy, 16% (38) died and 6% (13) did not participate as out-patients because they either disappeared, moved away or were treated as in-patients at WCC.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Outpat. at WCC</td>
<td>20.</td>
<td>31</td>
<td>24</td>
<td>12</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Outpat. at DCHC</td>
<td></td>
<td></td>
<td></td>
<td>16</td>
<td>29</td>
<td>31</td>
</tr>
<tr>
<td>Inpatient only</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>DIED</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>10</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>DISAPPEARED</td>
<td>2</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEFT STUDY AREA</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>31</td>
<td>38</td>
<td>33</td>
<td>42</td>
<td>41</td>
<td>49</td>
</tr>
</tbody>
</table>

2. Sample Boundaries.

The formal boundaries of the study were census tracts 57, 58 and 59. These Statistics Canada census tracts encompass the Vancouver districts of Strathcona, the Downtown core and the Downtown-Eastside and also correspond to the Northern, Western and Southern boundaries of the North Health Unit of Vancouver's Health Department. (See map in Appendix A)

These boundaries were chosen because they encompass the DCHC's patient target area. The DCHC was established to serve residents of the downtown districts in Vancouver. Also, the boundaries were chosen because Strathcona, the Downtown core and Downtown-Eastside have the highest rates of tuberculosis in the city and because nearly all the TB deaths in Vancouver over the past decade have occurred in these three districts.
7.3 VARIABLES:

The dependent variable in this study is compliance; the intervening variable is the out-patient treatment system (DCHC or WCC); and the independent variables consist of measureable socio-demographic and medical characteristics of the tubercular population.

1. Independent Variables. (details on categories follow)

A) Socio-demographic.

a) Sex
b) Birthplace
c) Age
d) Race.
e) Marital Status.
f) Occupation.
g) Location.

B) Medical Variables.

a) Diagnosis.
b) Whether hospitalized prior to out-patient treatment.
c) If hospitalized— for how long.
d) If hospitalized— length of interval between discharge and first drug pick-up as an out-patient.
f) Alcoholism.

Information on seven of the eight socio-demographic variables are recorded on a standardized TB 40 form which is filled out at each out-patient visit to the WCC. Because all patients at the DCHC are referred from the WCC, they too have a TB 40 form
containing this information on file at the Division of T.B. Control. Alcoholism or drug addiction are not a standard part of the T.B. 40 form so recording of this socio-demographic variable was less regular than the other variables. However, this was less of a problem for hospitalized patients as alcoholism is regularly discussed in the hospital discharge summary.

One of the medical variables, diagnosis is also recorded on the TB 40 form. However, the other medical variables were transcribed from the patients hospital discharge summary.

2. Intervening Variables.

The intervening variable is type of out-patient treatment. In the sample, patients either died, left the area after diagnosis, obtained all treatment as an in-patient or attended out-patient treatment at the WCC or DCHC. Thus, out-patients (with one exception, a man undergoing cancer chemotherapy who also received out-patient tuberculosis therapy from his private physician) attended the WCC or DCHC.

3. Dependent Variables.

Attendance compliance to out-patient treatment is the dependent variable. Compliance is measured in terms of attendance at drug pick-up appointments.

In terms of attendance to appointments, compliance was calculated by dividing actual attendances by expected appointment attendances and multiplying by 100 to give a percentage compliance figure for each patient. Length of out-patient treatment was measured in weeks from the date of the first to the last drug pick-up.

It must be pointed out that the number of expected attendances
at both clinics differed enormously. At the WCC drug pick-up appointments were monthly, every two months or quarterly. Thus over a treatment course of nine months the expected number of appointments varied from a maximum of nine to a minimum of three. At the DCHC, the number of expected drug pick-up appointments depended on the treatment regime recommended. For a daily treatment regime the number of expected clinic attendances over nine months was approximately one hundred and eighty. However, someone on a weekly treatment regime would be expected to attend thirty six appointments over a nine month span. Clearly, attendance expectations were quite different at the two clinics and within the DCHC across treatment modalities.

Attendance compliance was measured at both clinics over a maximum out-patient treatment length of 12 months because this was the minimum length of out-patient treatment prescribed for the WCC for the period 1977–79. Thus, appointments occurring after a person had been in out-patient therapy at either clinic for more than 12 months were not included in the compliance scores.

7.4 CODING

Data were transferred from the T.B. records to a specially designed data collection form. Ninety percent of the data transfer was performed by a research assistant employed by the University of B.C. (U.B.C) The remaining 10% was performed by the author. All the data coding and computer entry were performed by the author according to SPSS:X specifications. Once all the data were coded a frequency distribution was run for all variables.

In order to carry out the analysis some of the data were
Recoded independent variables were:

**Location:** The approximately 100 street names and 200 street numbers were recoded into 4 areas based on proximity to the DCHC (see map in Appendix B). The rationale behind recoding areas was that proximity to the clinic may affect clinic attendance because the population under study is poor and may have restricted access to transportation.

Two areas, each 18 square blocks were constructed in concentric squares around the DCHC. These areas 1 and 2 are the core and outer-core areas closest to the clinic. Also, these two areas encompass the DCHC T.B. nurses' regular surveillance route. The T.B. nurse thus patrols about half the Study Area. This active surveillance may be a factor influencing the compliance of patients.

A third area -area 3- encompasses the eastern and western edges of the boundaries. Area 4 is farthest from the clinic in the south-west corner of the study area.

Independent variables consisting of interval data like age, length of hospitalization, and interval between hospital discharge and first drug pick-up were recoded into 5 ordinal categories. These categories were constructed so as to contain equal frequencies by using the cumulative percentage intervals of twenty percent.

These worked out as follows:

**Age:**
1) 1 through 41
2) 42 through 50
3) 51 through 59
4) 60 through 67
5) greater than 68.

Length of Hospitalization: (in weeks)
1) 1 through 6
2) 7 through 13
3) 14 through 17
4) 18 through 24
5) greater than 25 weeks.

Interval between Discharge and Drug Pick-Up: (in weeks)
1) 1
2) 2 through 5
3) 6 through 9
4) 10 through 13
5) greater than 14 weeks.

Length of out-patient treatment: (in weeks)
1) 1 through 27
2) 28 through 38
3) 39 through 50
4) 51 through 60
5) greater than 61 weeks.

Independent variables consisting of categorical data were recoded as follows:

Occupation:
1) unemployed
2) retired
3) employed.
Marital status:
1) Single
2) Married
3) Widowed and divorced.

Diagnosis:
1) Far advanced active
2) Moderately advanced active
3) Minimally advanced active
4) Other. (eg.) extra-pulmonary T.B.

Dependent Variable:
Percent compliance:
1) 1 through 24
2) 25 through 50
3) 51 through 73
4) 74 through 99
5) 100% compliance.

7.5 DESIGN BIAS

A potential sources of bias arises because data collection was carried out by two people. A U.B.C. employee gathered most of the data. However, the author gathered data for 25 outstanding cases, (less than 10%). To test the reliability of data collection between the two people, the author randomly selected ten cases processed by the U.B.C. employee and transferred data from the records to the data collection sheet. Discrepancies between the two sets of 10 data sheets were recorded and Chi-Square test performed. No significant discrepancies were observable between the two people.

Another source of bias arises because of differences in the
volume and detail of T.B. records. In particular, patients who have been hospitalized have a hospital discharge summary as part of their T.B. record. Many hospitalized patients also have a social worker's assessment on file. These expanded T.B. files provide a more detailed socio-demographic and medical profile than is available for non-hospitalized patients.

7.6 STUDY DESIGN

1. Question 1.

A retrospective matched-case control study to evaluate the effectiveness of the DCHC in terms of compliance.

A) Population and Setting.

Physician selection largely on the basis of perceived compliability means that the WCC and the DCHC treat very different groups of patients. (See Table IX)

Clearly, selection of patients on the basis of perceived compliability has resulted in two socio-demographically distinct sub-groups of tuberculosis out-patients attending each clinic. Because the treatment groups at the two clinics are so dissimilar, these two groups cannot be used to measure the effect of clinic type on compliance.

To meaningfully compare the effect of both clinics on compliance it was necessary to retrospectively match cases attending the DCHC with WCC cases in terms of major socio-demographic and medical variables. Controls were sought among the 75 cases at the WCC in the 1977-79 period. Once matched, differences in compliance between the two groups are much more likely due to the intervening variable, out-patient treatment
type, than to social background. The control group was the 75 cases at the WCC in the 1977-79 period and the experimental group was the 76 cases at the DCHC in the period 1981-83.

B) Matching.

The 76 DCHC patients were divided into groups on the basis of sex, race and birthplace. The same procedure was done for the 75 patients who attended the WCC from 1977-79. These groups were matched. Within these exact matchings for sex, race and birthplace cases were matched (pair-wise) in order and according to the following process:

1. Age - was matched within 5 years of the DCHC patient.
2. Area - was matched to within 1 district.
3. Alcoholism - alcoholics were matched with alcoholics and non-alcoholics were matched with non-alcoholics or unknowns.
4. Diagnosis - was matched as closely as possible.
5. Whether the patient was hospitalized - was matched if possible.
6. Marital status and occupational status were also matched up as far as possible.

Using this procedure 55 out of the 76 DCHC cases were matched exactly for sex, race and birthplace with 55 out of the 75 cases treated at the WCC. When Chi Square tests were performed on the 110 cases, no significant differences were observable between the groups in terms of age, area, alcoholic, occupational and marital status, whether the patient was hospitalized or not and diagnosis of patients. This procedure resulted in matching of 73% of the DCHC cases.

This stratified matching process resulted in a series of non-normal distributions so that a non-parametric statistical test
was most appropriate. A Wilcoxon Signed Rank Test was performed to test for a difference in compliance between the matched pairs.

A pair-wise match with the criteria outlined was not achievable for 21 cases at the DCHC. These cases were therefore left out of the testing process. However, they were analyzed to determine the effect of the missing cases on the evaluative test outcome. (See Chapter 8 Section 8.1)

2. Question 2.

What characteristics or combinations of characteristics best predict compliance to drug therapy at the DCHC? A statistical model to handle this problem was difficult to find because the independent variables are mainly in nominal form while compliance is in ordinal form. By considering the ordinal scale an interval scale, ANOVA techniques can be used. In particular, Multiple Classification Analysis (MCA) was chosen because of the beta statistic it produces which approximate to a regression coefficient.

Besides producing a measure of strength of association between independent and dependent variables, MCA also presents results in terms of the amount of variation from the dependent variable mean caused by each category in each independent variable. This allows for a more detailed analysis of the data than would be accomplished using ANOVA alone.

Also, MCA can tell how much a second variable adds to the predictability of the first variable. Finally, the effects of the model as a whole can be ascertained.
3. Question 3.

Who benefits and who doesn't benefit from treatment at the DCHC?

This question was best answered by dividing the compliance scores of all 76 cases at the DCHC into quartiles. When the 76 cases were broken down into quartiles, compliance scores from 0 through 64% represented the first quartile, 65-92% the second quartile, 93-99% the third quartile and 100% the fourth quartile. Crosstabulations were run for independent variables in relation to these quartiles for compliance. From these crosstabulations a socio-demographic and treatment profile was built up for the low to high compliance quartiles to identify who benefits and who does not benefit from the DCHC program.

In this analysis, particular attention is paid to the role of those independent variables identified as predictive of compliance in the previous section.

4. Section 4.

Characterization of 'drop-outs' at the DCHC.

In this thesis attendance to appointments has been the major dependent variable. While this is a fairly easily measured variable, when analysed in isolation gives us little information on failure or success of treatment as opposed to attendance.

For example, a patient who achieved 100% compliance but dropped out of the clinic after 8 weeks may have less treatment success than a person who attended 65% of his/her appointments over a 45 week period. Or, a person could be 100% compliant but drop out of the program after 6 weeks. Although such a case would
be registered as 100% compliant he/she may be a treatment failure.

Measuring attendance compliance only does not tell us how many drop-outs occur in the program or who the drop-outs are. To round out the evaluation of the DCHC, some assessment of the drop-out rate is needed.

To identify drop-outs, those patients who attended the DCHC for 6 months or less were identified. Because many members of this group had been hospitalized for some length prior to out-patient treatment, they were expected to attend the DCHC for varying periods less than 6 months. When this group was separated out from the rest, the real drop-outs were isolated and described.
CHAPTER 8.

THE EFFECT OF TWO TYPES OF CLINIC SYSTEMS ON COMPLIANCE TO TUBERCULOSIS CHEMOTHERAPY.

RESULTS AND DISCUSSION

The reader is reminded that the three thesis questions are: 1) Which clinic best promotes compliance?; 2) What factors best predict compliance at the DCHC?; and 3) Who benefits and who doesn't benefit from treatment at the DCHC?

8.1 QUESTION 1: which clinic best promotes compliance?

The results of the Wilcoxon Matched-Pairs Signed-Ranks Test using compliance with appointments as dependent variable in Table XI.

<table>
<thead>
<tr>
<th>Mean Rank</th>
<th>Cases</th>
<th>-Ranks (DCHC less than WCC)</th>
<th>+Ranks (DCHC greater than WCC)</th>
<th>Ties (DCHC equal to WCC)</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.00</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.41</td>
<td>51</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>Ties (DCHC equal to WCC)</td>
<td></td>
<td>55</td>
</tr>
</tbody>
</table>

\[ Z = -6.0831 \quad 2\text{-TAILED } P = .0000 \]

The Wilcoxon Test tests for significant differences in compliance between each pair of matched cases. The test shows that we must reject the null hypothesis that compliance in the two clinics is equal at \( p=0.000 \) level.

The mean compliance for the 55 cases at the WCC was 37% compared to 83% for matched cases at the DCHC. These results indicate that compliance is significantly better at the DCHC.

It must be remembered that this result is valid for the 55
matched cases. What about the 21 unmatched cases? These cases were not matcheable because of the age disparity between the experimental and control time periods.(Table XII)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>59.0</td>
<td>55.7</td>
<td>49.2</td>
</tr>
<tr>
<td>Native</td>
<td>49.3</td>
<td>44.7</td>
<td>44.8</td>
</tr>
<tr>
<td>Chinese</td>
<td>63.8</td>
<td>56.0</td>
<td></td>
</tr>
</tbody>
</table>

The mean ages for White and Native tubercular patients registered in the Study Area dropped by approximately 5 years over the two time periods. For Chinese the decrease was about 7 years. The decrease in the mean age for Chinese cases may be explainable because of the influx of Vietnamese refugees. These recent arrivals added a youthful component to the Chinese T.B. population in the area. Because most of these younger Chinese patients were treated at the WCC during the 1981-83 period, matching was not an issue for this group.

However, for 10 Native and 11 White cases treated at the DCHC between 1981-83, age matches were simply not available in the WCC Control group treated during 1977-79. This relatively large downward age-shift within the Study Area over a 6 year span is curious and may be cause for concern and further study. (This shift is particularly curious for the white group because the cohort effect predicts higher rates for older segments of this group).

How does the exclusion of these 21 younger unmatched cases effect the comparison of compliance between the two clinics? As is shown in Section 8.2, younger patients tend to be less
compliant at the DCHC. Thus, the matching process has excluded cases which are likely among the most non-compliant group. Our result showing better compliance at the DCHC versus the WCC must be qualified by stating that compliance at the DCHC was better than at the WCC for 73% of DCHC cases. For the 27% of DCHC cases which were generally younger patients, no conclusions on relative clinic efficacy in terms of compliance can be drawn.

Other medical variables for these matched groups can be examined to assess the overall impact of the DCHC on tuberculosis treatment of the matched group. Table XIII compares the effect of clinic type on length of treatment for those patients hospitalized prior to out-patient treatment. (Thirty-five cases were hospitalized in each group prior to out-patient treatment)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WCC</td>
<td>11.3</td>
<td>3.1</td>
<td>43.1</td>
<td>57.4</td>
</tr>
<tr>
<td>DCHC</td>
<td>4.7</td>
<td>1.1</td>
<td>37.2</td>
<td>43.0</td>
</tr>
</tbody>
</table>

This table indicates that for matched hospitalized patients at the two clinics treatment lengths were different. Matched hospitalized patients treated at the WCC spent 14.4 weeks more than DCHC patients in treatment. Approximately half this difference is accounted for by the longer hospital stays of WCC patients. (It is essential to remember that the expected length of treatment at the WCC out-patient clinic program between 1977-79 was 12-24 months so that we would expect the length of out-patient treatment at the WCC to be significantly greater than for
It is also useful to compare the experience of hospitalized versus non-hospitalized patients at the two clinics (Table XIV).

**TABLE XIV: Comparison of Hospitalized and Non-hospitalized Cases.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>WCC</th>
<th>DCHC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospitalized</td>
<td>Hospitalized</td>
</tr>
<tr>
<td></td>
<td>Not hosp.</td>
<td>Not hosp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of out-pat.</td>
<td>43.1</td>
<td>37.2</td>
</tr>
<tr>
<td>treatment (weeks)</td>
<td>58.8</td>
<td>40.6</td>
</tr>
<tr>
<td>Complian. (percent)</td>
<td>29.2</td>
<td>82.8</td>
</tr>
<tr>
<td></td>
<td>51.8</td>
<td>88.3</td>
</tr>
</tbody>
</table>

Table XIV shows that the experience of hospitalized and non-hospitalized patients within both clinics is quite different in terms of length of out-patient treatment and attendance compliance. That is, hospitalized patients at both clinics remain on out-patient treatment for less time and comply less to treatment than non-hospitalized patients. This is likely explainable because of the selection procedure slotting those patients perceived as non-compliant into the hospitalized population and those patients perceived as compliant into the non-hospitalized population.

In summary, there is clearly a significant difference between the WCC and DCHC in terms of compliance to out-patient treatment for our matched groups. The DCHC shows an almost 50% better compliance record than the WCC. Also, the fact that, clinicians tend to hospitalize patients perceived as non-compliant is reflected in the compliance statistics computed at both clinics.

While length of out-patient treatment is not strictly
comparable at the two clinics (because expectations of treatment length were different at the two clinics) it is clear that the total length of treatment at the DCHC for the years 1981-83 was much less than the total treatment length at the WCC for the years 1977-79. Given this factor alone, it is likely that the evolution of the DCHC (for difficult-to-treat patients) is not only a progressive one in terms of efficacy of treatment but is also progressive in fiscal terms.

8.2 Question 2: What factors best predict compliance at the DCHC?

According to Chapter 6, socio-demographic and treatment factors likely affect compliance. The literature is somewhat inconclusive as to the nature or the strength of the effects of socio-demographic or treatment variables on compliance, particularly as the literature on compliance among a generally alcoholic alienated population is negligible.

To determine which variables may affect compliance a One-Way Analysis of Variance was done for each socio-demographic and treatment variable measured in the study. These analyses were performed on the 76 cases within the study area during the period 81-83 who attended the DCHC.

Socio-demographic variables significantly affecting compliance at a p level of less than .05 were age, area, alcoholism, occupation and race, in that order. The medical variables, diagnosis and whether hospitalized, had an effect at p values less than 0.1. The effect of sex on compliance is probably not reliably measured because the number of females is ten which is about 12% of our sample.
TABLE XV: Oneway Analysis of Variance for 12 Independent Variables in Relation to the Dependent Variable - Compliance.

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>F Value</th>
<th>F-Ratio Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Socio-demographic:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td>5.6</td>
<td>0.0005</td>
</tr>
<tr>
<td>AREA</td>
<td>4.1</td>
<td>0.0094</td>
</tr>
<tr>
<td>ALCOHOLISM</td>
<td>4.8</td>
<td>0.0303</td>
</tr>
<tr>
<td>OCCUPATION</td>
<td>3.4</td>
<td>0.0358</td>
</tr>
<tr>
<td>RACE</td>
<td>3.1</td>
<td>0.0491</td>
</tr>
<tr>
<td>BIRTHPLACE</td>
<td>2.0</td>
<td>0.1098</td>
</tr>
<tr>
<td>MARITAL STATUS</td>
<td>1.8</td>
<td>0.1684</td>
</tr>
<tr>
<td>SEX</td>
<td>0.1</td>
<td>0.6985</td>
</tr>
<tr>
<td><strong>Medical:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOSPITALIZED?</td>
<td>3.5</td>
<td>0.0634</td>
</tr>
<tr>
<td>DIAGNOSIS</td>
<td>2.1</td>
<td>0.0961</td>
</tr>
<tr>
<td>TYPE OF O.P. TREAT</td>
<td>0.6</td>
<td>0.6368</td>
</tr>
<tr>
<td>LENGTH OF HOSP.</td>
<td>0.5</td>
<td>0.6395</td>
</tr>
<tr>
<td>LENGTH OF O.P. TREAT</td>
<td>0.3</td>
<td>0.8265</td>
</tr>
</tbody>
</table>

Based on results in section 8.1 and the selection bias linking hospitalization with perceived non-compliance it is expected that the variable hospitalization will have an impact on compliance.

To more closely analyze the effect of these variables on the dependent variable Multiple Classification Analysis Analysis was performed with the seven variables found significantly affecting compliance. The results are presented in Table XVI.
TABLE XVI: MCA of 7 variables in relation to Compliance.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unadjusted Eta</th>
<th>Adjusted for Independents Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>.39</td>
<td>.38</td>
</tr>
<tr>
<td>Age</td>
<td>.39</td>
<td>.29</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>.21</td>
<td>.26</td>
</tr>
<tr>
<td>Race</td>
<td>.28</td>
<td>.20</td>
</tr>
<tr>
<td>Hospitalize</td>
<td>.19</td>
<td>.15</td>
</tr>
<tr>
<td>Alcoholism</td>
<td>.10</td>
<td>.13</td>
</tr>
<tr>
<td>Occupation</td>
<td>.20</td>
<td>.09</td>
</tr>
</tbody>
</table>

The beta statistic is a standardized regression coefficient in the sense used in multiple regression. Beta is associated with the adjusted category effects for each variable. The eta statistic is a correlation ratio associated with the unadjusted category effects for each variable.

By viewing the eta statistic for each variable the correlation between area and compliance is strongest with that between occupation and compliance weakest. When the eta statistic is adjusted for the effects of the other nominal variables, alcoholism, diagnosis, hospitalization and area remain relatively unaffected by the other variables. However, the effects of race and age on the dependent variable is reduced by about one third and the effect of occupation by about a half.

What do these results mean? Taking the model as a whole, area, age, diagnosis and race (in that order) appear to be the most predictive of compliance. While Table XVI shows these four variables may be the most predictive for compliance the direction of prediction is not shown. This is shown in Table XVII.
Table XVII shows that for the 76 cases at the DCHC, used in this analysis, the compliance mean (grand mean) was 79%. The unadjusted deviation column shows the deviation from the grand mean produced by each factor within categories. The adjusted deviation shows the effect of each factor after all other factors are controlled for.

Table XVII appears to confirm the results of Section 8.1 in terms of hospitalization. It is somewhat surprising that the impact of the variable hospitalization appears small relative to
the other variables as hospitalization is a selection variable for perceived compliance.

In terms of diagnosis, there is a fairly consistent relationship between severity of disease and compliance. As disease severity increases so does the positive deviation from the compliance mean.

Area also shows a consistent relationship with compliance. Positive deviations from the compliance mean increase with increasing proximity to the clinic. Race shows the same constancy with Natives having a negative deviation from the mean, Whites being at the mean and Chinese having a large positive deviation from the mean.

Patient categories over 60 years of age had a positive deviation from the mean. Those under 60 had negative deviation from the mean. For the under 60 categories there was a regular increasing negative deviation from the mean going from oldest to youngest.

The relationship between age and compliance is shown in Table XVIII.

**TABLE XVIII: Mean Compliance for Recoded Age Categories.**

<table>
<thead>
<tr>
<th>AGE CATEGORY</th>
<th>MEAN COMPLIANCE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 41</td>
<td>63.3</td>
</tr>
<tr>
<td>42 to 50</td>
<td>72.1</td>
</tr>
<tr>
<td>51 to 59</td>
<td>83.7</td>
</tr>
<tr>
<td>60 to 67</td>
<td>90.0</td>
</tr>
<tr>
<td>over 68</td>
<td>98.9</td>
</tr>
</tbody>
</table>

The results for the variable alcoholism are interesting. It appears that alcoholism is not correlated with compliance. Results indicate that when adjusted for other variables in the
model, non-alcoholics comply less than alcoholics. This result has a direct bearing on the clinic because one of the major selection criteria into the DCHC is alcoholism. In other words, most clinicians feel alcoholism is a major indicator of potential non-compliance. The limited results here show that alcoholism may be a very minor factor compared to age, area and race.

In summary, area of residence in relation to the clinic is the strongest predictor of compliance followed by age and diagnosis. Race, hospitalization, alcoholism and occupation are weaker predictors for compliance. A more detailed exploration of these relationships are presented in the next section.

8.3 QUESTION 3: Who benefits and who doesn't benefit from treatment at the DCHC?

In this section the 76 cases at the DCHC were divided into quartiles in terms of their compliance and a series of crosstabulations and breakdowns run to develop a profile of socio-demographic and treatment characteristics for all 4 groups using the 5 major predictive variables: area, age, race, diagnosis and hospitalization. When the 76 cases were broken down into quartiles, compliance scores from 0 though 64% represented the first quartile, 65-92% the second quartile, 93-99% the second quartile, and 100% the fourth quartile.
1. Socio-demographic Variables:

A) AGE.

TABLE XIX: Crosstab of Age Category by Compliance Quartile. (Figure in brackets is % within each age category)

<table>
<thead>
<tr>
<th>Quartile</th>
<th>1-41 (45)</th>
<th>42-50 (34)</th>
<th>51-59 (20)</th>
<th>60-67 (8)</th>
<th>68-98 (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 low</td>
<td>9 (45)</td>
<td>4 (34)</td>
<td>4 (20)</td>
<td>1 (8)</td>
<td>1 (10)</td>
</tr>
<tr>
<td>2</td>
<td>8 (40)</td>
<td>1 (8)</td>
<td>6 (30)</td>
<td>3 (23)</td>
<td>1 (10)</td>
</tr>
<tr>
<td>3</td>
<td>2 (10)</td>
<td>4 (33)</td>
<td>7 (35)</td>
<td>8 (80)</td>
<td>1 (10)</td>
</tr>
<tr>
<td>4 high</td>
<td>1 (5)</td>
<td>3 (25)</td>
<td>3 (23)</td>
<td>0</td>
<td>8 (80)</td>
</tr>
</tbody>
</table>

The mean age of the high compliance quartile was 62.7 years.

For the low compliance quartile the mean age was 42.3 years a difference of approximately 20 years. In terms of compliance, 85% of the youngest age group (1-41) are below the 50 percentile compared to 10% within the oldest age group (68-98). Conversely, 15% of the youngest age category is above the 50 percentile compared to 90% within the oldest age category.

B) AREA.

TABLE XX: Crosstab of Area by Compliance Quartiles. (Figure in brackets is % of cases within each area.)

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Area 1 (Core)</th>
<th>Area 2 (Outer-Core)</th>
<th>Area 3 (Wings)</th>
<th>Area 4 (Farthest)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 low</td>
<td>4 (17)</td>
<td>7 (23)</td>
<td>4 (33)</td>
<td>5 (50)</td>
</tr>
<tr>
<td>2</td>
<td>3 (13)</td>
<td>8 (26)</td>
<td>6 (50)</td>
<td>1 (10)</td>
</tr>
<tr>
<td>3</td>
<td>4 (17)</td>
<td>9 (29)</td>
<td>2 (17)</td>
<td>1 (10)</td>
</tr>
<tr>
<td>4 high</td>
<td>12 (53)</td>
<td>7 (23)</td>
<td>0</td>
<td>3 (30)</td>
</tr>
</tbody>
</table>

Approximately 70% of the core area residents are above the 50 percentile for compliance compared to 40% of the farthest and 17% of the wing area residents. Approximately 86% of the high compliance group lives in the core or outer-core area compared to 53% of the low compliance group.

Because it is known that the core area has a number of government housing units specifically geared to senior residents
an exploration of the link between age and area was necessary.

In fact, the mean age in the core area is 61.1 years, and 49.0 years for the outer-core area, 45.5 years for the wing areas and 50.0 for the farthest area. Thus, the core area contains a population with a mean age at least a decade greater than for the other areas. This makes it very difficult to determine whether the core area group is more compliant because it is located closer to the clinic or because it is an older and therefore a more compliant group.

To see if age and area interact to effect compliance a 2-Way Analysis of Variance was performed on the 76 DCHC cases using age and area as independent variables. (Table XXI) Clearly, there is little interaction between age and area in determining compliance. Therefore, area effects compliance independently of age.

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>F-Value</th>
<th>Significance of F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Effects</td>
<td>3.0</td>
<td>.009</td>
</tr>
<tr>
<td>Age</td>
<td>2.3</td>
<td>.070</td>
</tr>
<tr>
<td>Area</td>
<td>2.0</td>
<td>.122</td>
</tr>
<tr>
<td>2-Way Interaction</td>
<td>1.2</td>
<td>.301</td>
</tr>
</tbody>
</table>

TABLE XXI: ANOVA for Age and Area with Compliance

C) RACE.

<table>
<thead>
<tr>
<th>Quartile</th>
<th>White</th>
<th>Native</th>
<th>Chinese</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 low</td>
<td>9 (20)</td>
<td>10 (40)</td>
<td>1 (14)</td>
</tr>
<tr>
<td>2</td>
<td>8 (18)</td>
<td>9 (36)</td>
<td>1 (14)</td>
</tr>
<tr>
<td>3</td>
<td>12 (27)</td>
<td>4 (16)</td>
<td>5 (72)</td>
</tr>
<tr>
<td>4 high</td>
<td>15 (34)</td>
<td>2 (8)</td>
<td></td>
</tr>
</tbody>
</table>

Approximately 72% of Chinese patients at the DCHC are in the
high compliance quartile compared to 60% of whites and 25% of natives. Conversely, 76% of natives at the clinic are below the 50 percentile of compliance compared to 38% for whites and 28% for Chinese.

These results indicate a significant relationship between race and compliance. This result must be interpreted carefully as it was shown in the previous section that effects of the variable race were reduced by about one third when other independent variables were added to the model.

When we review the age structure of the major racial groups using the clinic we find the mean age for Chinese was 65.2 years, for Whites 55.5 years and for natives 43.0 years. To determine whether there is interaction between race and age a 2-Way ANOVA was performed. Results were the same as those for age and area, that is no interaction effect between age and race.

The pattern of hospitalization also interacts with race, (Table XXIII)

**TABLE XXIII: Hospitalization by Race.**

<table>
<thead>
<tr>
<th>Hospitalization?</th>
<th>Chinese</th>
<th>Native</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitalized</td>
<td>5</td>
<td>19</td>
<td>29</td>
</tr>
<tr>
<td>Not hospitalized</td>
<td>2</td>
<td>4</td>
<td>13</td>
</tr>
</tbody>
</table>

Approximately twice as many Chinese and Whites are hospitalized compared to non-hospitalized. However within the Native category 6 times as many natives are hospitalized as compared to non-hospitalized. The likelihood of a native being hospitalized is therefore much greater than for the other races. Natives are probably perceived as non-compliant by the clinicians
at T.B. Control and hospitalized at a greater rate.

1. Medical Variables:

A) DIAGNOSIS.

TABLE XXIV: Diagnosis by Compliance Quartile.

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Far Adv.</th>
<th>Mod Adv.</th>
<th>Minimal</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 low</td>
<td>5 (20)</td>
<td>8 (30)</td>
<td>3 (19)</td>
<td>4 (57)</td>
</tr>
<tr>
<td>2</td>
<td>5 (20)</td>
<td>6 (22)</td>
<td>4 (25)</td>
<td>2 (29)</td>
</tr>
<tr>
<td>3</td>
<td>4 (16)</td>
<td>10 (37)</td>
<td>1 (6)</td>
<td>1 (14)</td>
</tr>
<tr>
<td>4 high</td>
<td>11 (44)</td>
<td>3 (11)</td>
<td>8 (50)</td>
<td></td>
</tr>
</tbody>
</table>

Forty four percent of far advanced cases are in the high compliance quartile compared with 11% of moderately advanced cases and 50% of minimal cases. While no real pattern is discernable, it is clear that 74% of the cases above the 50 percentile for compliance are either diagnosed as moderately advanced or far advanced. According to the analysis in the previous section, diagnosis acts independently of other independent variables.

B) HOSPITALIZED?

TABLE XXV: Hospitalization by Compliance Quartile.

<table>
<thead>
<tr>
<th>Quartile</th>
<th>Hospitalized</th>
<th>Not-hospitalized</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 low</td>
<td>16 (30)</td>
<td>2 (11)</td>
</tr>
<tr>
<td>2</td>
<td>14 (27)</td>
<td>3 (17)</td>
</tr>
<tr>
<td>3</td>
<td>10 (19)</td>
<td>6 (33)</td>
</tr>
<tr>
<td>4 high</td>
<td>13 (25)</td>
<td>7 (39)</td>
</tr>
</tbody>
</table>

Fifty three cases were hospitalized, eighteen were not hospitalized and the fate of five cases was unknown. From Table XXV the proportion of non-hospitalized cases above the 50 percentile for compliance is almost double the proportion of hospitalized cases.

In summary, (in terms of socio-demographic variables) older
tuberculosis and who have not been hospitalized tend to perform best as out-patients in terms of attendance compliance.

Conversely, younger patients (these are usually White and Native in equal proportion) who have less severe diagnosis, live farther from the clinic and who have been hospitalized tend to perform worst as out-patients in terms of attendance compliance.

What do these findings mean in terms of the T.B epidemiology of the Study Area? It was shown in Chapter 5 that the age group 20-59 had a disproportionate number of cases compared to the population of the Study Area. The findings in this chapter also indicate that this age group is among the least compliant to treatment. Obviously, this group which is mainly White or Native Canadian-born must receive special attention from the DCHC.

Findings for this chapter also suggest that Natives are hospitalized far more frequently than other groups even though severity of diagnosis appears no greater for Natives. Natives still appear over-represented in the low compliance quartile. This may suggest that the high rate of hospitalization for the Native group may not help attendance compliance at the DCHC.

8.4 DROP-OUTS:

Of 76 DCHC cases, 16 attended for less than 6 months. Of the group which had less than 6 months treatment as out-patients a proportion cannot be considered drop-outs because they needed shorter treatment at the DCHC as they received much of their care as in-patients. In fact 5 of the 16 cases attending the DCHC for less than 6 months received an average of 45 weeks of uninterrupted chemotherapy because of their in-patient care. This
left 9 out of 76 cases who could be considered drop-outs.

These 9 records were analyzed in greater detail to try and determine whether they were true non-complying drop-outs. In fact, five of the nine cases moved to other cities in B.C. A follow-up of these five records showed they all completed a course of outpatient chemotherapy at another clinic. This left four cases who stayed in the area and appeared to be drop-outs. However, three of these four cases were discontinued from the DCHC program by physicians order. One of these was discontinued because she was such a good complier she was allowed to treat herself at home. Another was discontinued because he developed renal failure and could not tolerate the drugs. The third case was discontinued because he proved completely uncooperative.

The single true drop-out was a 24 year old Vietnamese woman who received 12 weeks of chemotherapy on the DCHC program and then disappeared for 9 months. Thus, of the 9 apparent drop-outs, 6 completed successful courses of T.B. chemotherapy. Two cases were discontinued from the program by physician order and were therefore not true non-complying drop-outs.

In conclusion, one out of 76 cases can be called a drop-out. This means the drop-out rate at the DCHC for residents of the Study Area during the Study Period was about 1.5 percent.
Whether a person was alcoholic or not, or employed or unemployed had little effect on compliance.

Residence in relation to the clinic is the single most important predictor. If we analyze the maximum distance of each of the four recoded areas from the DCHC it is evident that Area 1 lies within a 0.5 kilometer radius of the clinic, Area 2 within a 1 kilometer radius, Area 3 within a 2 kilometer radius and Area 4 within a 4 kilometer radius of the clinic.

It is clear from the data that 70% of residents within 0.5 kilometers of the clinic attended 93% of appointments or more (Area 1). Fifty-two percent of residents located between 0.5 and 1 kilometer from the clinic attended 93% of appointments or more (Area 2). For distances greater than 1 kilometer from the DCHC attendance to 93% or more of appointments was achieved by only 30% of residents. These data suggest that for the skid-row population under study, the most effective location for clinic services is within 1 kilometer of clients residences.

An interesting finding in this study was that alcoholism appears as a minor factor predicting attendance compliance. Alcoholism is a major selection factor used by physicians at the WCC for placing patients in the DCHC program. In view of the findings in this study, physicians may want to select patients on the basis of some of the other predictive variables particularly age, race and area.

3. The third question:

The answer to this question follows from the second question. Older persons who live close to the clinic and have more severe diagnoses tend to attend well. If the older person is Chinese or
patients tend to benefit most in terms of compliance and younger clients least. Although a socio-demographic gradient of increasing age coincides with increasing proximity to the DCHC, proximity to the clinic acts independently of age in terms of compliance. Location in relation to the clinic is the single most potent socio-demographic variable effecting compliance.

Age, race and hospitalization are linked. Age may appear more significant than it really is because the three racial groups in the area have unique age structures. It is particularly interesting to note that 86% of Native T.B. patients are hospitalized compared to respectively 67% of White and 71% of Chinese patients.

It may be that clinicians at the T.B. Division view natives as more non-compliant and tend to hospitalize them more frequently than other racial groups. Another possibility is that Natives tend to present with more severe diagnoses thereby requiring hospitalization. However, reference to Table XXVI shows that severity of diagnosis among Natives appears less than among the White group. (63% of Natives have moderate or far-advanced diagnoses compared to 80% of Whites)

<table>
<thead>
<tr>
<th>RACE</th>
<th>Far-adv.</th>
<th>Mod.-adv.</th>
<th>Minimal</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native</td>
<td>6 (27%)</td>
<td>8 (36%)</td>
<td>3 (14%)</td>
<td>5 (23%)</td>
</tr>
<tr>
<td>White</td>
<td>17 (41%)</td>
<td>16 (39%)</td>
<td>7 (17%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>Chinese</td>
<td>2 (29%)</td>
<td>1 (14%)</td>
<td>3 (42%)</td>
<td>1 (14%)</td>
</tr>
</tbody>
</table>

In general, older White or Chinese patients who live close to the clinic who have been diagnosed with far-advanced or moderate...
RECOMMENDATIONS

To increase the effectiveness of the DCHC, T.B. Division staff must know who is at high risk for non-compliance at the DCHC. That is, Canadian-born younger patients (particularly those living at a distance from the clinic) must receive special attention. It is recommended that the role of the T.B. nurse at the clinic be enhanced to give this special attention.

Specifically, the T.B. nurse needs to expand her regular home-visit route beyond current boundaries (which extend roughly between Abbot Street and Heatley Street and Hastings and the waterfront). This is likely a good method of maintaining clinic contact with the young at-risk group living at a distance from the DCHC. This expanded role has current urgency because of local Expo-86 related upheavals underway on skid-row.

Because of the importance of residence in relation to the clinic in terms of attendance compliance, it is very important that planners locate out-patient clinic services very closely to the main area of residence for the tubercular skid-row population. This means that any development of tuberculosis services for this population must be based on accurate address information. For skid-row areas like Vancouver's which are undergoing rapid change and population flux, tuberculosis control planners may have to establish satellite clinics to essentially 'follow' skid-row populations as they relocate.
REFERENCES


15. Devi, S., "A Controlled Comparison of Self-Administered
CHAPTER 9
CONCLUSIONS AND RECOMMENDATIONS.

CONCLUSIONS.

This thesis set out to examine three questions: 1) Is the community-based out-patient treatment system at the DCHC better (in terms of attendance compliance) than the hospital-based system at the WCC for skid-row patients? 2) Which socio-demographic and treatment factors predict attendance compliance at the DCHC? and; 3) Who benefits and who does not benefit from the new treatment system.

1. The first question:

In terms of attendance compliance, the DCHC has significantly greater attendance to out-patient appointments than the WCC when comparing a matched population of skid-row tuberculosis patients. The DCHC, which represents one of the latest developments in tuberculosis treatment systems appears to promote better attendance compliance among skid-row patients than the WCC. The community-based approach at the DCHC is a significant improvement over the former hospital-based approach for skid-row patients.

2. The second question:

Area, age, diagnosis and race (in that order) are the main factors predicting attendance compliance at the DCHC. Patients who live closest to the clinic attend appointments better than those who live far away. Older patients attend better than younger patients. Persons with more severe diagnoses attend better than those with less severe diagnoses. In general, Chinese attend better than Whites who in turn attend better than Natives.


White he/she will more likely attend better than a Native person.

Younger patients (especially those who live far from the clinic) dominate the ranks of the low compliance quartile. These patients tend to be White or Native in about equal proportion.

Another purpose to the thesis was to gather some epidemiological data on tuberculosis in skid-row. This study showed that Study Area rates were in the region of 250 per hundred thousand and rates in the Downtown-Eastside approached 375 per hundred thousand during the Study Period. Results indicate that 60% of cases in the Study Area were Canadian-born. Of these, 40% were Native and 60% non-Native. The foreign-born high-risk group represented 40% of cases in the area.

Rates in the Study Area appear relatively stable as does the mix of cases among the 3 high-risk groups. However, the area is rapidly depopulating due to Expo-86 related developments so that fairly stable absolute numbers may indicate increasing rates in the Study Area.

Sixty percent of cases in the area were Canadian-born. This group represents the majority of cases in the area. Canadian-born persons are also more likely to belong to the 'difficult-to-treat' group referred to the DCHC. Once referred to the DCHC Canadian-born persons are at highest risk for non-compliance to appointments. Thus, the Canadian-born cases in the Study Area require particular attention in terms of tuberculosis control.


40. The Division of Tuberculosis Control, Province of British Columbia. Annual Report, 1953.


42. The Division of Tuberculosis Control, Province of British Columbia. Annual Reports, 1977-82.


APPENDIX A

MAP OF THE NORTH HEALTH UNIT SHOWING
THE STUDY AREA AND CENSUS TRACTS 57, 58 and 59.
APPENDIX B

MAP OF THE STUDY AREA SHOWING RECODED AREAS