

MIGRATION AND SURVIVAL: THE MORTALITY EXPERIENCE OF IMMIGRANTS IN CANADA

Frank Trovato

Professor

Department of Sociology,

University of Alberta

Edmonton, Alberta, Canada, T6G 2H4

Research report submitted to the Prairie Centre for Research on
Immigration and Integration (PCRII)

August 2003

Acknowledgments

This study is based on a Social Sciences and Humanities Research Grant through the Prairie Centre of Excellence for Research on Immigration and Integration (PCRII). The author is grateful to Dr. Zongli Tang, Auburn University at Montgomery, for his research assistance. Many thanks to the PCRII for its support.

TABLE OF CONTENTS

Content	Page
EXECUTIVE SUMMARY	7
OVERVIEW	17
1.0 BACKGROUND	23
2.0 MORTALITY IN THE NEW LAND: THEORETICAL FRAMEWORK	32
2.1 External Causes of Death	34
2.2 Hypotheses	48
2.2.1 Violent and Accidental Mortality	48
2.2.2 Chronic Disease Mortality	50
3.0 DESCRIPTION OF THE DATA	55
3.1 The Immigrant Groups	55
3.2 Data Adjustments	56
3.2.1 Cause of Death “Undetermined”	58
4.0 DESCRIPTIVE OVERVIEW	58
4.1 Demographic and Socioeconomic Composition of Immigrant Groups	58
4.2 Crude Death Rates	62
4.2.1 Age Distribution by Broad Nativity Class	64
4.2.2 Death Distribution by Broad Nativity Class	67
4.3 Standardized Death Rates	69
4.4 Standardized Cause-Specific Mortality Ratios	71
4.5 Health Selection Effects	77
4.5.1 The Concept of Selectivity	77
4.5.2 Indirect test for health selectivity: Immigrants in Canada	81
4.5.3 Age Pattern of Mortality	83
4.5.4 Age-Specific Pattern of Mortality by Cause of Death	92

5.0 MULTIVARIATE ANALYSIS: APPROACH AND METHOD	103
5.1 Poisson Regression Model for the Expected Death Rate	103
5.2 Operationalizations	107
5.2.1 Country of Origin Effects	107
5.2.2 Ethnic Community Effects	108
5.2.3 Socioeconomic Status	112
5.2.4 Acculturation Effects	113
5.2.5 Health Selectivity Effects	114
5.2.6 Country of Birth of Immigrants	117
5.2.7 Age	118
5.2.8 Region of Death	118
5.2.9 Causes of Death	119
6.0 GENERAL MORTALITY	121
7.0 MORTALITY ACCORDING TO CAUSE OF DEATH	125
7.1 Heart and Cerebrovascular Disease Mortality	125
7.2 Cancer	128
7.3 External Causes of Death	133
8.0 EVALUATION OF HYPOTHESES	138
8.1 General Mortality	138
8.2 Summary: General Mortality	146
8.3 External Causes of Death	148
8.3.1 Suicide	148
8.3.2 Standardized Suicide Rates	151
8.3.3 Method of Suicide	162
8.3.4 Discussion of Suicide Results	167
8.4 Homicide	170
8.5 Other Forms of Accidental and Violent Mortality	176
8.6 Chronic/Degenerative Disease Mortality	184
8.6.1 Ischemic Heart Disease	184
8.6.2 Other Heart Disease	192

8.6.3 Cerebrovascular Disease	201
8.6.4 Chronic Liver Disease and Cirrhosis	205
8.6.5 Diabetes	209
8.6.6 Stomach Cancer	212
8.6.7 Lung Cancer	217
8.6.8 Other Cancers	222
8.7 Residual Causes of Death	226
9.0 CONCLUSION	231
REFERENCES	242

TABLES

Table 1: Demographic indicators for the Canadian born population and 19 immigrant groups; 1991 census of Canada

Table 2a: Unadjusted and adjusted crude and directly age-standardized death rates (per 1000); 20 nationality groups; Canada 1991

Table 2b: Cause-specific indirectly standardized mortality ratios (SMRS) for immigrants and their countries of origin, where applicable (Canadian born population as standard)

Table 3: Log-linear equations for general mortality; population aged 15+

Table 4: Log-linear equations for heart and cerebrovascular disease: population aged 15+

Table 5: Log-linear equations for lung cancer, stomach cancer, other cancers, and all Cancers: population aged 15+

Table 6: Log-linear equations for suicide, other accidents and violence, and residual causes: population aged 15+

Table 7: Log linear models for overall mortality: Canadian Born and 19 immigrant groups

Table 8: Log-linear models for general mortality; immigrants only

Table 9: Crude suicide rates by nationality group; Canada, 1991

Table 10: Suicide SMRs: immigrants and their countries of origin (Canadian born as standard)

Table 11: Ratio of immigrant suicide SMRs to the SMRs of corresponding countries of origin (I / O), presumed direction of change in migrant SMRs in relation to country of origin, and proximity of migrant SMRs to either country of origin or the Canadian born (CB) population

Table 12: Log-linear equations for suicides (plus undetermined deaths)

Table 13: Log-linear equations for suicide (plus undetermined deaths): Canadian born, Old Wave, and New Wave immigrants; Canada 1991

Table 14: Log-linear equations for suicide by method of suicide; Canadian born, Old and New Wave immigrants

Table 15: Log-linear equations for immigrant suicide in accordance with method of suicide

Table 16: Log-linear equations for homicide mortality by nativity

Table 17: Log-linear equations for other forms of accidental and violent mortality

Table 18: Log-linear equations for other forms of accidental and violent mortality

Table 19: Log-linear equations for Ischemic Heart Disease mortality

Table 20: Log-linear equations for Ischemic Heart Disease mortality

Table 21: Log-linear equations for Other Heart Disease mortality

Table 22: Log-linear equations for Other Heart Disease mortality

Table 23: Log-linear equations for Other Heart Disease mortality: Old Wave Immigrants

Table 24: Log-linear equations for Cerebrovascular Disease mortality

Table 25: Log-linear equations for Cirrhosis of the Liver mortality

Table 26: Log-linear Equations for Diabetes mortality

Table 27: Log-linear equations for Diabetes mortality

Table 28: Log-linear equations for Diabetes mortality

Table 29: Log-linear equations for Stomach Cancer mortality

Table 30: Log-linear Equations for Stomach Cancer mortality

Table 31: Log-linear Equations for Lung Cancer mortality

Table 32: Log-linear equations for Lung Cancer mortality

Table 33: Log-linear Equations for Other Cancer mortality

Table 34: Log-linear equations for Other Cancer mortality

Table 35: Log-linear equations for Residual causes of death

Table 36: Log-linear equations for Residual causes of death

FIGURES

Figure 1: Framework for the study of immigrant mortality

Figure 2: Percentage population distribution: Canadian Born, Old and New wave Immigrants, 1991

Figure 3: Percentage distribution of deaths: Canadian Born, Old and New wave Immigrants, 1991

Figure 4: Age pattern of mortality for the Canadian Born and the Foreign Born, 1991

Figure 5a: Age pattern of mortality: Canadian Born, Old and New Wave immigrants, 1991 (age regrouped)

Figure 5b: Age pattern of male overall mortality: Canadian Born, Old and New Wave immigrants, 1991 (age regrouped)

Figure 5c: Age pattern of female overall mortality: Canadian Born, Old and New Wave immigrants, 1991 (age regrouped)

Figure 6a: Age pattern of male heart disease mortality: Canadian Born, Old and New Wave immigrants

Figure 6b: Age pattern of female heart disease mortality: Canadian Born, Old and New Wave immigrants

Figure 6c: Age pattern of male cancer mortality: Canadian Born, Old and New Wave immigrants

Figure 6d: Age pattern of female cancer mortality: Canadian Born, Old and New Wave immigrants

Figure 6e: Age pattern of male external mortality: Canadian Born, Old and New Wave immigrants

Figure 6f: Age pattern of female external mortality: Canadian Born, Old and New Wave immigrants

Figure 6g: Age pattern of male residual mortality: Canadian Born, Old and New Wave immigrants

Figure 6h: Age pattern of female residual mortality: Canadian Born, Old and New Wave immigrants

APPENDIXES

Appendix A: Country of birth classification

Appendix B: Analysis of Irish Republic immigrant deaths and population figures

Appendix C: Indirectly standardized mortality ratios (SMRS) for immigrants and countries of origin, by sex and cause of death; 1991.

Appendix D: Crude cause-specific death rates (per 100,000 population) for immigrant groups and the Canadian born, 1991.

Appendix E: Crude cause-specific death rates (per 100,000 population) for old wave and new wave immigrants, 1991.

Appendix F: Cause-specific indirectly standardized mortality ratios for Old and New Wave immigrants, 1991 (Canadian Born as standard)

Appendix G: Crude and directly standardized death rates (per 100,000) for the Canadian Born, Old and New Wave Immigrants; four broad causes of death

Appendix H: Distributions of deaths (1990-92) and 1991 Census populations for three broad classes of nativity.

Appendix I: Mortality in the ages 0-14

Executive Summary

Frank Trovato
Professor

This study examined general and cause-specific mortality for immigrants and the Canadian born population during the period of 1990-1992. The mortality data are from the Canadian Vital Statistics system, and the population counts are from the 1991 census of Canada. Although 19 separate immigrant groups are included in the study, a large part of the analysis is restricted to two broad categories of migrants: New Wave, and Old Wave. The former immigrants constitute for the most part (as of the early 1990s) relatively recent arrivals to this country (i. e., China, Other Asia, Africa, South-Central America/Caribbean/Mexico). Most of the New Wave immigrants are Visible Minorities (immigrant groups that fall under the official definition of “visible” in terms of racial characteristics). The Old Wave immigrants have a more established history of immigration to Canada (predominantly Europeans and Americans).

The research is grounded in a conceptual framework based on factors that pertain to the pre and post migration experiences of immigrants as well as demographic compositional differences between groups (age, sex, marital status). Among the former set of factors are conditions associated with the country of origin (culture and situations exposing the migrant to disease causing agents in the home country). In the host society, immigrants' conditional risk of death is partly determined by their socioeconomic status, their degree of attachment to their ethnic community and the extent of acculturation to the new society. There are also unmeasurable factors that may determine mortality risk,

including health selectivity and genetic predispositions to disease. A number of hypotheses are specified based on the conceptual framework and tested against the available mortality and census data. The typical strategy of the study involves a comparison of migrant death rates to the death rates of the Canadian born population and to the corresponding rates of the home based countries of the immigrants.

The findings of this investigation are generally consistent with research based on the experience of other immigrant receiving nations: Australia, France, United Kingdom and the United States. In Canada and in these societies overall death rates for immigrants are typically lower than the host populations. There appears to be a gradient in the observed mortality risks with respect to causes of death, with the more recent immigrants tending to enjoy noticeably reduced relative risks of death for both general and cause specific mortality. This suggests there is a combination of effects associated with migration and health. Positive health selectivity of the immigrants, especially among the more recent arrivals, and other aspects of the migrants' background culture as well as conditions associated with their acculturation and adaptation to the new environment appear to also contribute to their relative survival advantage.

Multivariate analyses provide further indirect support for the proposition that immigrants enjoy the benefits of positive health selectivity throughout their experience in the new land, though with increasing duration in the host country there is some loss of their health advantage. The multivariate results also lend indirect support for the idea that acculturation can in some cases have health enhancing effects on immigrants, while in others it either has no relevance on death risk, or it works in such a way as to erode the

survival advantage of the immigrants. Thus it seems acculturation as a process can have both beneficial and health-eroding influences on the immigrants.

Crude Death Rates

There are wide variations in crude death rates across immigrant groups. Some immigrant groups have unusually high, while others have exceptionally low, crude death rates. In the former category are the immigrants from the Irish Republic, the former USSR, Sweden, Other Scandinavia, and Hungary. CDRs for these groups range from a high of 39.97 per 1000 population (Republic of Ireland), to 20.36 (Hungary). The Canadian born crude death rate is 6.54 per 1000.

Some of the lowest crude rates are found among immigrants from China, Other Asia, Africa, South Central America/Caribbean/Mexico. Among the Old Wave immigrant groups (i.e., those from traditional sending areas), the Greeks, the Italians and the Portuguese share overall crude death rates between four and nine per thousand population.

Standardized Death Rates

Indirect standardization involves the application of a standard population's age-cause-specific death rates to the age-specific population distribution of a study group. In the present application, the Canadian born population is used as the standard to derive group-specific standardized mortality ratios (SMR_s).

In general, immigrants enjoy lower standardized death rates in relation to the Canadian born population. As well, the migrant SMRs tend to be lower than the SMRs

of their countries of origin. Thus, not only do immigrants in general enjoy a lower mortality level from total and cause-specific mortality as compared to the Canadian born, but they also share a more favourable situation in relation to their home countries.

The overall mortality advantage of immigrants in relation to their host population and their countries of origin is partly a function of selectivity. The health selectivity thesis of immigrant mortality says that immigrants have below average mortality rates as compared to their host populations because they are selected for good health. Selection takes on two forms: healthy persons migrate; and official health screening ensures that only healthy individuals enter the host nation.

Heart Disease

The New Wave immigrants have a noticeable advantage in heart disease mortality risk as compared to the Canadian born and the Old Wave immigrants. Among the Old Wave immigrants, the most advantaged are the Greeks. Generally speaking, the heart disease risk profile of the Old Wave immigrants appears to be intermediate between their New Wave counterparts and the Canadian born. This suggests there may be some assimilative process at work, accounting for this apparent differential in heart disease. Perhaps the more established groups have been assimilating the diet and life style of the Canadian born, and over time this is resulting in a convergent process in heart disease mortality.

Cancer

In general, cancer mortality is lower among immigrants as compared to their home countries and the Canadian born population. However, immigrant males and females have unusually high death rates from stomach cancer. This situation is likely the result of dietary change, associated with the migration experience. The New Wave immigrants enjoy very low death rates from all types of cancer examined in this study.

External Causes of Death

External types of mortality include suicide, homicide, and accidents.

Immigrants may experience high rates of suicide because of the stresses associated with settlement in a new land. If immigration is a stressful experience, immigrant groups should have relatively high suicide rates. And the stresses should be more intense during the early years after relocation, when the demands of adjustment to a new environment are greatest. As it turns out, the more recent immigrants groups---the New Wave---have very low suicide death rates.

Among the Old Wave immigrants, Greeks, Italians, Portuguese, and immigrants from the United Kingdom, have reduced risks, while Hungarians, Polish, and USSR migrants, share relatively high death rates of self-destruction. There appears to be some association (though imperfect) of immigrant suicide rates with religion, as evidenced in the cases of Italians, Portuguese, and South Americans/Mexicans, all of whom share a Catholic religious background culture. (The Polish, who are a predominantly Catholic group, show above average suicide rates; and migrants from the United Kingdom, a predominantly Protestant group, have suicide rates below expectation.)

These results suggest that both religion and other elements of national culture may be important determinants of immigrant suicide.

Americans, Irish Republic, and former USSR migrants all share elevated chances of death from “other accidents and violence.” Of the remaining nativity groups, significant coefficients are noted for the Portuguese, Other Asians, Africans, South Central American/Caribbean/Mexico, and “other countries” immigrants.

The study examined a number of hypotheses for the observed group differences in general and cause-specific mortality. A fairly consistent finding is that socioeconomic status (SES) is in most cases a significant factor of mortality in both the Canadian born and the immigrant populations.

It was hypothesized that differences in ethnic community cohesion would explain part of the variations in mortality risk. This thesis received some support. But the effect of ethnic community seems more relevant among New Wave immigrants than among the Old Wave migrants. Thus, the “protective” effects of community seem more important for relatively new immigrant groups.

Another hypothesis was in connection with country of origin effects on immigrant mortality. It was surmised that there would be a correlation between the death rates of home country with the death rates of corresponding immigrants. This hypothesis gained partial support. Among Old Wave migrants the association is negative (i.e., the higher the death rate in the country of origin, the lower the immigrant death rate); and among New Wave, it is positive (i.e., the higher the death rate in the home country, the higher the death rate among immigrants).

The hypothesis of acculturation was also investigated. According to this thesis, acculturation to the host society would lead to convergence in death probabilities between immigrants and the Canadian born population. This hypothesis gained some support. However, acculturation in some cases raised the risk of death among immigrants, while in others it helped to reduce it.

Overall Summary

In an overall sense the results of this exploratory investigation suggest the following profile of immigrant health and survival prospects in Canadian society.

First, the majority of newcomers to this land have been persons in the prime working ages, which in most cases represent the most productive and healthiest years of one's life. A related feature of this is the corollary fact that immigrants self-select themselves out of their populations of origin with respect not only to age, but also with regard to occupational skills and training and also good mental and physical health. In general, individuals who make the decision to move to an immigrant receiving country will tend to be a healthy subset of their populations of origin. Sick people generally do not migrate. This is especially true in the case of long distance moves that involve the crossing of national boundaries.

Secondly, due to the highly regulated and restricted nature of international migration in the modern context, prospective immigrants are screened to ensure they do not carry into the new country any major health problem. Another side to this scenario, which is extremely difficult to verify, is the likely possibility that the less adaptive and less healthy elements of the immigrant population in Canada will select themselves out of the country

and return to their countries of origin. To the extent that this return migration process represents a real aspect of the migration experience of immigrants in Canada, it would certainly have the effect of further enhancing the positive health selectivity of those migrants who remain in the host society.

Thirdly, the more advantaged survival profile of immigrants may also arise from their access to Canada's exceptional array of health services. This fact alone would account for a gain in health status among newcomers, who for the most part consist of people from areas of the world in which health care accessibility is nowhere near that provided by Canada. All other things being equal, greater access to good health care should translate into gains in the health status among immigrants.

Fourthly, notwithstanding health selectivity and access to a superior health system, it is also likely that with increased duration of stay in the adopted society, the greater the degree to which the health advantage of the immigrants reduces towards the general average of the host population. This may be thought of as being a generalized phenomenon of regression to the average level of health in a society. The causal mechanisms for this regressive tendency in terms of overall health involve the tendency of immigrants to gradually acculturate the life styles, habits and orientations of the host society. To this one may also add the cumulative effects on health of life stresses on the organism as one gets increasingly older.

Fifthly, most immigrants (especially among the first generation) maintain close ties to their ethnic communities in the New World. This affords newcomers and more established immigrants an indispensable source of informal and formal support, thus minimizing the health eroding effects of rapid change associated with immigration to a

new environment. One way in which the support of the ethnic community affects health is through its social integrative and social control functions in reducing the risk of certain types of mortality, including suicide, homicide, and other forms of violence.

A sixth factor underlying the survival advantage of immigrants may be associated with their socioeconomic experience. Some of the Canadian based literature on immigrants suggests that for most foreign born people in this country socioeconomic hardship is of a transitory nature. Economic difficulties, if they arise, tend to occur in the early phases of settlement. While many newcomers go through an adjustment phase and perhaps even experience poverty, over the long term the majority of immigrants in Canada do reasonably well economically and are able to extricate themselves out of poverty or economic deprivation. This means that in most cases the negative consequences of economic hardships on health are likely temporary.

Finally, it is important to point out that due to heterogeneity in genetic and biological factors among immigrant populations, the health and mortality profiles of immigrants cannot be assumed to be uniform. Some immigrant groups will do better than others in terms of health as a result of inherent genetic differences in predisposition to serious diseases (e.g. sickle cell anemia). Even within any given population, there are countless unmeasurable differences in frailty, again related to constitutional differences among persons (i.e. some people are more advantaged in genetic make up and will therefore live longer than others). As well, immigrant populations are culturally diverse entities. As such, any observed health and mortality differentials across groups may be partly linked to variations in diet, nutrition, health habits, and psychological orientations, all of which are partly if not wholly conditioned by culture. Culture can either confer advantages or

disadvantages in terms of health to the extent that it promotes or fails to promote healthy ways of living.

A word of caution is necessary when interpreting the results of this investigation. The data used in the analysis of immigrant mortality cannot be assumed to be devoid of errors. Despite any methodological and data issues, however, the present study offers insight into one aspect of the immigrant experience in Canada. It provides insight into the mortality and survival patterns of the immigrant population, an area of research that has been generally neglected in Canada.

OVERVIEW

Although much has been written about the adjustment and adaptation of immigrants to Canadian society, very little is known about the mortality experience of the foreign born--a puzzling situation in view of the importance of immigration to the development of Canada as a nation and to its future. This study is an exploration of this topic. It looks at general and cause-specific mortality for immigrants and the Canadian born population during the period of 1990-1992. The mortality data are from the vital statistics system, and the population counts from the 1991 census of Canada. Although 19 separate immigrant groups are included in the study, a large part of the analysis is restricted to two broad categories of migrants: New Wave, and Old Wave. The former immigrants constitute for the most part (as of the early 1990s) relatively recent arrivals to this country. The latter are assumed to be a more established component of the immigrant population with a longer migration history to Canada. This categorization of migrants provides a rough indication of duration of residence in Canada. It affords an indirect means to explore the potential association of recency of arrival to this country with overall and cause-specific mortality.

This research is grounded in a conceptual framework based on factors that pertain to the pre and post migration experiences of immigrants as well as demographic compositional differences between groups (age, sex, marital status). Among the former set of factors are conditions associated with the country of origin (culture and situations exposing the migrant to disease causing agents in the home country). In the host society, immigrants' conditional risk of death is partly determined by their socioeconomic status, their degree of attachment to their ethnic community and the extent of acculturation to the

new society. There are also unmeasurable factors that may determine mortality risk, including health selectivity and genetic predispositions to disease. A number of hypotheses are specified based on the conceptual framework and tested against the available mortality and census data. The typical strategy of the study involves a comparison of migrant death rates to the death rates of the Canadian born population and to the corresponding rates of the home based countries of the immigrants.

For the most part the findings are consistent with other research based on the experience of other immigrant receiving nations, including Australia, France, United Kingdom and the United States. In Canada and in these societies overall death rates for immigrants are typically lower than the host populations. There appears to be a gradient in the observed mortality risks with respect to causes of death, with the more recent immigrants tending to enjoy noticeably reduced relative risks of death for both general and cause specific mortality. This suggests there is a combination of effects associated with migration and health. Positive health selectivity of the immigrants, especially among the more recent arrivals, and other aspects of the migrants' background culture as well as conditions associated with their acculturation and adaptation to the new environment appear to also contribute to their relative survival advantage.

Multivariate analyses provide further indirect support for the proposition that immigrants enjoy the benefits of positive health selectivity throughout their experience in the new land, though with increasing duration in the host country there is some loss of their health advantage. The multivariate results also lend indirect support for the idea that acculturation can in some cases have health enhancing effects on immigrants, while in others it either has no relevance on death risk, or it works in such a way as to erode their

survival advantage. Thus it seems acculturation as a process can have both beneficial and health-eroding influences on the immigrants.

In an overall sense the results of this exploratory investigation suggests the following profile of immigrant health and survival prospects in Canadian society. First, the majority of newcomers to this land have been persons in the prime working ages, which in most cases represent the most productive and healthiest years of one's life. A related feature of this is the corollary fact that immigrants self-select themselves out of their populations of origin with respect not only to age, but also with regard to occupational skills and training and also good mental and physical health. In general, individuals who make the decision to move to an immigrant receiving country will tend to be a healthy subset of their populations of origin. Sick people generally do not migrate. This is especially true in the case of long distance moves that involve the crossing of national boundaries.

Secondly, due to the highly regulated and restricted nature of international migration in the modern context, prospective immigrants are screened to ensure they do not carry into the new country any major health problem. Another side to this scenario, which is extremely difficult to verify, is the likely possibility that the less adaptive and less healthy elements of the immigrant population in Canada will select themselves out of the country and return to their countries of origin. To the extent that this return migration process represents a real aspect of the migration experience of immigrants in Canada, it would certainly have the effect of further enhancing the positive health selectivity of those migrants who remain in the host society.

Thirdly, the more advantaged survival profile of immigrants may also arise from their access to Canada's exceptional array of health services. This fact alone would account for a gain in health status among newcomers, who for the most part consist of people from areas of the world in which health care accessibility is nowhere near that provided by Canada. All other things being equal, greater access to good health care should translate into gains in the health status among immigrants.

Fourthly, notwithstanding health selectivity and access to a superior health system, it is also likely that with increased duration of stay in the adopted society, the greater the degree to which the health advantage of the immigrants reduces towards the general average of the host population. This may be thought of as being a generalized phenomenon of regression to the average level of health in a society. The causal mechanisms for this regressive tendency in terms of overall health involve the tendency of immigrants to gradually acculturate the life styles, habits and orientations of the host society. To this one may also add the cumulative effects on health of life stresses on the organism as one gets increasingly older.

Fifthly, most immigrants (especially among the first generation) maintain close ties to their ethnic communities in the New World. This affords newcomers and more established immigrants an indispensable source of informal and formal support, thus minimizing the health eroding effects of rapid change associated with immigration to a new environment. One way in which the support of the ethnic community affects health is through its social integrative and social control functions in reducing the risk of certain types of mortality, including suicide, homicide, and other forms of violence.

A sixth factor underlying the survival advantage of immigrants may be associated with their socioeconomic experience. Some of the Canadian based literature on immigrants suggests that for most foreign born people in this country socioeconomic hardship is of a transitory nature. Economic difficulties, if they arise, tend to occur in the early phases of settlement. While many newcomers go through an adjustment phase and perhaps even experience poverty, over the long term the majority of immigrants in Canada do reasonably well economically and are able to extricate themselves out of poverty or economic deprivation. This means that in most cases the negative consequences of economic hardships on health are likely temporary.

Finally, it is important to point out that due to heterogeneity in genetic and biological factors among immigrant populations, the health and mortality profiles of immigrants cannot be assumed to be uniform. Some immigrant groups will do better than others in terms of health as a result of inherent genetic differences in predispositions to serious diseases (e.g. sickle cell anemia). Even within any given population, there are countless unmeasurable differences in frailty, again related to constitutional differences among persons (i.e. some people are more advantaged in genetic make up and will therefore live longer than others). As well, immigrant populations are culturally diverse entities. As such, any observed health and mortality differentials across groups may be partly linked to variations in diet, nutrition, health habits, and psychological orientations, all of which are partly if not wholly conditioned by culture. Culture can either confer advantages or disadvantages in terms of health to the extent that it promotes or fails to promote healthy ways of living.

A word of caution is necessary when interpreting the results of this investigation. The data used in the analysis of immigrant mortality cannot be assumed to be devoid of errors. Vital statistics are not always complete for immigrant decedents. In some cases the death records do not contain information on the country of birth of the decedent. In other cases the country of origin may be incorrectly stated on the death record. This can also happen in self-reports on the census. In combination, errors in the vital statistics (i.e. recording of deaths) and in the census (i.e. errors in the population counts) can seriously distort the computed death rates. Despite any methodological and data issues, however, the present study offers insight into one aspect of the immigrant experience in Canada. It provides insight into the mortality and survival patterns of the immigrant population, an area of research that has been generally neglected in Canada. Systematic investigations are needed concerning the health and morbidity trends---chronic and psychiatric---of not only immigrants, but also refugee populations. It will be also necessary to consider in greater detail the social psychological determinants of health status and morbidity among immigrants: social supports, acculturation, life stresses, background culture and personal life style factors. As well, future studies should incorporate the descendants of immigrants. This would provide an additional source of comparison of death rates, thus making results and generalizations about the relationship of migration to health more robust.

1.0 BACKGROUND

At the time of the 1991 census, there were 4,342,890 immigrants in Canada, comprising 16 per cent of the total Canadian population. Just over one million of these immigrants had arrived in the five years preceding this time point (Badets and Chui, 1994). In the 1996 census, immigrants comprised close to 17 per cent of the total Canadian population, a figure that has remained largely unchanged in the 2001 census of the Canadian population (Statistics Canada, 2003). The more established components---i.e. immigrant groups with a long history of immigration to this country---are predominantly from the British Isles, Western and Eastern Europe, and the United States. The more recent waves of immigrants consist mainly of persons and their families from non-European sending areas, including China, Hong Kong, India, Vietnam, the Philippines, South and Central America and the Caribbean, among others. Given the centrality of immigration to the development of Canada as a nation, and the fact that it is to a large extent (along with the First Nations peoples) a land of immigrants and their descendants, the foreign born in Canada continue to attract a great deal of sociological and demographic analysis (Driedger, 2003; Hawkins, 1988; Kalbach, 1970; Li, 2003; Halli, Trovato and Driedger, 1990; Halli and Driedger, 1999).

One important area of investigation is immigrants' adjustment to Canadian society and their integration to the new institutional environment. According to recent findings, immigrants in Canada may experience some difficulties in the early stages of settlement, but over the long term tend to do relatively well in terms of social and economic integration; for the most part, resettlement entails a significant improvement in

life (Beaujot, Basavarajappa and Verma, 1988; Boyd et al., 1985; Kalbach, 1970; Richmond, 1967; Richmond and Kalbach, 1980).

At the same time, it is also a fact that many immigrants experience serious difficulties, some of which are related to language fluency, the gaining of employment that is commensurate with one's educational training, and the psychological challenges associated with adjustment and acculturation to a new environment (Berry et al., 1987). Although in most cases it is likely that such difficulties may be temporary for the majority of immigrants, such multidimensional processes, viewed in combination, can be very stressful and may entail varying degrees of resocialization on the part of the individual. The resocialization may be most intense for those newcomers whose cultures are distinctly different from that of the host society, that is to say, the North American way of life (Beiser and Hyman. 1997; Berry et al., 1987; Hull, 1979; Shuval, 1993). In severe cases, as in situations of forced movements (i.e. refugees) the experience of relocation can be even more problematic and risky for the migrants, especially in terms of their mental health (National Research Council, 2001).

Sociologists usually consider mortality differentials as an indication of group inequalities in life chances. Demographers, on the other hand, tend to view mortality primarily as a crucial component of population change, though they also look at death differentials as manifestations of socioeconomic conditions and inequalities across populations. Among other things, epidemiologists tend to rely on immigrant studies as a way to assess indirectly the possible role of change in environment (i.e. by migrants) in the etiology of certain diseases like cancer and circulatory conditions that are thought to have a strong link to environment and behaviour (Haenszel, 1961; 1975; Stawski et

al., 1970; Lilienfeld et al., 1972; Marmot et al., 1984a; Kasl and Berkman, 1985; Sundquist and Johanson, 1997; Young, 1987).¹ In Canada, surprisingly scant attention has been devoted to the study of immigrant mortality, and only recently have researchers begun to look at the health of immigrants and refugees (Ali, 2002; Chen, Wilkins and Ng, 1996, Chen, Ng and Wilkins, 1996; Perez, 2002; Health Canada, 1999). The present study is premised on the assumption that a systematic analysis of death rate differences across immigrant populations can reveal important clues about the health and morbidity conditions of immigrants, and indirectly, their adaptation to the new society.

In the international context, studies of immigrant mortality have been based on evidence gathered from the experiences of several immigrant receiving nations, including Canada, the United States, Australia, France, England and Wales. As reflected in this literature, post-World War II immigrants typically enjoy lower overall death rates than their respective receiving populations (Brahimi, 1980; Burwill et al., 1973; Courbage and Khlat, 1995; Gomez et al., 2003; Kestenbaum, 1986; Khlat, 1993; McCall, 1970; Marmot et al., 1983, 1984a, 1984b; Singh and Siahpush, 2001; Trovato, 1985; 1986; Voets, Schoorl and Bruijn, 1995; Young, 1987). In contrast to these findings, studies conducted prior to World War II, particularly in the context of the United States, indicate immigrants had higher relative mortality as compared to their receiving society (Dublin et al., 1949; Dublin and Baker, 1920; Dublin, 1933; Jacobson, 1963). This difference probably reflects the very different social and economic conditions of the receiving society and the immigrants themselves during these two historical periods. It seems that

¹ 1. Many studies of immigrant mortality have been conducted by epidemiologists and demographers. Sociologists tend to treat mortality differentials as indicators of group discrepancies in life chances, on the assumption that the higher the rate of mortality, the lower the relative socioeconomic wellbeing of a given

for the most part contemporary immigrants are healthier and also enjoy a greater degree of access to good health care in the host society as compared to earlier generations of immigrants. It may also be that immigrants today are more select group than migrants in earlier historical times. An interesting aspect of this area of inquiry is the apparent paradox of immigrants possessing low death rates on the one hand, but relatively high morbidity levels. This phenomenon has been reported in some European contexts as well as in Australia (Young, 1987, 1992; Khlat, 1993; Courbage and Khlat. 1995). The possible paradox of low mortality and high morbidity among some contemporary immigrant groups remains unsolved.²

On the other hand, in the United States, some immigrant groups have been observed to have a very favorable health profile notwithstanding their relative socioeconomic disadvantage. This seems paradoxical, as in general socioeconomic disadvantages are associated with high morbidity and also high mortality rates. Some authors have noted, for example, that some relatively poor immigrant groups have positive birth outcomes and low rates of infant mortality (Collins and Shay, 1994; Singh and Yu, 1996; Weeks and Rumbaut, 1991). Also interesting is that recent research in the context of the United States concerning Mexican and other Hispanic immigrants tend to show in many cases a health advantage in young adulthood, but experience health

social category (Tumin 1967; Simpson and Yinger, 1985). Kasl and Berkman (1985) and Kliewer (1992) have conducted reviews of the epidemiological literature in this area.

² Some interesting hypotheses---to be explored later---have been advanced for the apparent “paradox” of migrants being healthier than their receiving populations. Palloni and Arias (2003), for example, talk about the possibility of this being a data artifact (errors in the data), a sociocultural effect (i.e., resources), a healthy migrant effect (positive health selectivity of migrants), or what they call a “salmon effect” (i.e., a return migration effect, whereby the less healthy immigrants leave to relocate in their countries of origin, thus leaving behind a healthy subset of the immigrant populations). For results that contradict the “paradox” noted for infant mortality among foreign born mothers in the United States, see Wilkins, Sherman and Best (1991), who found that foreign born mothers in Canada have a 20 per cent greater risk than native born mothers for having small for gestational age births.

disparities in middle age and old age (Zsembik, 2003). Although this is not a uniform phenomenon among all immigrants, it has also been shown elsewhere that the migrant advantage in health in some cases can be in the range of 30 per cent or more as compared to the native born white population of the United States. Palloni and Arias (2003) suggest that along with a “healthy migrant” (i.e. positive health selectivity) effect, culture may play a major role for this effect. That is, it is surmised that certain unmeasured aspects of the migrants’ culture may promote behaviours that translate into overall better relative health. It has also been reported in the American context that notwithstanding the apparent health advantage, the children of immigrants tend to fare less well in terms of aptitude and scholastic ability tests as they progress into childhood and beyond (Hummer et al., 1999; Padilla et al 2002; Landale, Oropesa and Gorman, 2000, 1999; Landale et al., 1999).

Returning to immigrant mortality studies in the international context, while in general the immigrant populations as a whole will show a mortality advantage over their host populations, once the analysis shifts to specific causes of death (i.e. varying diseases or conditions) there often emerges a rather complex picture and the differences do not always follow a clear and consistent pattern. For instance, in the United States, Kestenbaum (1986) has shown the foreign born have a more favorable mortality situation than the American born in connection with cancer, cardiovascular complications, heart disease, and external causes of death. In France, Brahim (1980) has shown that during 1974-75, there existed a mortality gradient based on a group’s period of immigration: more recent groups to France had lower death rates than both more established migrants and the French born. Male immigrants showed relatively high risks of premature death

from accidents and violence, while enjoying reduced risks from cardiovascular disease, cancers, alcoholism and suicide. Foreign-born females suffered elevated risks from cardiovascular related problems, cerebrovascular and respiratory ailments, and accidents and violence. Young's extensive research (1987) in Australia has corroborated earlier finding concerning immigration and mortality (see for example, Burwill et al., 1973; Stenhouse and McCall, 1970). With regard to chronic and degenerative diseases, the foreign-born generally fare better than the Australian born. However, in connection with external causes of death, with few exceptions, immigrants share higher probabilities of death than the Australian born. This situation is similar to the findings obtained by Marmot and colleagues (1983, 1984a, 1984b) in England and Wales.

Courbage and Khlat (1995) have reported on the mortality situation of Maroccans in France during 1989-91. They found that even after adjustments for underreporting of deaths and other potential problems with the vital statistics mortality data, Moroccan men still have lower mortality than both French-born men and men born in Morocco. But in the case of Moroccan females, their life expectancy is lower than French-born women, though higher than women born in Morocco. What explains these patterns of mortality differentials according to these authors is a combination of factors, including health selectivity and health screening; better access to health care in France; and better lifestyles and consumption patterns for the immigrants in France as compared to the population of Morocco. They also point out that in the case of women, entry controls are less stringent than in the case of men because many women enter France in the context of family reunification. This difference may explain the lower life expectancy of immigrant women in France. Another important process discussed by Courbage and Khlat (1995) is

the effect of return migration selectivity on the health profile of the migrants. There is a tendency for the less healthy elements of the Moroccan immigrant community in France to return to their home country, thereby reinforcing the relative mortality advantage of those immigrants that remain in France.

In another study, Khlat (1993) examined the overall mortality patterns of immigrants from Lebanon and Syria ("Levantins") in Australia during 1969-83. In relation to the Australian born, migrants from Lebanon had low Standardized Mortality Ratios (.64 for men and .84 for females). Men from Lebanon are less likely to die from cancer, cardiovascular complications, accidents and violence. Interestingly, it was also discovered that the Standardized Mortality Ratios (MRs) are lower for migrants residing in Australia for less than 15 years, as compared to more established immigrants. In terms of life expectancy differences, the Lebanese immigrants showed an average length of life of 79.67 for females, and 73.04 for males. The corresponding figures for the Australians were 78.42 and 71.38, respectively. Therefore, the female migrant advantage over Australian women is 1.25 years, while that of the male migrants is 1.66 years. For the country of Lebanon, Khlat (1995) estimated life expectancies of 67.10 for females and 63.20 for males. Thus, the improvement in average length of life for the immigrants as compared to their home country is in the excess of 9 additional years of life (12.57 for women, and 9.84 for males).

What substantive factors underlie the apparent mortality advantage of immigrants? Five possible answers come to mind. First, there may be problems with the census and vital statistics data as to artificially reduce migrant death rates. The studies reviewed above are all based on the experience of nations with highly developed vital

statistics systems and censuses. Given the consistency of the immigrant mortality advantage across a variety of settings, it seems unlikely that this result is due to data errors. The more favorable mortality situation of immigrants may be a function of the “healthy migrant” effect. Immigrants may represent a healthy subset of the population because most immigrants are generally healthy to begin with, and in addition must undergo health screening by the receiving country. Furthermore, as suggested by Courbage and Khlat (1995), there may be the additional selectivity effect of return migration to the home nations by less healthy immigrants. These selective processes combine to produce a healthy immigrant population in host countries. Thirdly, the mortality advantage of immigrants may result from socioeconomic status (SES) advantages. But this is unlikely, as immigrants tend to be heavily concentrated in low skilled, manual, and service types of occupations (Khlat, 1995). Fourthly, low mortality rates among immigrants may be due to life style patterns and habits that foster in the long term, good health and longevity. Elements of immigrant background culture may serve to promote diets and patterns of life that serve to reduce the chances of premature mortality. Diet and ways of living imported from the Old country can condition the risk of premature mortality from major diseases (cancer and cardiovascular) (Khlat, 1995; Young, 1987, 1993). It is known that some immigrant groups, particularly those from Mediterranean countries, tend to practice a healthy diet: they consume more vegetables, fruits, and olive oil, and less animal fats (Powles, 1990). Differences in alcohol consumption and smoking may also play a part in explaining the lower mortality profile of immigrants (Balzi et al., 1994; Geddes et al, 1991, 1993; Khlat, 1995). Such aspects of immigrant diet and life style are closely linked to background culture, brought with them

to the New World. Finally, the relative mortality advantage of immigrants in relation to their populations of origin and the receiving society may be the results of differences in the health care systems of the immigrants' countries of origin and those of their receiving societies. This is probably a very important factor. Indeed, many immigrants come from less developed societies, where health care systems are severely underdeveloped and cannot possibly match the provision of health care available in the host societies of immigrants (Khlat, 1995). This may contribute to the observed lower immigrant death rates as compared to their home countries (Kliewer, 1992).

In this study general and cause-specific mortality are examined with data for 19 immigrant groups and two broad categories of immigrants: New Wave and Old Wave, using the Canadian born population as the standard for the purposes of statistical comparisons. The time period under observation is 1990-92. A theoretical framework is developed that considers a number of pertinent factors for explaining variations in immigrant death rates: demographic compositional differences (age, sex, marital status), socioeconomic discrepancies (income), country of origin effects, ethnic community integration, and residual factors (i.e., health selectivity and other sources of unobserved heterogeneity). Testable hypotheses are specified based on this framework and verified against vital statistics mortality data and census population counts. The analysis looks at migrants from both traditional (Europe and United States) and more recent sending regions of the world (developing countries). Both external (suicide, homicide, accidents) and chronic causes of death (cancer, heart disease, diabetes) are investigated. The underlying premise of this analysis is that observed patterns of mortality reflect, to a large extent, problems and complications in living. For example, high suicide and homicide

rates may be interpreted as reflecting unusually high levels of psychological distress and conflict in the process of adjustment to a new society. On the other hand, a high incidence of cancer and heart disease mortality rates may be reflective of problems associated with diet and life style, among other things.

2.0 MORTALITY IN THE NEW LAND: THEORETICAL FRAMEWORK

The preceding discussion may be subsumed under a more general framework, consisting of five components: (1) country of origin effects; (2) country of destination effects; (3) selection effects; (4) demographic compositional effects, and (5) residual influences (e.g., group differences in genetic predisposition to disease). Figure 1 conveys these sets of factors, plus some additional ones, in schematic form. Discussion of Figure 1 begins with the relevance of external types of mortality and then shifts to chronic and degenerative types.

FIGURE 1: Framework for the Study of Immigrant Mortality

Country of Origin Effects

- Cultural norms, values and orientations regarding:
 - diet
 - alcohol consumption
 - smoking
 - exercise
 - attitudes toward suicide and other types of life-threatening behaviours, etc.
- Exposure to disease-causing agents in the home country environment (e.g., at work)
- Exposure to acute and/or chronic stresses prior to migration (trauma, persecution, other crises)

Country of Destination Effects

- Acculturative stress (life change)
- Socioeconomic inequalities/poverty
- Ethnic community supports
- Access to good health care

Selectivity Effects

- Positive health self-selection
- Official health screening process
- Return migration selectivity (salmon effect)

Demographic Effects

- Age composition
- Sex composition
- Marital status composition

Other Factors

Predisposition to genetically based diseases

Chronic/Degenerative Disease Mortality

- Cancer
- Heart Disease
- Other

External Causes of Death (injuries/poisonings)

- Suicide
- Homicide
- Other Accidents/ Violence

Other Causes of Death

2.1 External Causes of Death

The probability of mortality for migrants in their New World may be conditioned by a number of factors intervening between the experience of personal troubles and suicide and other types of violent death. Durkheim (1951) was one of the first theorists to advance the proposition that persons who are socially integrated benefit from a lower risk of suicide. This proposition is also applicable to the cases of homicide and accidental death.³ Cultural norms and values learned in the home country with regard to suicide and other types of life-threatening behaviours also play a role in the explanation of immigrant external mortality. In the case of suicide, analysts have argued that some societies share a system of values and norms that predispose their members to increased odds of self-inflicted death (Hendin, 1964; Kushner, 1984). There also exists a substantial body of literature supporting the proposition that homicidal tendencies are linked to culture (Fiala and LaFree, 1988; Gartner, 1990; Gastil, 1971; Hachney, 1969; Loftin and Hill 1974; Messner, 1983, 1989; Williams and Flewelling, 1989; Wolfgang and Ferracuti, 1967).⁴

³ External causes of death can be viewed as being mainly a function extreme distress (e.g., suicide) and conflict (e.g., homicide) in one's life. Accidents leading to death may be also linked to stress in life. Persons who experience significant troubles in their lives may unconsciously expose themselves to a greater risk of accidents, such as on the job, or while driving a motor vehicle. From the point of view of this study the proximate causes of accidental and violent deaths among immigrants are unambiguously a function of conditions that prevail in the new environment of action as opposed to situations that may have prevailed in one's home country. For example, in the case of cancer it is not certain whether a migrant's death in the host country is totally attributable to one's exposure to conditions in the new society; the cancer could have resulted as a function of early exposure to carcinogenic agents while the individual was a resident of his/her homeland. Thus, by focusing on external causes of death we avoid this thorny issue of separating origin vs. destination proximate conditions in the etiology of risk. In this connection, it is important to distinguish between "conditions" in the country of origin (such as exposure to carcinogenic agents) as opposed to the possible influence of one's culture of origin as a background factor that may predispose present behaviour in the host nation. The latter, as a significant component of socialization, may be an important factor in predisposing immigrant behaviour in the new society.

⁴ Although Durkheim's study dealt with suicide, it is reasonable to assume that in the case of violent and accidental death, the same principles that govern suicide risk apply. That is, the greater one's degree of integration to his/her social group, the lower the risk of death from accidents or violence. As an example we may cite the empirical evidence concerning the likelihood of death from suicide, homicide and motor vehicle fatalities being significantly lower for the married than the non-married. In all three cases, the married state seems to provide the individual with greater "protection" against risk than is the case with

In Australia, the evidence indicates that migrant suicide rates tend to surpass both those of Australia and their respective countries of origin, but they are more akin to those of their home countries than to their receiving society (Burwill et al., 1973, 1982; Sainsbury and Barraclough, 1968; Young, 1987). The majority of migrant groups in Canada also seem to exhibit suicide rates that are closer in level to their countries of origin than to their receiving society (Kliewer and Ward, 1988). Such evidence suggests that immigrant death rates are determined by cultural factors associated with their countries of origin.⁵ Traditional values and beliefs may contribute to either an increase or a reduction in anomie in the new country (Burwill et al., 1973, 1982).

Trovato and Jarvis (1986) observed that foreigners in Canada from Southern European origins and a Catholic religious culture (such as Italians and Portuguese) tend to share low odds of suicide, whereas immigrants from predominantly Protestant and Anglo-

those who are not in a marital union. The regularity and persuasiveness of this fact lends strong credence to the social integration proposition (see Gove, 1973; Kobrin and Hendershot, 1977; House et al., 1988; Maulitz, 1989; Mirowsky and Ross 1989 for further comment and evidence on this topic). Official homicide statistics in Canada do not record country of birth of both the victim and the assailant. Therefore, it is impossible to give a direct answer to the question concerning the nationality of murderer and victim (see Kennedy et al., 1989, for further comment on this topic).

⁵ An interesting thesis regarding the possible role of national culture on suicide has been proposed by Kushner (1984). Essentially, his theory is based on the psychoanalytic principle that humans have an unconscious desire to do away with authority figures, who by their very roles, tend to inhibit or control one's actions, impulses and desires. This presumed unconscious tendency to eliminate authority figures, is a source of psychic conflict in the individual, as quite often such figures---particularly parents---are also a source of love, affection and protection. These two opposing unconscious features of the human psyche, according to Kushner (1984) causes suicide. Thus variations in self-murder may be partly a function of cultural differences in the extent to which individuals under circumstances of parental loss are allowed to resolve their psychic guilt. Those cultures that promote or encourage overt, even exaggerated, expression of unconscious guilt (e.g. South European) on the occasion of the death of a loved one, tend to be characterized by low suicide rates, whereas in cultures where overt expression of loss is discouraged (e.g. Nordic European) suicide rates are generally high. As reported by Kushner, many Southern European societies have elaborate bereavement rituals, and therefore in accordance with the psychodynamic principles of his thesis, both national and corresponding migrant rates of suicide are generally low. On the other hand, nations in which expressive mourning rituals are not a central part of the culture, such as in the Nordic countries of Europe, both national and corresponding immigrant suicide rates tend to be high (Kushner, 1984). There may also be a strong interrelationship between Catholicism and cultural supports for elaborate and expressive grieving in certain parts of the world (Aries, 1974, 1982, 1985).

Saxon countries share above average risks (i.e., American, German, Scottish). A similar discovery was reported by Whitlock (1971) in Australia in the case of the British, the Irish and the New Zealanders, who share a common Anglo-Saxon culture with the Australian-born. These groups displayed higher odds of self-inflicted death than both their countries of origin and destination. In contrast, Southern Europeans enjoyed lower rates of suicide than both corresponding origin and destination countries. Whitlock (1971) attributed these mortality differences to group variations in tradition and social attitudes concerning suicide.

Homicide and motor vehicle fatalities can also be viewed as symptomatic of difficulties in a new land. Unfortunately, information about migrants' pattern of death from these causes is scant. The available evidence based on countries other than Canada suggests that rates of homicide and accidental death are quite high among foreigners in Australia (Burwill et al., 1973), in France (Brahimi, 1980), in England and Wales (Marmot et al., 1984), and in the United States (Rosenwaike, 1984, 1987). Little is known about immigrant homicide in Canada, but a study by Trovato (1992) based on four migrant groups in 1970-72 shows that the foreign-born share lower risks of violent and accidental death than the native-born. Of the groups in the analysis, Italians stood out for their low rates of suicide, homicide and motor vehicle fatalities.

Burwill and colleagues (1973) discovered that migrant rates from motor vehicle accidents are higher than among the Australian-born in virtually all age groups. Unlike suicide, migrant death rates from traffic accidents tend to be closer to the Australian-born levels than to those prevailing in their home countries. In general, immigrant groups with high suicide rates also share high rates of mortality from motor vehicle fatalities and other

forms of violence, suggesting that violent and accidental mortality may be a function of a common underlying factor.

In fact, the evidence from France gives further indication that immigrants tend to die more from violent causes such as homicide and from road accidents in comparison to the receiving population (Brahimi, 1980). An interesting observation by Brahimi (1980) is that the more recent immigrant groups tend to show higher rates of road accidents mortality than the more established groups. This may indicate adjustment problems for newcomers, such as difficulty in internalising the rules and norms of the road prevailing in the host nation. Concerning immigrant homicide mortality, Burwill and colleagues (1973) have proposed that murder is a form of aggression carried over from the migrant's culture of origin ---a view consistent with Wolfgang and Ferracuti's (1967) culture of violence theory, which proposes that the tendency for outward aggression is a learned behaviour.

Criminologists have applied this perspective to explain differences in homicide rates among nations. For example, Gartner (1990) tested a model of cross-national and temporal variations in homicide rates for 1950-1980 on the assumption that homicide victimization rates reflect a society's tendencies for lethal violence. Gartner found support for the prediction that homicide rates will be higher where the death penalty is legally sanctioned and where involvement in national war has been more frequent and more deadly. Her study is based partly on the importance of socialisation in explaining violent behaviour and on the modelling-habituation principle: that the more one is exposed to a particular behaviour (e.g., violence), the more likely one is to execute that behaviour (Bandura, 1973). Thus, group differences in homicide can be thought to reflect "an underlying system of norms prescribing, or failing to prescribe, violence as a

response to conflict" (Gartner, 1990: 96). Williams and Flewelling (1989) provide some additional support for this thesis. In their study of criminal homicide in American cities, they included indicators of "violent cultural orientation." It was found that cultural orientation is indeed an important predictor of homicide resulting from interpersonal conflicts, even after the effects of resource deprivation and social disorganization variables were held constant in their multivariate equation.

Why would certain immigrant groups experience greater levels of homicide victimization than others? While there is overwhelming evidence in the United States and Canada that the majority of homicides are intra-racial (Kennedy and Forde, 1990; O'Brien, 1987), the facts are less certain with regard to immigrants. In Canada, it is not known whether homicide is predominantly an intra-group phenomenon as opposed to an inter-group problem (Nettler, 1982). It is known that approximately 78 percent of all homicide victims in this country share close relational ties with their assailants (Silverman and Kennedy 1987). While this evidence says nothing about inter-group violence among immigrants, it may suggest that perhaps most immigrant homicides involve persons of the same group. Information on the country of birth of both assailant and homicide victim would be required to determine the veracity of this assumption; unfortunately, such data are not available.⁶

⁶ From the experience based on England and Wales, France, Australia, Canada and the United States, immigrants show on the whole, relatively low death rates as compared to their host populations. This can be interpreted as a reflection of positive health selectivity. There is only one documented case of negative selection in the literature concerning immigrant mortality. According to Adelstein, Marmot and Bradshaw (1986), Irish male immigrants to England and Wales show all-cause mortality being higher than males in the Republic of Ireland and then the total England and Wales male population. This is thought to be due in part to an adverse selective effect of easy migration. They argue that since there is no restriction in immigration between Ireland and the UK, the migrants are negatively selected, both in health and other aspects such as socioeconomic status. For further analysis on this and related aspects of Irish Immigrants' relatively high death rates, see Rafferty, Jones and Rosato (1990).

Any explanation of homicide victimization rates among immigrant communities must consider economic inequality and group differences in community integration as factors (Cohen et al., 1981; Fiala and LaFree, 1988; Gartner, 1990; Messner, 1982; Sampson and Groves, 1989; Shaw and McKay, 1942; Williams, 1984; Williams and Flewelling, 1988). Criminologists have shown that there is a direct association between economic inequality and homicide rates (Gartner, 1990; Messner, 1989; Williams and Flewelling, 1988). Inequality causes alienation, despair and pent up aggression, conditions that often result in personal conflict and criminal violence (Gartner, 1990). Therefore, one may anticipate that the relationship between measures of economic inequality and lethal violence across immigrant communities should also be positive.

Though country of origin of immigrants is thought to be a relevant factor in explaining suicide and homicide variations among immigrants, but it is not believed to be a factor in connection with accidental deaths. Differences in accidental mortality among migrants are largely a function of situational problems in the adoptive environment. They are unrelated to factors associated with one's country of origin. In this connection, the ethnic community can provide an important integrative function for newcomers to a new land (Breton, 1964; Janes, 1990; MacDonald and MacDonald, 1964; Trovato and Jarvis, 1986; Yancey et al., 1976). A welcoming ethnic community provides the newcomer with an important source of social integration and wellbeing that may condition the relationship between prolonged life stresses and the risk of suicide, homicide and possibly even accidental death. This point is reinforced by Janes (1990: 168) based on his observations of the Samoan immigrant community in Los Angeles: "Salutogenesis for Samoans, ... involves maintaining their unique urban social institutions, and their sense of cultural

distinctiveness...” In accordance with the social integration perspective in criminology (Shaw and McKay, 1942), variations in ethnic community integration may explain group discrepancies in violent and accidental mortality rates. Communities characterized by strong lasting formal and informal social networks exert greater levels of control on the activities of its members (Breton, 1964; Pescosolido and Georgianna, 1989; Reitz, 1980) and are better able to assuage or prevent conflicts that could potentially culminate in lethal violence (Sampson and Groves, 1989).

According to the social historian Philippe Aries (1974, 1982, 1985), death is a central aspect of a society's collective identity, as reflected in its images of mortality: in art, tombs and bereavement rituals. Similarly, the psychohistorian Harold Kushner (1984, 1989) has proposed that national differences in suicide rates reflect the role of psychodynamic factors reflected in a nation's bereavement rituals. He has noted that in countries where exaggerated mourning is embedded into the culture, suicide rates are generally low (e.g., Southern Europe), whereas in countries where mourning rituals are more subdued, suicide mortality is relatively high (e.g., Scandinavian and other Nordic countries). Kushner's thesis is grounded on the psychodynamic principle that the cathartic effect of expressive mourning acts to alleviate for the individual an unconscious tendency for self-punishment. The unconscious desire for self-punishment arises as a consequence of another unconscious tendency in humans---the desire to do away with authority figures in one's life, including parents and other loved ones. Unless the culture provides some acceptable mechanism for the outward expression of this unconscious guilt, suicide rates in the population will be relatively high. Insofar as bereavement practices are part of a nation's culture, this argument provides a psychodynamic basis concerning differences in orientation toward the act of

suicide among immigrants, the assumption being that antipodes to the New World take with them the cultural predispositions learned in their home societies.

One other important source cross-national suicide variations is national religion. Catholic countries have lower suicide rates than Protestant ones because Catholicism has always viewed suicide as a sin. Individuals socialized in a Catholic tradition would be less likely to commit suicide, even in the presence of extreme psychological distress. Immigrants carry with them elements of their early socialization (therefore culture) for conflict management and outward aggression learned in their home land (Wolfgang and Ferracuti, 1967; Gartner, 1990). On this premise, homicide rates among immigrants should correlate highly with the homicide rates prevailing in their respective countries of origin.

The second component of Figure 1 pertains to mortality factors in the host country. Migration can be a very stressful process due to the severing of ties, often permanently, with one's homeland, friends and family (Berry et al., 1987; Noh and Avison, 1996; Shuval, 1982, 1993). For many newcomers, language barriers must be overcome, and the immigrants must learn a new culture. This is a continuous process, but it is perhaps more stressful for persons whose culture of origin differs significantly from that of the receiving society. Barry and colleagues (1988) have identified five major acculturative stressors for immigrants: physical changes (a new place to live, new housing, different population density, pollution; biological changes (new nutritional status, new diseases; cultural changes (alteration in political, religious, economic, technical, linguistic, religious, and social institutions); new sets of social relationships (in-group vs. outgroup relationships, establishment of dominance-subordinate statuses based on ethnicity; and psychological

changes (adaptation to a new milieu often entails psychological and behavioural changes; and alteration in mental health status almost always occurs as individuals attempt to adapt to change).

Berry and associates (1987: 492-3) explain that “[A]cculturative stress refers to one kind of stress, that in which these stressors are identified as having their source in the process of acculturation; in addition, there is often a particular set of stress behaviors which occurs during acculturation, such as lowered mental health status (specifically confusion, anxiety, depression), feelings of marginality and alienation, heightened psychosomatic symptom level and identity confusion.⁷ Acculturative stress is thus a reduction in the health status of individuals, and may include physical, psychological and social aspects...” Acculturative stress can translate into increased rates of psychological distress, psychiatric illness and mental hospital admissions (Hull, 1979; Kasl and Berkman, 1985; King and Locke, 1987; Krupinski, 1967, 1984; Locke and Duval, 1964; London, 1986; Mirowsky and Ross, 1980; Odegard, 1932, Vega, 1987), and increased odds of

⁷ According to Berry and colleagues (1987), not all groups experience the same level of acculturative stress. The level of acculturative stress depends on a number of factors, including: (a) the nature of the society (pluralistic multicultural vs. assimilationist); (b) the nature of the acculturating group may be different (did the group move as a result of force? (refugees); was the move voluntary? (most immigrants to Canada); (c) the mode of acculturation differs from group to group (e.g., groups that value their cultural uniqueness and wish to maintain distinct culture vs. those that are more individualistic in orientation; groups that value extensive contact and interaction with larger community vs. those that are less inclined to do so, etc. There are four possible types of groups: integrationist, assimilationist, separatist, and marginalized). Each of these will have different levels of stress in their experiences. For example, the lowest should be integrationist-voluntary and the highest will be marginalized-involuntary migrants. Thus, for all groups, acculturation has some unavoidable costs, which can be alleviated by the type of society (i.e. multicultural ideology). In fact, in their empirical investigation in Canada, the authors found that Native peoples, Sojourners, and Refugees have the highest acculturative stress scores, while immigrants and ethnic groups have the lowest levels. Native peoples movers to cities, and refugees represent involuntary types of migrants, and therefore score high on stress level index. Sojourners score intermediate because they have an unsettled status in the receiving society. Immigrants and ethnic groups score relatively low because they are largely voluntary groups in a society that generally welcomes them and allows them freedom to continue their traditions.

suicide, and possibly accidental or violent death (Rosenwaike, 1987, 1983; Rosenwaike and Shai, 1989; Shai and Rosenwaike, 1988).⁸

Many immigrants who have resettled in a new society as refugees have experienced persecution and psychological trauma prior to relocation. This is a rather common problem for many refugees, who in their countries of birth may have faced a range of traumatic events, including prolonged civil war, murder, persecution, and other forms of aggression against themselves, their families and friends (Beiser, 1988; Beiser and Hyman, 1997). Although life in the New World is often significantly better, they many never free themselves of their psychological turmoil and post-traumatic stress. It goes without saying that this psychological condition is a critical risk factor for self-inflicted harm. In Canada, we have no direct knowledge of the extent of suicide among refugees; however, the suspicion is that while suicide rates may not be very high, attempts at self-destruction may be more frequent. Unfortunately, official death records in Canada do not specify whether a decedent is a refugee or not.

Acculturative stress may be conditioned by socioeconomic well being and also by a group's level of community integration (Trovato and Jarvis, 1986). Socioeconomic status is inversely related to suicide and homicide in the general population (Simon, 1968; Gartner, 1990; Messner, 1989); therefore, measures of socio-economic status

⁸ Janes (1990) has reviewed the dominant social stress models in the social epidemiological literature. These include: (1) Stress as ego's response to life change or events (Dohrenwend and Dohrenwend, 1974) whereby Ego appraises the life events and responds psychologically; the response may induce stress. (2) Cultural incongruity model (Cassel, 1975; Marmot and Syme, 1976). In this model, stress is a function of inconsistency or discrepancy arising when the essential predictability of social life is compromised by new or competing cultural systems. (3) Status inconsistency (Dressler, 1982, 1985). Here, stress is a function of new statuses becoming available to Ego, but Ego lacks the resources or experience to fulfill the behavioural expectations associated with those statuses. Moreover, Janes (1990: 6) argues that stress stems from three processes that are linked to the wider social context: deficiencies of social, economic, or psychological resources that compromise role performance; the acquisition of new statuses or roles that are unfamiliar and /or conflict with other social positions the individual occupies; and hindrances placed on the acquisition of

should correlate inversely with immigrant mortality rates. Following Durkhemian principles, one may surmise that groups that promote enduring informal and formal ties in the context of a cohesive ethnic community would experience few cases of stress related mortality (Lin and Ensel, 1989; Litwak and Messeri, 1989; Moen et al., 1989; Pescosolido and Georgianna, 1989; Trovato and Jarvis, 1986).

The third component in Figure 1 pertains to the effects of demographic characteristics on mortality, age, sex and marital status compositions being three of the most significant. Accidental or violent death occurs most frequently to people who are young, male and single (Gove, 1973). These compositional variables are treated as statistical controls in the analysis of mortality differentials.

Observed differences in mortality may also be a function of selective processes (Borjas, 1991). As explained by Shuval (1982: 679): "All migration is selective. The population moving from one setting or country to another is rarely representative of the population from which it is drawn; however, the criteria of selection vary. In some cases, the selection will be 'positive', resulting in highly educated, ambitious, adventurous and adaptable migrants. In other cases, migrants may be characterized by failure in their place of origin, low education, present or potential social or psychological pathology, lack of occupational skills, or susceptibility to illness. A mixture of these traits often occurs, although it is usually possible to discern a dominant pattern of positive or negative selection. Processes of selection determine the kinds of personal resources migrants bring with them in the form of education, skills, and personality traits. Their level of sensitivity and susceptibility to different stresses is also a function of selection

desired statuses/roles. These conditions may be either relatively acute such as the stress that is produced by major life changes, or chronic, such as the stresses produced by status inconsistencies.

processes... The selection process is mediated by freedom of exit from the place of origin and policies concerning admission to the destination. On a formal level, there are often barriers to leaving and requirements--educational or occupational--to entry.”

Positive health selection would manifest itself, all other things being equal, in lower immigrant death rates in relation to the host country and the population of origin, while negative selection would result in higher immigrant mortality with respect to both home and receiving countries. From the point of view of Canada, the formal process of migrant screening should lead predominantly to positive selection of newcomers, both in connection with personal adaptability and health due to the formal requirements and screening associated with entry into the country, and the self-selective nature of migration itself (Lee, 1966).

Selectivity effects on mortality can also result as a consequence of return migration of migrants to their home countries. This has been referred to as the “salmon effect” by some authors (Brahimi, 1980; Khlat, 1993; Young, 1986a, 1992; Palloni and Arias, 2003). Usually, for every in-migration stream, there is a corresponding, but weaker, counterstream (Lee, 1966); therefore, some level of return migration can be expected to occur across most immigrant groups. If return migrants are those who are less adaptable and less healthy, observed death rates across immigrant categories will be potentially lower than otherwise simply by the process of self-selection of the less healthy return migrants. This phenomenon is likely common in the European context, where distances between countries are not large; however, in Canada, this is probably an uncommon occurrence, as most immigrants who move to Canada do so permanently.

Another possible source of observed mortality differences is genetic predisposition to disease (Cooper, Rotimi and Ward, 1999). In fact, as already indicated, epidemiological investigations of immigrant mortality are largely concerned with the isolation of genetic versus environmental sources of diseases.⁹ According to Kasl and Berkman (1985) such studies often do not try to answer questions about the impact of the migration experience on mortality, but focus instead on clarifying the relative influence of heredity (genetics) and environment on disease. Mayers (1980: 138-139). explains the reasoning behind such studies, using multiple sclerosis as an illustrative example:

“The reasoning which underlies migrant studies is straightforward. Imagine a disease of unknown or unproven aetiology, such as multiple sclerosis, which is one of many diseases for which migrant studies have been used. By studying a group of individuals who migrate from a high incidence area to a low incidence area, or vice-versa, and by assessing the migrants' chances of developing MS, much evidence can be gathered to differentiate between its possible genetic or exogenous bases. For example, if migrants from a high incidence area to a low incidence area assume a low risk of developing multiple sclerosis, the evidence certainly suggests that the disease is caused by exposure to an agent or agents in the old environment which do not remain as risk factors for migrants after they migrate. If migrants from a low incidence area to a high incidence area assume a relatively great risk

⁹ It is highly likely that genetics and environment interact in accounting for differences in disease incidence and prevalence among subpopulations. A review of the evidence by Cooper, Rotimi and Ward (1999) with special reference to the case of African-Americans suggests that “genes are often invoked to account for why high blood pressure is so common among African-Americans. Yet the rates are low in Africans. This discrepancy demonstrates how genes and the environment interact” (p. 57). These authors contend that the African Diaspora is linked to the difference in hypertension between African-Americans in and persons in Africa. The higher level of this condition in the African-Americans is linked to the change in environment generations ago, when Africans were forcibly enslaved, taken away from their usual locales in Africa. In addition to perhaps a genetic predisposition, the “migration” experience of the Africans in the context of the United States over several generations of hardship and discrimination has been a powerful factor in their developing very high levels of hypertension.

of developing the disease, it is then highly probable that an agent or agents operating in the destination country are of etiological significance. If the risk of developing a disease is not changed by migration, the set of plausible hypotheses is somewhat different. For example, if migrants from a high incidence environment to a low incidence environment retain a great risk of developing a disease, there are at least two mechanisms possible. These may operate either alone or in combination with one another. The disease may have a genetic basis which is obviously not altered by migration. An equally important and plausible explanation, however, is that an exogenous factor or set of factors at the origin is important, and that exposure prior to migration determines subsequent risk. Three types of analysis aid in the differentiation of these interpretations. First, the offspring of migrants may be studied prospectively, and their risk of developing a given disease assessed. If the offspring retain a high risk of developing the disease, the evidence is interpreted in favour of a genetic mechanism. Second, a sample of migrants may be selected and age at migration noted. Prevalence, incidence, or mortality rates may then be calculated for specific strata of migration age. If people who migrate before a specific age tend to assume the risk of their destination country, while those who migrate after the specific age retain the risk of the origin country, the evidence is strong that the risk of developing the disease is age-dependent, and that exposure at or after a specific age determines the risk of disease. This method has been used in the epidemiological study of multiple sclerosis. People who migrate prior to the age of 15 tend to assume the risk of developing MS of the destination, while those migrating after the age of 15 tend to retain the risk of their homelands. This suggests that exposure before the age of 15 is critical. This method does not assist in the differentiation between genetic factors and exogenous factors operating in infancy or in

early childhood. Since relatively few infants are involved in migration, there will be little discernible effect of migration in either case.”

The empirical identification of genetic effects on migrant death rates requires data that are difficult to obtain. In Canada information on the death records regarding decedents’ ethnicity is scant and incomplete, making it virtually impossible to compare first generation immigrants with their corresponding Canadian-born descendants. Given this limitation, it is difficult, if not impossible, to study the mortality patterns of the offspring of immigrants for possible indirect evidence for genetic effects on disease (but see the attempt of Balzi and associates, 1994).

2.2 Hypotheses

2.2.1 Violent and Accidental Mortality

From the foregoing discussion four hypotheses may be specified concerning external causes of death:

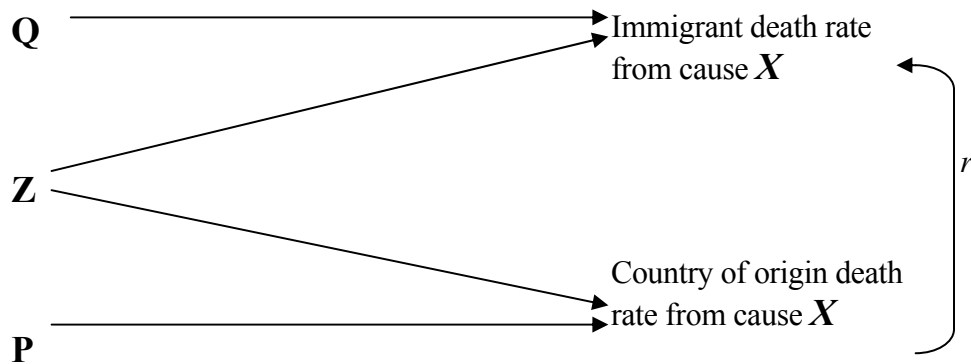
- (1) immigrant mortality rates from suicide and homicide will approximate more closely the rates of suicide and homicide prevailing in their countries of origin than those prevailing in their country of destination; therefore, the independent effect of country of origin on immigrant suicide and homicide mortality will be positive;
- (2) immigrant accidental mortality rates will approximate more closely the rates of accidental mortality prevailing in the host country than those prevailing in the country of origin;
- (3) the higher the socio-economic status of immigrants, the lower the death rate from suicide, homicide and accidental death;

- (4) immigrant differentials in mortality rates from suicide, homicide and accidents are partly a function of immigrant groups' differences in ethnic community cohesiveness.

The first prediction is based on the premise that if there is a culture of origin effect on immigrant suicide and homicide the differences in rates between immigrants and their respective home countries should be relatively small and less than their differences in relation to their adopted country. Thus, in a multivariate analysis, an indicator of the immigrants' national origin culture should be statistically significant. Such an outcome, it was argued, is not expected in connection with accidental mortality. Accidents are determined by situations in the host environment and have no relationship to one's national cultural background; rather, they are a reflection of the individual's immediate circumstances. Correspondingly, hypothesis two calls for migrant accidental mortality rates to be more akin to their country of destination than to their countries of origin, and therefore not statistically related to country of origin. Hypothesis number three is grounded on the principle that the relationship between measures of economic position and mortality are generally inverse (Antonovsky, 1967; Duleep, 1989; Gartner, 1990; Kitagawa, 1977; Kitagawa and Hauser, 1973; Messner, 1983; Simon, 1968). This inverse relationship should also apply in the cases of immigrant homicide, suicide and accidental mortality. Hypothesis number four derives in part from arguments posed earlier concerning the protective and salutogenic influence of the ethnic community on immigrants' mortality risk. The expectation is also consistent with the criminology literature concerning the relationship of community integration and rates of homicide (Gartner, 1990; Sampson and Groves, 1989; Shaw and McKay, 1942).

2.2.2 Chronic Disease Mortality

The conceptual framework shown in Figure 1 is also applicable to chronic/degenerative disease mortality such as heart disease and cancer. Such diseases have a strong lifestyle component to them (e.g., diet, exercise, smoking, and so on). Of particular importance is the possibility that migrants may have developed the early stages of a given ailment in their home country prior to relocation (Mayers, 1980). Deaths occurring in the adopted country may be the final outcome of a disease process that may have begun in the migrant's country of origin. Unfortunately, it is virtually impossible to discern directly for such a possibility. One indirect way to check for such a link is to correlate disease-specific death rates in the home country with the rates of the corresponding immigrants. If both origin country and immigrants in a new land have the same predisposing factors to disease, then their corresponding death rates should correlate. Schematically, this can be represented as follows:



In this sketch the death rates of the immigrants and their country of origin from cause X are correlated (r) due to their common dependence on cause Z . However, each of the two

death rates have independent causes as well (**P** in the case of origin country and **Q** in the case of immigrants in their host nation: **Q** might be the host society's legal restrictions to alcohol use, while **P** might represent access to alcohol in the home country, for example). **Z** may be cultural in nature, as in the case of alcohol consumption as a predisposing condition to cirrhosis of the liver; in some societies the consumption of alcohol is widely tolerated by the culture, while in others it is less supported (Lin, 1986). France and Italy are two examples of the former, while Anglo-Saxon countries (including Canada) would represent examples of the latter. A suitable hypothesis that follows from this example might be that alcoholism would be higher among immigrants from countries where alcohol is not legally restricted, and thus will experience above average death rates from cirrhosis of the liver, given this disease's strong (but not perfect) link to alcohol consumption.

A similar connection can be expected in the case of heart disease, primarily through its association with dietary customs. To the extent that dietary fat intake varies from society to society, there should be corresponding variation among immigrants, on the assumption that they retain many of the dietary customs of their home country. Cultural proscriptions against animal fat intake may translate into lower levels of heart disease, all other things equal. As well, smoking is a culturally conditioned behaviour that has far reaching effects on health. To the degree that smoking is considered acceptable in a given society, its population would experience high rates of lung cancer mortality. Migrants would likely reflect the smoking and dietary patterns of their countries of origin and would therefore show corresponding variation in death rates from associated diseases in their adopted land. Undoubtedly, there are other complex causal linkages intervening between country of origin effects and immigrant mortality. What has been attempted here is a demonstration of some

of the more obvious connections for illustrative purposes. Operationally, the effects of country of origin on migrant death rates from specific diseases should manifest themselves in a degree of correlation between the death rates of the home country and its antipodes.

Regarding the association of country of destination effects with chronic-degenerative mortality, an important conditioning factor is the immigrants' socio-economic status in their New Land. In Canada, certain ethnic groups, particularly those of Anglo-Saxon origin, have traditionally fared better than other groups (Porter, 1965). However, in recent decades immigrants from other national backgrounds have been making significant socio-economic strides (Boyd et al., 1985; Richmond and Kalbach, 1980). Unfortunately, we no direct information in Canada concerning socio-economic status and immigrant mortality. Nevertheless, the international literature clearly demonstrates there is an inverse relationship between measures of SES and mortality (Antonovsky, 1967; Benjamin, 1965; Berkman and Syme, 1979; Duleep, 1989; Dutton, 1978; Fein, 1977; Kitagawa and Hauser, 1973; Powles, 1978; Preston, 1977; Stockwell, 1963). This inverse relationship is assumed to prevail among immigrants as well.

The social epidemiological literature has established the existence of a strong link between difficulties in life, susceptibility to illness and premature mortality (Berkman and Syme, 1979; Casel, 1974; Cobb, 1976; Cohen and Brody, 1981; Marmot and Syme, 1976; Syme and Berkman, 1976). Also, stressful life events have been linked to morbidity and death probabilities (Antonovsky, 1971; Evans, 1987; Hull, 1979; Kasl and Berkman, 1985; Krupinski, 1967; King and Locke, 1987; Locke and Duvall, 1964; London, 1986; Odegard, 1932; Rahe, 1979; Reed et al., 1982; Vega et al., 1987; Whitlock, 1971). This large body of literature is consistent with the proposition that migration is a form of life change, involving

serious challenges for the individual confronted by a new setting. The challenges include having to establish a new residence, finding new employment, learning a new language and culture, and possibly coping with a very different climate than one has been accustomed to in his homeland (Berry, 1992; Berry et al., 1987; Shuval, 1982, 1993). For many immigrants, these types of stressors may prevail over a prolonged period of time or possibly permanently. A large proportion of immigrants may never fully adjust to their new environment. This condition may cause psychological distress and poor health. Some individuals may resort to suicide or perhaps other forms of self-harm.

An important intervening mechanism between life stresses and premature mortality is variation in degree of social support available to immigrants in their receiving ethnic community (Trovato and Jarvis, 1986; Van Tran, 1987). Ethnic communities have, in varying degrees, both informal and formal sources of social support for its members. In the informal sense, people usually have access to friends, relatives and family, which under difficult times can rally to offer material and non-material assistance to an individual. In the formal sense, ethnic communities often have churches and social clubs, religious leaders and other community officials that can facilitate difficult situations for the individual. Established ethnic communities will have more of these important properties than relatively new ones. Thus, the community can be an important buffering agent against prolonged psychological stress and distress, possibly serving to diminish the risk of premature mortality from stress related diseases---not only suicide, but also cardiovascular types of ailments (Egolf et al., 1992).

Besides being conditioned by demographic compositional effects, chronic disease mortality rates are also affected by the same set of selectivity factors discussed earlier.

Migrants represent a select group in terms of not only human capital, but also health (Kasl and Berkman, 1985; Trovato and Clogg, 1992). They carry with them the benefits of self-selection for good health on the one hand, and the required formal health screening process on the other. And, as already mentioned, self-selection for return migration may also impact death probabilities through the process of return migration. At present, given the lack of direct evidence, there is no reason to assume that immigrant groups differ in their propensity to experience return migration, it may be surmised that the effect of return migration on immigrant mortality rates is likely uniform across nationality groups in Canada.

Groups may also have differences in biological/genetic predispositions to disease. This can represent another possible source of selectivity. Indeed, the biodemographic literature has established that individual differences in longevity may be partly a function of genetic factors (Gavrilov and Gavrilova, 1991; Osterfeld, 1967). While this point is acknowledged, unfortunately it is impossible to provide direct measures for this source of variability in this study. However, if one may assume randomness in the distribution of genetic factors that determine the average length of life across migrant populations, this source of variations should be of little consequence statistically in explaining group differences in mortality rates. Ideally, this assumption should be tested empirically.

The preceding discussion pertaining to chronic-degenerative disease mortality suggests three hypotheses:

- (1) country of origin effects (as measured by the death rates of immigrants' home countries), will correlate significantly with immigrant group mortality rates in Canada, such that the higher the death rate in the home country, the higher the death rate in that corresponding immigrant group;

(2) the greater a group's degree of ethnic community cohesiveness, the lower will be the corresponding immigrant group's death rate;

(3) the greater an immigrant group's socioeconomic status, the lower its death rate.

Given the complex nature of immigrant mortality, it is virtually impossible to test all relevant factors in Figure 1. The present study will therefore confine itself to the specification of testable hypotheses given the nature of the data available.

3.0 DESCRIPTION OF THE DATA

3.1 The Immigrant Groups

Mortality data for 1990-92 and corresponding population counts for 19 immigrant groups and the Canadian born population in 1991 were obtained from Statistics Canada as special tabulations (Statistics Canada, 1997a, 1997b). All death rates in this study are three-year averages, with 1991 as the central year. The 20 nationality groups in the analysis are (see Appendix A): the Canadian born, USA, Germany, Republic of Ireland, England/Wales/Scotland/Northern Ireland, Greece, Italy, Portugal, Hungary, Poland, USSR, Czechoslovakia, Sweden, Other Scandinavia, Japan, China, Other Asia, Africa, South-Central America/Caribbean/Mexico; and all Other (residual category). As noted, some of these immigrant groups are relatively recent to Canada (i. e., China, Other Asia, Africa, South-Central America/Caribbean/Mexico); for the most part, the rest are old wave European immigrants, having a more established history of settlement to Canada. Also, the new wave categories are generally Visible Minority immigrants. That is, immigrant groups that fall under the official definition of “visible” in terms of their racial characteristics (Emploi et Immigration Canada, 1987). Official mortality records in Canada do not include the year of immigration to Canada for decedents of foreign born origins. Clearly, this makes it impossible to partition cases on the basis of period of immigration. Nonetheless, it is

believed that a significant component of the Chinese, as well as Other Asia, Africa and South-Central America/Mexico categories consist of relatively recent arrivals. These groups, besides being predominantly Visible Minority immigrants, are also defined here as “new wave” to distinguish them from “old wave” Europeans (Simmons, 1990; Kalbach et al., 1993; Trovato, Verma and Dai, 1993; Badets and Chui, 1994).

3.2 Data Adjustments

Researchers have relied on official vital statistics to study mortality differences between immigrants and the Canadian-born (e.g., Kliever, 1979; Michalowski, 1990; Sharma, Michalowski and Verma, 1989; Trovato, 1985, 1986a, 1990, 1992; Trovato and Clogg, 1992; Trovato and Jarvis, 1986; Trovato, Verma and Dai, 1993). All of these investigations have been plagued--in varying degrees, by the existence of incomplete or missing information on the country of birth variable on the official data file from Statistics Canada. Depending on the period of observation, the availability of information on this important variable can be as high as 100 percent. Two strategies may be applied to deal with this problem:

- (1) if the proportion of “unknowns” is small, use the known distribution of deaths to derive apportioning weights to distribute the “unknowns” to the known distribution of deaths;
- (2) if the proportion of “unknowns” is large, apply a mixed distribution, consisting of the average distribution of known deaths and the corresponding population, to derive apportionment weights to distribute the “unknowns” to the known distribution of deaths.

For the period under investigation (1990-1992) the average proportion of “unknown” and “not stated” deaths for the country of birth variable is just over five percent.

	1990	1991	1992
Deaths---country of birth not stated	8	1,498	1,113
Deaths---unknown country of birth	9,273	8,775	8,752
Total deaths	191,631	195,217	196,162
% “Unknown” + “country of birth not stated”	4.84	5.26	5.03

It was deemed appropriate to apply method (1), as described below:

$$D_{ijk} = W_{ijk}(d_{ij}^u) + d_{ijk}^o$$

Where,

D_{ijk} = adjusted deaths by characteristics I and J for nativity group K;

W_{ijk} = cell-specific weights obtained by d_{ijk}/Σ_{dij}^o (where d_{ijk} is the number of deaths in any intersection of characteristics I and J for nativity group K; and Σ_{dij}^o is the observed number of deaths in the intersection of I and J for nativity group K);

d_{ij}^u = the number of deaths in intersection I and J that are classified in the official records as “country of birth unknown/not stated.”

This formula assumes that the distribution of “unknowns/not stated” deaths follows the same distribution as the known cases (i.e., the deaths distributed by identifiable country of birth categories). It also assumes that the underlying distribution of the “unknowns/not stated” country of birth is identical to that of cases for which the country of birth of decedents is known. Given that there are relatively few “unknowns” and that we have no

systematic knowledge of the circumstances which “created” them, this method of apportionment is justifiable. When the number of “unknowns” is large, this procedure may not be suitable. In such cases an alternative method that has been shown to yield reasonable results is procedure (2) above (Michalowski, 1990; Trovato, 1985).

3.2.1 Cause of Death “Undetermined”

Another important issue concerns the treatment of cases for which the cause of death was declared on the official records as “undetermined.” This is an official category in the International Classification of Diseases (ICD-9), coded as E980-E989. The suspicion is that “undetermined” deaths, officially defined as *“injury undetermined, whether accidentally or purposely inflicted,”* likely comprise “disguised” suicides for which there is insufficient information to warrant an official pronouncement of self-inflicted mortality. For the coroner or attending medical examiner, the circumstances surrounding such deaths are of such an ambiguous nature as to render them “undetermined.” According to a number of analysts, such cases are thought to be unconfirmed suicides (Ohberg and Lonnqvist, 1998; Holding and Barraclough, 1978; Wasserman and Varnik, 1998), and were therefore included with reported suicides in this study.

4.0 DESCRIPTIVE OVERVIEW

4.1 Demographic and Socioeconomic Composition of Immigrant Groups

Table 1 displays basic demographic and socioeconomic information for the 20 nationalities in this study, as reported in the 1991 census of Canada. The immigrant populations range from being small numerically to relatively large. For instance, the Japanese are a mere 19,925, and the Swedish total only 8,421. On the other hand, the Americans, United Kingdom immigrants, and the new wave immigrants from China,

Other Asia, Africa, South Central America/Mexico tend to be fairly large numerically. Among the Europeans, Italians comprise the most sizable group, followed by the Germans, the Polish and the Russians (i.e., current and former USSR). As can be seen from this table, the Canadian born population has the youngest age composition among the 20 groups, with 24 per cent of its members being below age 15. Among the immigrants, Other Asia and South Central American/Mexico possess the youngest age compositions, while those from Europe tend to show a greater proportion of their populations concentrated in the 65 and older category. By this measure, the oldest group is USSR migrants, and the youngest are those from South Central America/ Mexico (5.1%), Other Asia (5.5%), Africa (5.9%) and Portugal (7.5%). These differentials in age structure affirm the importance of taking into account age composition in any analysis of suicide discrepancies. These figures also indicate the considerable variance in age structures between new wave and old wave immigrants.

Another indicator of demographic structure is the sex ratio, defined as the number of males to females, multiplied by 100. A value above 100 indicates more men than women; and a value below 100 would reflect the opposite condition. Some nationalities have sex ratios below 100, the most extreme cases being the Japanese (73.68), USA (78.04), United Kingdom (84.93), and South-Central America/Caribbean/Mexico (85.95). Greek, Italians, Hungarians, Czechoslovakians and Africans, all have ratios above 100; that of Canadian born is 96.5. Though fertility plays a role in the determination of sex ratios, the observed variations are largely the result of group differences in sex selective migration (i.e., differences in numbers coming into the country and those leaving), and sex selective mortality, in combination.

The proportion married in a given population is another important demographic index of particular relevance. As shown in Table 1, the prevalence of marriage across nationality groups is far from uniform: The percent married ranges from a low of 59 or 60 for the Japanese and Canadian born, to a high of 83 and 80 among the Italians and the Greeks. To some extent, these reflect group differences in migration experience. For instance, the Italians typically moved to Canada as families, as did the Greeks. The relatively low proportions for some new wave immigrant groups may reflect a greater tendency or preference for individual based migration rather than family grounded moves. Another likely source of variation may have to do with cultural differences in the desirability of marriage, as well as discrepancies in the availability of potential spouses of the same nationality. The relatively low prevalence of marriage in the Canadian born population (only 60 per cent married) however, has little to do with immigration processes, and more with the desirability and availability of marriage.

If we apply the overall national average income of \$46,343 as the standard, ten of the 20 groups' average incomes are below this benchmark; these include the Canadian born (\$45,875), the Southern Europeans (Greeks, Italians, Portuguese), the Hungarians, the Polish, those born in the USSR, the new wave migrants (less Africans), and the residual "Other countries." The high-income groups are the Americans (\$51,800) the Scandinavians (Sweden, \$51,280, Other Scandinavians, \$51,272) and the Africans (\$49,021). Immigrants from China and South Central America/Caribbean/Mexico share the lowest income ranks (\$38,186 and 40,102, respectively). As can be seen in Table 1, there are also notable differences in education across groups.

Table 1: Demographic indicators for the Canadian born population and 19 immigrant groups; 1991 census of Canada

Nationality	Total Population		Population Distribution %			Sex Ratio: (m/f) x 100	% Married	Average Family Income	Education: Average Years of Schooling
	Males	Females	<15	15-64	65+				
Canadian Born	11,175,157	11,417,108	24.2	66.1	9.7	96.5	59.8	\$45,875.26	11.20
USA	129,127	163,927	9.3	70.1	20.5	78.04	63.5	51,800.40	13.23
EW Germany	97,489	103,068	4.2	78.4	17.3	93.20	71.7	49,527.91	12.64
Ireland Rep.	14,193	15,455	5.5	75.4	19.2	90.32	69.0	50,447.16	12.66
UK/Scotland/NIr.	348,072	404,321	2.4	68.7	28.8	84.93	68.1	49,989.18	12.68
Greece	44,804	41,908	1.6	86.6	12.3	105.71	80.4	41,422.54	9.59
Italy	192,276	171,151	0.5	80.7	18.7	111.11	83.2	48,383.86	9.37
Portugal	84,600	83,130	5.3	87.1	7.5	100.60	77.2	44,979.16	7.68
Hungary	30,872	27,714	1.8	66.7	31.5	109.97	69.6	42,039.89	11.82
Poland	95,701	96,676	7.8	60.3	31.8	97.94	68.9	42,507.47	11.06
USSR	49,074	54,041	1.7	37.8	60.6	88.89	65.5	46,067.39	10.77
Czechoslovakia	23,199	20,835	4.5	69.3	26.2	109.57	68.4	46,261.59	12.48
Sweden	3,847	4,599	3.5	68.1	28.4	82.63	66.1	51,280.11	12.31
Other Scandinavia	24,588	24,017	1.3	66.0	32.7	101.25	70.4	51,272.19	12.31
China	83,426	88,655	2.6	76.1	21.3	92.99	73.6	38,186.93	10.28
Japan	8,618	11,487	8.2	82.0	9.7	73.68	59.1	46,149.19	11.92
Other Asia	499,105	49,8249	10.6	83.9	5.5	98.80	62.0	42,785.42	11.71
Africa	103,636	87,186	8.7	85.4	5.9	117.24	62.0	49,021.68	13.48
SCAmerica/Carib/Mexico	235,286	269,582	10.3	84.6	5.1	85.98	56.4	40,102.94	11.83
Others Countries	242,163	228,506	3.9	78.3	17.8	104.80	73.4	42,105.69	11.85
Totals	13,485,233	13,811,625	21.1	68.0	10.9	95.68	61.4	\$46,343.54	11.66

Note: In this and subsequent tables, the following abbreviations are used: EW Germany = East and West Germany combined; UK/Scotland/NIr. = England, Wales, Scotland and Northern Ireland; SCAmerica/Carib/Mexico = South and Central America, the Caribbean, and Mexico combined.

4.2 Crude Death Rates

Table 2a displays sex-specific crude and directly age-standardized death rates for the total population of Canada and 20 nationality groups. Unadjusted and adjusted crude death rates are given. The unadjusted rates were computed prior to apportioning the “unknown” country of birth cases, as described earlier. As can be seen from the results, the differences between the two sets of crude death rates are not large. This is to be expected, given the relatively small proportion of “unknowns.” The first point worth noting about Table 2 is the wide variations in crude death rates across the 20 groups. Some immigrant categories have unusually high, while others have exceptionally low crude death rates. In the former category are the immigrants from the Irish Republic, the former USSR, Sweden, Other Scandinavia, and Hungary. Overall adjusted CDRs for these groups range from a high of 39.97 per 1000 population (Republic of Ireland), to 20.36 (Hungary).

The Canadian born crude death rates fare quite favourably in comparison to most of the immigrant groups in this analysis, with an overall Crude rate of 6.54 per 1000. Some of the lowest crude rates are found among the more recent immigrants: i.e., China, Other Asia, Africa, South Central America/Caribbean/Mexico. Among the Old Wave immigrant groups (i.e., those from traditional sending areas), the Greeks, the Italians and the Portuguese share overall crude death rates between four and nine per thousand. It is instructive to examine the adjusted crude death rates for the Old and New Wave immigrants. Old Wave consists of USA, EW Germany, Irish Republic, England-Wales/Scotland/Northern Ireland, Greece, Italy, Portugal, Hungary, Poland, Former USSR, Former Czechoslovakia, Sweden, Other Scandinavia, Japan, and Other Countries.

The New Wave immigrant class is comprised of China, Other Asia, Africa, South Central America/Caribbean/Mexico. On the whole, the foreign born population shows a greater overall crude death rate than the Canadian born population. The Old Wave immigrants have almost twice the crude rate as those of Canadian born. And according to the information below, New Wave immigrants enjoy a very favourable mortality situation.

	Old Wave	New Wave	Total Foreign Born
Males	15.75	2.34	10.35
Females	14.75	1.95	9.64
Total	15.24	2.14	9.99

Of course, all of these crude death rates are incomplete accounts of mortality levels and differentials. Crude death rates are insensitive to group differences in age composition. Given the nature of immigration, and the very different age-sex structures of the immigrant groups, a more appropriate measure of mortality level is the directly age-standardized death rate. Before examining directly standardized death rates, a closer look at the population and death distributions of Canadian born, the Old and the New Wave immigrants is in order.

Table 2a: Unadjusted and adjusted crude and directly age-standardized death rates (per 1000); 20 nationality groups; Canada 1991

Nationality	Adjusted CDR			Unadjusted CDR			Standardized Death Rate		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Canadian Born	7.25	5.84	6.54	6.84	5.51	6.17	9.70	5.97	7.84
USA	16.42	16.54	16.48	15.95	16.04	16.00	8.95	5.88	7.41
EW Germany	10.51	8.55	9.50	10.19	8.28	9.21	7.29	4.80	6.04
Irish Rep.	39.41	38.97	39.18	38.23	37.74	37.98	24.63	18.01	21.32
EW/Scot./NIr.	19.09	20.43	19.81	18.54	19.82	19.23	7.91	5.57	6.74
Greece	7.01	5.59	6.32	6.61	5.27	5.96	5.82	3.32	4.57
Italy	10.78	8.07	9.50	10.19	7.62	8.89	6.79	4.08	5.43
Portugal	5.38	3.75	4.57	5.12	3.56	4.35	7.67	4.40	6.04
Hungary	21.73	18.82	20.36	20.87	18.09	19.56	8.67	5.32	7.01
Poland	19.40	14.64	17.01	18.66	14.07	16.35	7.68	4.74	6.21
Former USSR	42.76	35.35	38.88	41.36	34.21	37.61	8.14	5.23	6.68
Czechoslovakia	18.26	15.50	16.96	17.59	14.89	16.31	8.01	5.86	6.94
Sweden	39.77	23.99	31.18	38.82	23.48	30.47	9.01	5.48	7.25
Other Scandinavia	29.04	20.72	24.93	28.33	20.15	24.29	8.62	5.41	7.02
China	9.91	8.56	9.21	9.08	8.18	8.62	6.27	3.97	5.12
Japan	7.00	6.99	7.00	6.77	6.79	6.78	4.98	3.54	4.26
Other Asia	1.69	1.29	1.49	1.57	1.20	1.38	3.36	2.32	2.84
Africa	1.89	0.83	1.85	1.74	1.67	1.71	3.80	2.79	3.29
SCAm./Carib/Mex	1.08	9.06	0.95	0.88	0.68	0.78	2.12	1.29	1.71
Other Countries	10.85	9.06	9.98	10.43	8.71	9.59	7.12	4.54	5.83
Total	7.78	6.50	7.13	7.37	6.17	6.76	7.83	5.13	6.48

Notes: The standard population is the Canadian population for 1991. Calculations based on death and population counts including ages 0 and above.

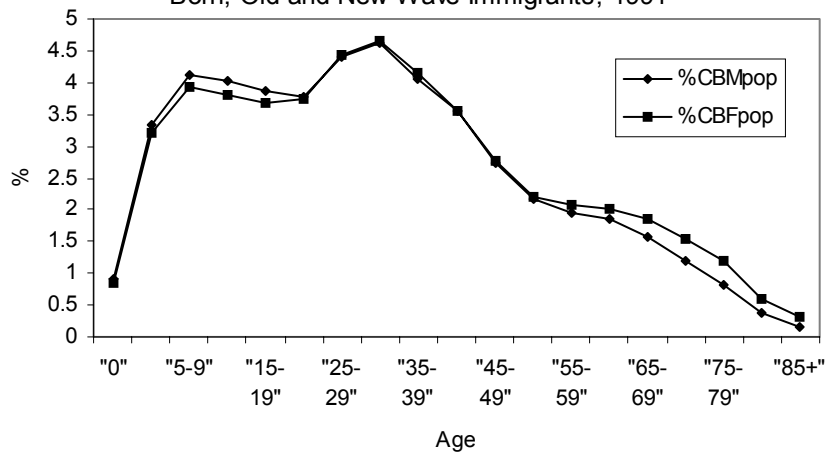
The unadjusted crude death rates are based on deaths before apportionment of the “country of birth unknown/unavailable” cases (see text).

4.2.1 Age Distribution by Broad Nativity Class

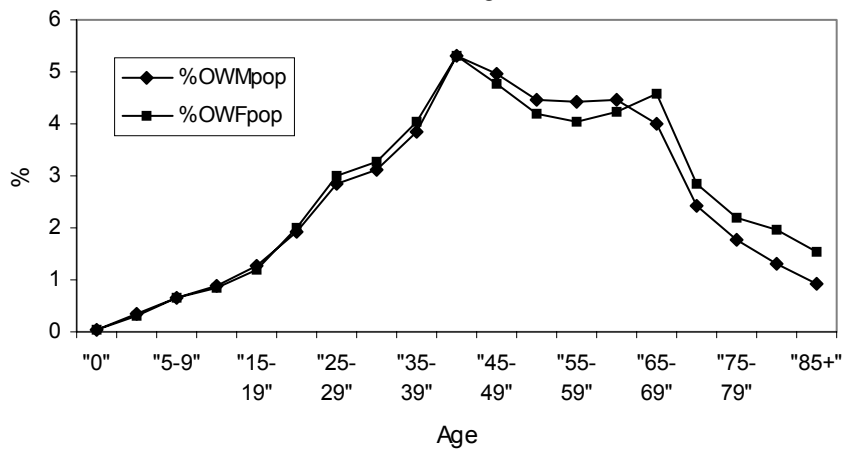
Figure 2 shows the population distributions of the Canadian born, the Old Wave and New Wave migrants in Canada, respectively, based on 1991 census information. The Canadian born distribution is much more consistent with expectation from the point of view of a national population. That is, the age structure is reflects a more balanced

distribution of men and women, with the vast majority of the population in the prime youth and working ages. On the other hand, the situation for the Old Wave immigrants is more reflective of a grossly distorted age composition, with a rather top-heavy structure (i.e., proportionately more in the ages above 65. Interestingly, the New Wave distribution is the most unusual of the three: there are proportionately few men and women in the very young and the very old age groupings; this is a population that is heavy represented in the prime working ages.

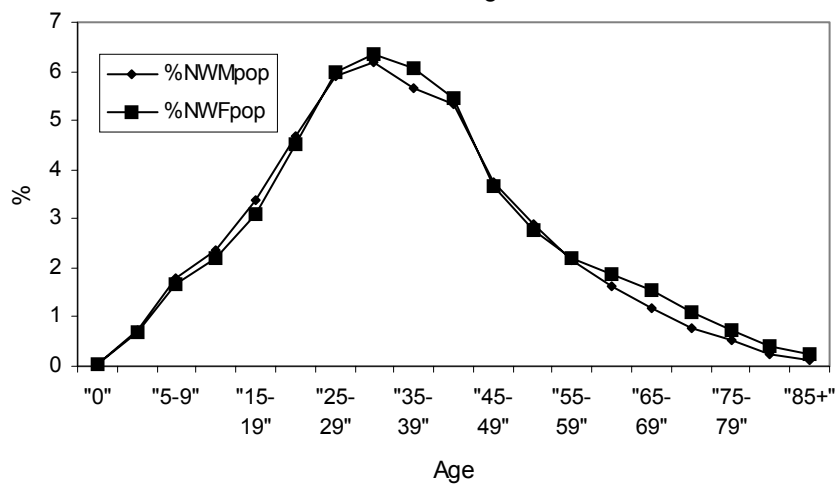
Figure 2: Percentage Population Distribution: Canadian Born, Old and New Wave Immigrants, 1991



Old Wave Immigrants



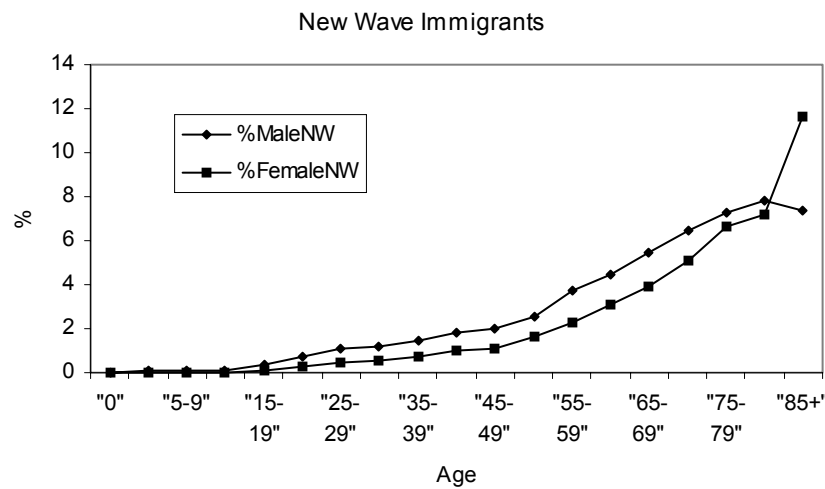
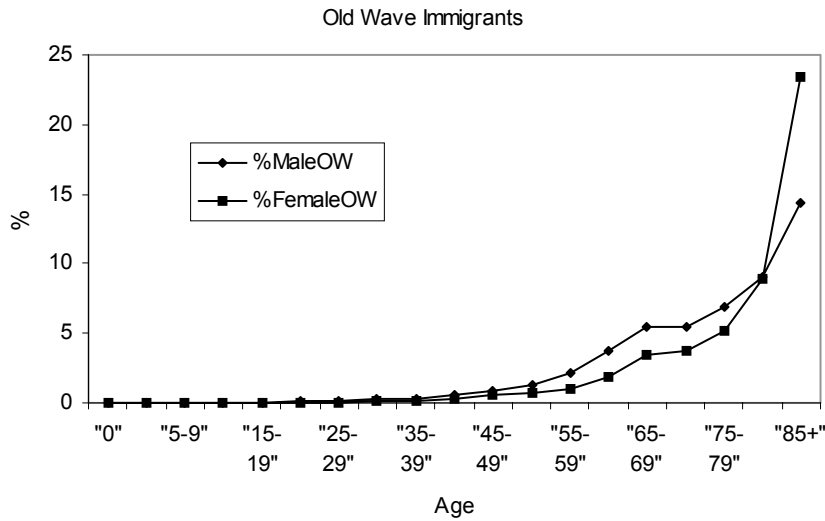
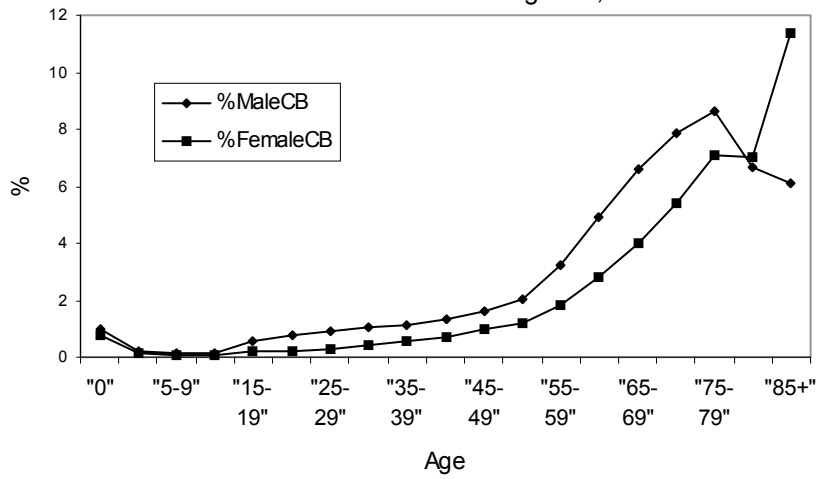
New Wave Immigrants



4.2.2 Death Distribution by Broad Nativity Class

As expected, the death distributions are also quite different. Figure 3 demonstrate that among the Canadian born, the distribution is more akin that of a national population. For instance, one can see the infant mortality effect, and the declines in deaths thereafter until the age of 20 or so, where the numbers start to pick up and accelerate with advancing age. On the other hand, the immigrant patterns are more heavily concentrated in the adult and older ages. This is a function, of course, of the population distributions examined above, as the number of deaths by age, are to a large extent, a function of age composition.

Figure 3: Percentage Distribution of Deaths: Canadian Born, Old Wave and New Wave Immigrants, 1991



4.3 Standardized Death Rates

In Table 2a, once age compositional discrepancies across groups are removed through direct standardization, the resultant death rates for the 20 nationality groups are greatly reduced. The standardization formula used in these calculations takes on the following form:

$$DR_i = \sum_j (M_{ij} \cdot P_j^S) / \sum_j P_j^S$$

Where, DR_i is the directly standardized death rate for immigrant group i . The term $\sum_j (M_{ij} \cdot P_j^S)$ is the sum of the product of age-specific death rates (M_{ij}) for a given group i , multiplied by the corresponding population counts within age class j in the standard population (in this case the total Canadian population). The denominator $\sum_j P_j^S$ is the sum of age-specific population counts in the standard population.

Directly standardized death rates can be interpreted as the expected overall death rate for group i , if it were to experience the age structure of the standard population. Since all study groups (i.e., immigrants) are subjected to the same standard, directly standardized death rates can be compared across groups. In general, the more distorted a group's age-sex composition, the more unusual will be its crude death rate; and therefore, the effect of standardization in such cases will be quite dramatic. Note, in this connection, that for the Canadian born, the standardized rates are not radically different from their corresponding crude death rates. It is also worth noting that for New Wave immigrants their standardized rates tend to be larger than their crude death rates. This is a function of their disproportionate concentration of their population in the prime working ages (i.e., relatively young ages). On the whole, the standardized death rates show less variability

in mortality conditions across groups than was the case for the crude death rates. Nevertheless, New Wave immigrants continue to exhibit very low death levels; and in comparison to the Canadian born, all the immigrant groups (with the exception of the Irish Republic) show lower overall standardized death rates.

Standardization reduced the overall death rate of the Irish Republic immigrants from a crude death rate of 39.18, to 21.23. Although diminished, this is still a very high rate. This level of mortality can be found in some developing countries today, though it should be mentioned that other scholars have also noted a high mortality rate for this group. For example, Rafferty, Jones and Rosato (1990), report that in England and Wales, Irish immigrants had an excess level of mortality in comparison to the host population.

A number of possibilities were considered with respect to the unexpectedly high death rates of the Irish Republic immigrants. Appendix B gives a detailed explanation of the issue and the possible solutions considered. Subsequent to detailed analysis, it was concluded that while the census population figures (i.e., denominators) for this immigrant class are generally sound, there is less confidence in the accuracy of the reported deaths. A hypothesis considered seriously is that many Northern Irish immigrant decedents were included with the Republic of Ireland cases, thus inflating the latter's mortality rate. Unfortunately, due to the nature of the data, no adjustment was possible for this likely source of error. Therefore, it was decided to include the Irish Republic nationality in this study, but only as a way of better monitoring the influential role of this group on mortality. As explained in Appendix B, collapsing this group with the England-Wales/Scotland/Northern Ireland category was not feasible, nor was it feasible to group the Irish Republic with "Other Countries. " Both options served to raise the mortality

levels of these immigrant classes from below to substantially above average. Given the large effect of the Irish Republic immigrants on any regrouping of nationality categories, it was deemed prudent to leave it in the analysis as a distinct category, and to interpret its corresponding mortality rates with caution.

4.4 Standardized Cause-Specific Mortality Ratios

An efficient way to examine group-specific mortality rates when the mortality data are sparse---as in the current case--- is to apply the method of indirect standardization. Indirect standardization involves the application of a standard population's age-cause-specific death rates to the age-specific population distribution of a study group. In the present application, the Canadian born population is used as the standard to derive group-specific standardized mortality ratios (SMR_S) of the type:

$$SMR_X = \sum d_X / \sum_i r_{iX} \cdot p_i$$

Where, SMR_X is the standardized mortality ratio for cause X for a given study group, and $\sum d_X$ corresponds to the study group's observed number of deaths for cause X. r_{iX} is the age-specific death rate for cause X of the standard population; p_i is the study group's corresponding age-specific population. As can be seen here, the SMR is a ratio of observed deaths for a given study group divided by the sum of age-specific expected deaths. The meaning of "expected" in this case is: the number of deaths that would occur in the study group if it had the same age-specific death rates as those of the standard population. A ratio above unity indicates the study group possesses a higher level of mortality than the standard, whereas SMR below one would imply lower mortality than

the standard. A value of unity would mean no difference in death rates between the population being examined and the standard.

Table 2b shows overall cause-specific SMRs for immigrants and countries of origin. It should be noted that these figures represent average SMRs based on group/country-specific SMRs for each particular cause of death. Appendix C contains graphs of cause-specific SMRs by group/country, sex and cause of death. For some of the immigrant categories it was not possible to obtain corresponding mortality data for the home country. This is most clearly evident for the Africans, Other Asians, and Other Countries, as these immigrant classifications contain too many nationalities to allow for easily identifiable countries of origin. For instance, in the case of African immigrants, one would have to derive a composite mortality schedule for all the countries in Africa. As it turns out, not only is this a daunting task, but the data are simply unavailable. For the Other Scandinavia immigrants the task was manageable, as it required the compilation of age-sex specific mortality schedules by cause of death for Denmark, Finland, Norway and Iceland. These data were easily accessible from the World Health Statistics Annual tabulations (1998 and 1995).

Given the large number of nations involved in the category of “South Central America/Caribbean/Mexico” immigrants, it was decided to compile a composite schedule of age-sex-cause specific mortality rates to represent the country of origin for this immigrant class. Thus, Argentina, Colombia, Mexico and Puerto Rico formed the representative mortality rates. Though imperfect, these four nations are thought to provide a reasonable representation of mortality conditions in South Central America/Caribbean/Mexico. It would have been desirable to combine all South

American countries with those in the Central part of the continent and the Caribbean. Unfortunately, the World Health Organization does not publish mortality data for all countries in South America and the Caribbean. The death rates for the countries of origin are for the periods around 1991, and 1986 in some cases. For the purposes of computing SMRs, the data were arranged in accordance with the following age grouping: 0, 1-4, 5-14, 15-25, 25-34, 35-44, 45-54, 55-64, 65-74, 75+.

Table 2b: Cause-specific indirectly standardized mortality ratios (SMRS) for immigrants and their countries of origin, where applicable (Canadian born population as standard)

Cause of Death	Immigrants		Countries of Origin		Difference: Immigrants- Origin		Correlation: Immigrant SMR with Origin SMR	
	Male	Female	Male	Female	Male	Female	Male	Female
Overall Mortality	0.808	0.893	1.082	0.951	-.274	-.058	-.173	-.283
IHD	0.781	0.895	0.809	0.769	-.028	.126	.367	.261
OHD	0.879	0.945	1.822	1.839	-.943	-.894	-.486*	-.521*
Stomach Cancer	1.460	1.317	1.904	1.865	-.444	-.548	.293	.608*
Lung Cancer	0.645	0.534	1.070	0.702	-.425	-.159	.191	.384
Other Cancers	0.786	0.804	0.974	1.013	-.188	-.199	.425*	.409*
Diabetes	0.733	1.010	1.036	1.306	-.303	-.296	-.070	.037
Cirrhosis of Liver	0.780	0.797	1.829	1.323	-1.046	-.526	-.104	.038
Cerebrovascular	0.996	1.026	1.876	1.411	-.880	-.385	-.334	-.487*
MVA	0.672	0.803	1.552	1.721	-.880	-.918	-.176	.289
Accidental Falls	1.179	1.901	0.956	0.733	.223	1.168	-.244	-.417
Suicide	0.734	1.020	1.035	1.466	-.301	-.446	.925*	.733*
Suicide+Undetermined	0.735	1.029	1.069	1.412	-.334	-.383	.910*	.711*
Homicide	0.930	1.166	0.677	0.244	.253	.922	-.215	.055
Other Accs./Violence	0.749	0.934	1.782	1.238	-1.040	-.304	-.299	-.138
Residual	0.916	0.958	1.386	1.332	-.470	-.374	-.245	-.488*

Note: Republic of Ireland immigrants and corresponding country of origin population are excluded from these computations. Data for countries of origin is for 1991 or as close as possible to that year (World Health Organization Statistics Annuals).

Judging from the magnitude of SMRs in Table 2b, immigrants tend to reflect a better mortality condition as compared to the Canadian born population. The migrant mortality ratios also tend to be lower than those of their countries of origin. Thus, not only do immigrants in general enjoy a lower mortality level from total and cause-specific mortality as compared to the Canadian born, but they also share a more favourable situation in relation to their home countries.

However, some exceptions to these generalizations are evident in Table 2b, particularly in connection with stomach cancer among both male and female migrants (SMRs greater than unity) and deaths associated with accidental falls. It is also noted that for immigrant females, diabetes, cerebrovascular, homicide and suicide SMRs are above unity, which means the immigrant women have higher death rates from these conditions than do native born females. But with the exception of accidental falls and to a lesser extent homicide, the excess mortality for the immigrant females is slight.

Most country of origin SMRs are greater than one, indicating that overall, in relation to the Canadian born, the home countries of the immigrants in this analysis share higher mortality levels. This is not surprising given Canada's generally high standards of living and health care. Canada is a low mortality society.

It is also of interest to compare immigrant overall SMRS with those of the corresponding countries of origin. If we subtract immigrants' SMRs from those of their countries of origin, we gain a sense of the degree of mortality advantage of the immigrants in relation to their home based populations. With the exception of IHD among women, and accidental falls and homicide among both sexes, the immigrant show a more favourable mortality experience than their countries of origin (i.e. the majority of the differences are negative).

The last two columns of Table 2b display correlation coefficients between the SMRs of immigrants and the countries of origin. This information allows one to ascertain whether in general there is a direct correlation between cause-specific death rates in the home nation and cause-specific death rates among corresponding immigrants in Canada. Positive correlations are found for both sexes in connection with IHD, stomach cancer,

lung cancer, other cancers, and suicide. Positive correlations are noted for females only in the cases of diabetes, cirrhosis of the liver, motor vehicle fatalities, and homicide. All other correlations in the table are negative.

The positive cause-specific correlations indicate that immigrants from countries where mortality is relatively high will also tend to experience relatively high cause-specific mortality in Canada. In other words, it seems that for certain diseases/conditions, there is a carryover effect in that immigrant rates and home based rates are connected in such a manner that those migrants from high mortality countries will reflect relatively high mortality from those same cause/conditions.

Inverse associations are noted in Table 2b in connection with OHD, cerebrovascular complications, accidental falls, other accidents/violence, and residual causes. These results suggest that immigrants from high mortality areas of the world will tend to experience in their new land reduced chances of death from such causes, as compared to their home populations. Judging from the number of negative correlations, the immigrant men are more advantaged in this way than are the immigrant women, suggesting perhaps a greater degree of health selectivity among male migrants.

Finally, it is important to note that, as indicated by the inverse correlation for total mortality (all causes combined) for both sexes, on the whole, the correlation between home based overall mortality with that of the immigrants is such that the higher the overall mortality of the country of origin, the lower the overall relative risk of mortality of the immigrants residing in Canada. This suggests a number of possibilities. On the one hand it may indicate immigrants are selected for good health, and therefore enjoy a more favourable mortality situation than both origin and host nations. On the other hand,

it may suggest that migration has a generally beneficial effect on the health of migrants and hence helps to reduce mortality overall. At this point in the analysis it is not possible to disentangle these two sources of mortality variation.

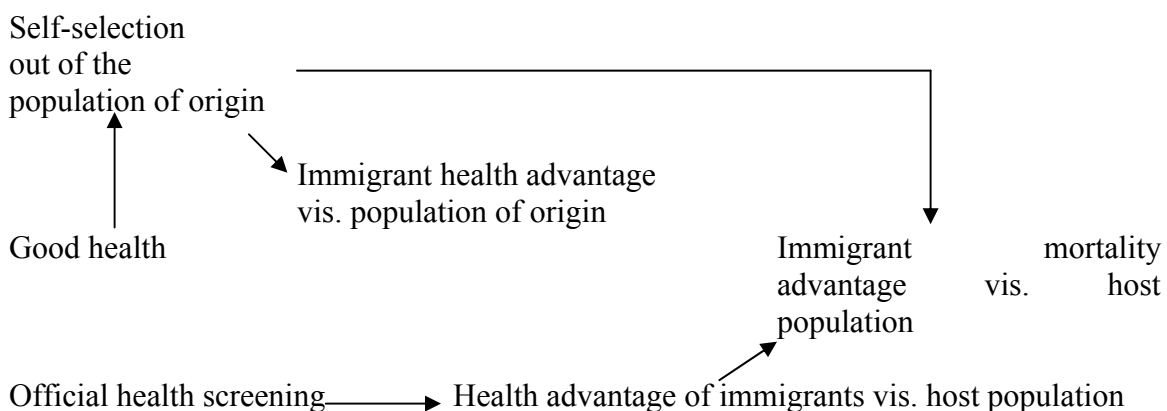
4.5 Health Selection Effects

4.5.1 The Concept of Selectivity

Selectivity is both a statistical and substantive concept. Statistically, it arises in cases when one observes a subset of the population possessing some property of interest, say health status. If that subset has a uniform distribution with respect to the property of interest, then there will be little, if any variation to observe. For example, if all immigrants are self-selected for good health, it will not be possible to examine this selective property among the immigrants due to lack of sufficient variation, in this case health status. The health selectivity thesis of immigrant mortality says that immigrants have below average mortality rates because only immigrants in good health migrate out of their national populations. Stated differently, the health selectivity explanation implies that individuals most likely to migrate are persons in good health, that is to say, healthy persons self-select themselves out of their populations of origin for the purposes of migration to another society (i.e. a receiving population). It is also a fact that in the modern context the process of gaining entry into a receiving society such as Canada involves official health screening. Prospective migrants found to be ill or carrying a communicable disease are not likely to be admitted into the new country. This furthers the selectivity of immigrants that do gain entry into their adopted country. These two processes in combination are thought to account in the post-War literature for a large part

of the often-noted mortality advantage of immigrants in host countries and also in relation to their populations of origin.

There is yet another possible source of health selectivity. It is generally known that some immigrants will return to their countries of origin after a short stay in a new country. Why such immigrants return is a matter of speculation. One possible explanation rests on the possibility that those who are least healthy and adaptable to the new environment will find it difficult to stay and will therefore opt for a return to the homeland. If return migrants consist predominantly of individuals who experience health difficulties, it follows that what remains in the new land will be a healthy subset of immigrants. Thus, return migration selectivity, though difficult, if not impossible to observe directly, must be acknowledged as an additional component of immigrant health selectivity in the study of migrant mortality (Weitoft et al., 1999). The following sketch shows the basic ideas behind the health selection thesis.



Direct information on health selectivity of immigrants is virtually impossible to obtain. To complicate matters, the data for the present study (i.e., official death records)

are devoid of information concerning the duration of residence in Canada of immigrant decedents. Knowledge of the duration of residence of immigrant decedents in Canada would allow for a more complete analysis of mortality differentials. For example, if one knew how long a given person had lived in Canada it would be possible to examine how migrant mortality rates converge, or fail to converge, across time with the death rates of the host population.

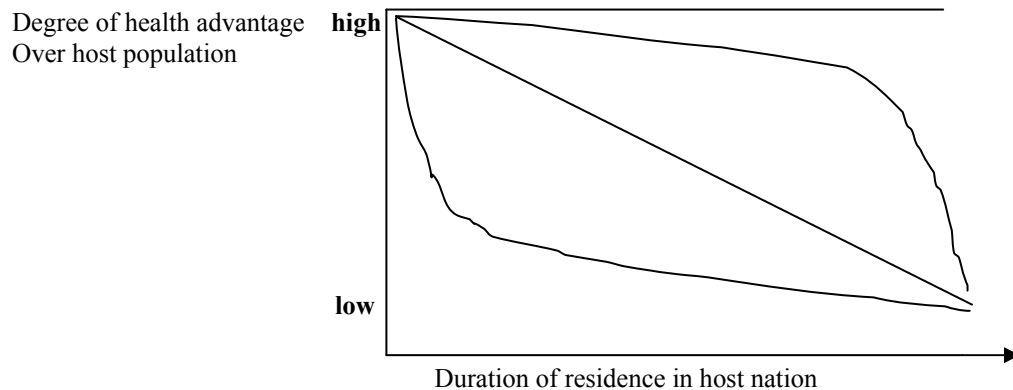
One may suppose that the intensity of selectivity for good health is not constant over time in the host nation. Indeed, studies have shown that there is a tendency for immigrants in host nations to gradually acculturate many of the life styles and ways of life of their adopted society. It may also be the case that as part of the acculturation process, any initial health advantage conferred by health selection would tend to erode with the increasing time in the new land. The effects of selectivity on health and mortality among immigrants may thus be conditional on the duration of residence in the new country. Advantage in health and mortality in relation to the host nation would be most intense during the initial early stages of the migration experience. Indeed, studies show that immigrants tend to demonstrate the largest health advantage in relation to the receiving population during the first ten years of relocation. After about 10 years, their health advantage reduces considerably, though it does not disappear (Ali, 2002; Perez, 2002). This suggests that selective effects on health and mortality are most intense early in the migration experience but wane with the passage of time in the new country. Thus, the immigrant health selection thesis posits that the more recent the period of immigration to Canada, the lower the death rate of immigrants. Conversely, the longer

the duration, the more similar the health and mortality profile of the immigrants and their host population.

This assumed mechanism in this thesis implies selectivity effects are most pronounced in the early years of relocation and become less intense with the passage of time. The erosion of the immigrant health advantage with increased duration of residence in the host nation reflects the multitude of forces acting on the immigrant experience, including: assimilation and acculturation of health habits, diets, behaviours and orientations that impinge on health.

It is also highly probable that notwithstanding a homogenizing tendency among all immigrants to gradually acculturate and assimilate the health and mortality profile of the host population, the migrants may nevertheless enjoy some degree of health advantage over their receiving population irrespective of duration of residence. That is, health selection may be enduring even though it may erode with the passage of time due to acculturation and assimilation processes. This aspect of the selectivity thesis implies that independent of duration of residence in the host nation immigrants would persist to enjoy a mortality advantage of some degree over their receiving population. Schematically, the selectivity thesis, as explained above, may be conceptualized as having at least four different functional forms as against duration of residence in the host country: a "constant" intensity form, whereby there is a uniform and constant health advantage over time; a concave functional form in which the immigrant health advantage gradually declines over time, but the decline intensifies after about 10 years duration in the adopted country; a convex form of the association suggests a rapidly declining health advantage in the early years after relocation, and a more gradual pace of decline thereafter; finally, a

linear inverse form would suggest a constant rate of decline with duration, starting immediately after settlement in the new land. These functional relationships are shown in the figure below.



We leave the question of which of these models accurately describes the situation in Canada for another study. The presentation here is primarily aimed at conceptual clarification of a concept that is difficult to operationalize and thus study empirically.

4.5.2 Indirect test for health selectivity: Immigrants in Canada

For the present purposes, one may gain a sense of possible selectivity effects on migrant death rates by examining the pattern of age-specific mortality rates of relatively recent and relatively established immigrant groups. Further, these immigrant classes could be compared to the host population to see if the differentials by age conform to the elemental postulates of the selectivity thesis. As done in an earlier part of this study, the immigrants were classified as New Wave and Old Wave, and their age-specific death rates were compared to each other and to the Canadian born. In accord with the preceding discussion, selectivity effects on mortality risk are presumed to be most intense among the more recent

immigrants, and less pronounced among the more established immigrants. Thus, given the three sub-groups' age-specific death rates (M_x) for men and women, respectively, for Canadian Born (CB), New Wave (NW), and Old Wave immigrants (OW), the following mortality differences can be computed:

$$M_{x\text{ NW}} - M_{x\text{ CB}} \quad (1)$$

$$M_{x\text{ OW}} - M_{x\text{ CB}} \quad (2)$$

$$M_{x\text{ NW}} - M_{x\text{ OW}} \quad (3)$$

The difference obtained with (1) may be viewed as representing a presumed maximum gap in age-specific death rates between recent immigrants and the host population. On the assumption that positive health selectivity is most intense in the early phases of the immigration experience, this can serve as an indirect measure of selectivity for good health, as would be reflected by the most recent arrivals to Canada, the New Wave immigrants. Equation (2) reflects the mortality differential between Old Wave immigrants and the Canadian Born population. In this case, the difference should be considerably narrower, as presumably, the established immigrants, having resided in Canada longer, would have progressed farther toward assimilating the health and mortality profile of the host population. Under this assumption, the migrants' mortality conditions should approximate closely the risk profile of the host population. Therefore, the mortality contrast between Old Wave and the Canadian born may be viewed as capturing an indirect measure of the eroding effects of the acculturation/assimilation process in reducing immigrants' initial selectivity for good health at the time of arrival to the new country.

Through Equation (3) we obtain a measure of the distance in age-specific mortality rates between relatively new and relatively established foreign born people. Based on the preceding set of assumptions, this differential can be assumed to mirror the effects of acculturation/assimilation on relative mortality risk of immigrants. Displayed graphically, the age schedules of mortality for the three sub-populations would be expected to follow a predictable gradient---that is, the gap in (1) would be largest and that in (2) narrowest, with that of (3) intermediate.

4.5.3 Age Pattern of Mortality

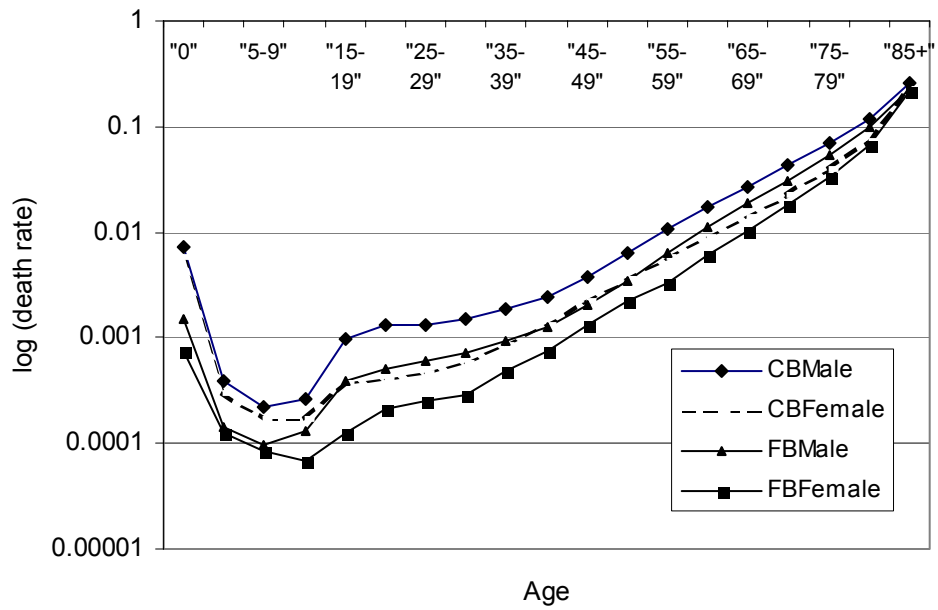
Figure 4 contains age-sex-specific death rates for the Canadian born and the total foreign born population. The pattern of death rates by age conforms to the general age schedule of mortality for human populations (Coale and Demeny, 1983): Death rates are high in infancy, decline thereafter until age 10 then rise predictably with youth and young adulthood, accelerating with the onset of middle age, reaching their apex at the advanced ages; typically, female death rates are lower than those of males. Figure 4 also includes ratios of age-sex specific death rates of the foreign born to the age-sex specific death rates of the Canadian born. Thus, in Figure 4 and subsequent graphs the differences in age-specific death rates between immigrants and the Canadian born are expressed as ratios, with the Canadian born as the denominators.

As shown in Figure 4, all age-specific ratios are below one, indicating that male and female immigrants enjoy clear mortality advantages across age as compared to their host counterparts. The advantage is most pronounced in infancy. Also evident is the fact that the ratios do not follow a linear pattern: With advancing age, the ratios tend approximate a value of unity (i.e. equality with the Canadian born); and seem to increase with greater intensity

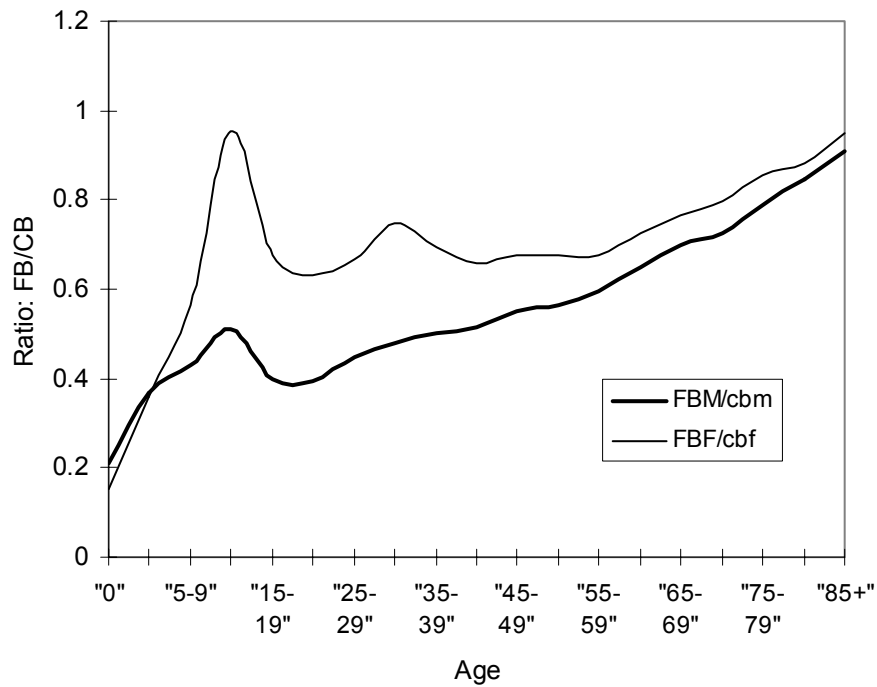
after about age 40. There is a noticeable peak for the immigrants (though more prominent for females) at ages 10-14, where the difference between the foreign born and the host population reaches a minimum (i.e. close to a value of 1.000). On the whole, however, the gap in mortality rates is evidently more pronounced in favour of immigrant men (with the exception of infancy), as their ratios are substantially lower than those of immigrant women.

In substantive terms, this means that the difference in death rates between immigrant women and Canadian born women is smaller than it is for immigrant men and Canadian born men. Thus, immigrant men enjoy a larger relative mortality advantage. Of course, this in no way negates the generally lower absolute age-specific death rates of females, irrespective of nativity---something clearly noted in the upper part of Figure 4.

Figure 4: Age Pattern of Mortality for the Canadian Born and the Foreign Born, 1991



Ratios of Age-Specific Death Rates: Foreign Born/Canadian Born



Selective effects on immigrant mortality should be most pronounced in the adult ages. This is assumed to be the case because self-selection involves a conscious decision making process on the part of the migrant. Adults make rational evaluations of perceived opportunities in their home country as compared to opportunities in the country of intended destination. Thus, if selectivity is a factor in health and mortality probabilities for immigrants, it should manifest itself to a greater extent among adults in the prime working ages. However, given the dual nature of selectivity, children are subject to one form of selectivity: the health screening process prior to admission to the new land. Presumably, unhealthy individuals with serious illnesses would not be allowed entry to a new country. Therefore, adult immigrants in the prime labour force years are presumed to experience two types of selection: self-selection for good health out of their population of origin, plus the selective effects of health screening. For children, only the latter type of selection seems applicable, as their migration is totally dependent on their parents.

The top panel of Figure 5 displays age-specific death rates for the Canadian born, New Wave and Old Wave immigrants during 1991, while the bottom part concerns itself with the ratio of age-specific death rates of immigrants to those of the Canadian born. Looking first at the age patterns of mortality, Canadian born men have the highest age-specific death rates, while New Wave females enjoy the most favourable age specific mortality. Old Wave males share death rates that are not too distant from the Canadian born men. Among the females, the Canadian born have higher mortality at each age. The evidence in the graph leads to the conclusion that Old Wave immigrants (presumed to have resided in Canada significantly longer than the New Wave), enjoy a much smaller mortality advantage in relation to the Canadian born than do the more recent New Wave immigrants. And as seen

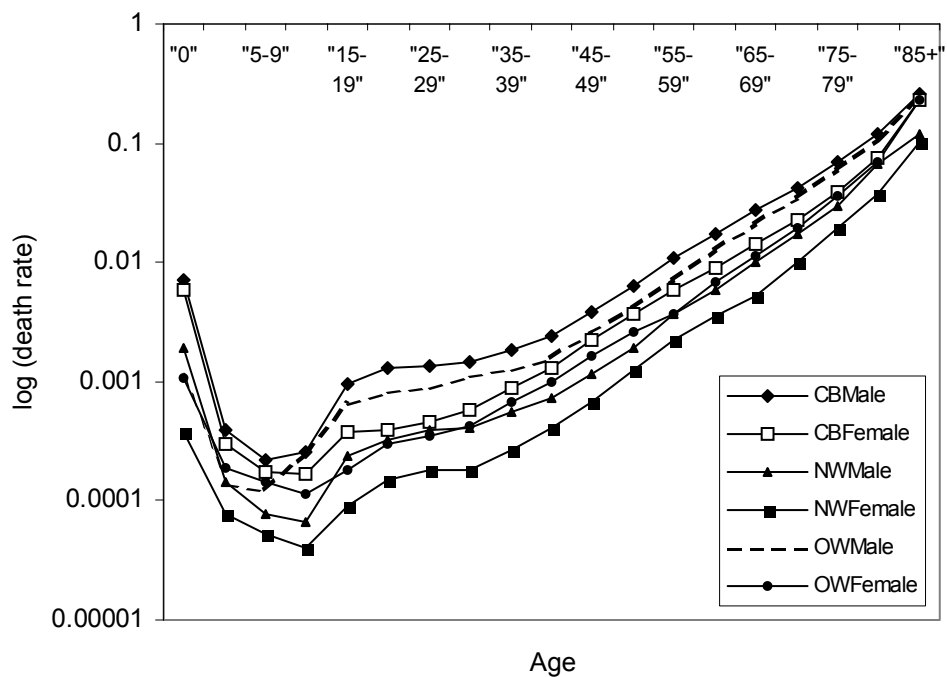
in the preceding analysis, the differences are larger for males than for females, suggesting that selectivity is more pronounced in men (Brahimi, 1980; Khlat, 1992; Courbage, and Khlat, 1995).

Clearly, this evidence for selective effects on immigrant mortality is indirect. However, the pattern of differences do conform to the postulated relationships specified earlier in connection with the selectivity hypothesis. Firstly, all age-specific death rates of the immigrants are lower than those of the Canadian born, providing support for the general proposition that there may be some general selective factor favouring the foreign born. Secondly, the rank order of distances in age-specific risk were such that the Old Wave immigrants are closest in death rates to the host, while those of the New Wave are the farthest from the Canadian born. Finally, the gap between Old and New Wave may be interpreted as representing an indirect representation of the overall effects of acculturation/assimilation on immigrant mortality probabilities. The postulated mechanism entails the importance of time spent in the new society and its strong correlation with migrants' propensity to adopt the health habits and life styles of their host society. The longer the duration of residence in the new country, the greater the tendency to approximate the health and mortality profile of the receiving society.

Another potential issue with this indirect method of detecting selectivity effects, has to do with the fact that the classification of "Old" and "New" waves to denote established versus more recent immigrants, is imperfect and therefore subject to some degree of error. A clear reflection of this problem is detected in the Old Wave age pattern of mortality. If one assumes these are immigrants of long-standing residence in Canada, there ought not to be any deaths in the ages below 15. In fact, we have seen in the preceding figures that this

immigrant category shows death rates at ages 0, 1-4, 5-9, and 10-14. What possible reason would there be for this anomaly? Most probably, this is due to the strong possibility that the Old Wave group, while largely comprised of Europeans immigrants from the pre- and post-WWII eras, may also contain some recent immigrants, most likely from Eastern Europe.

Figure 5a: Age Pattern of Mortality: Canadian Born, Old and New Wave Immigrants, 1991



Ratios of Age-Specific Death Rates: Immigrants/Canadian Born

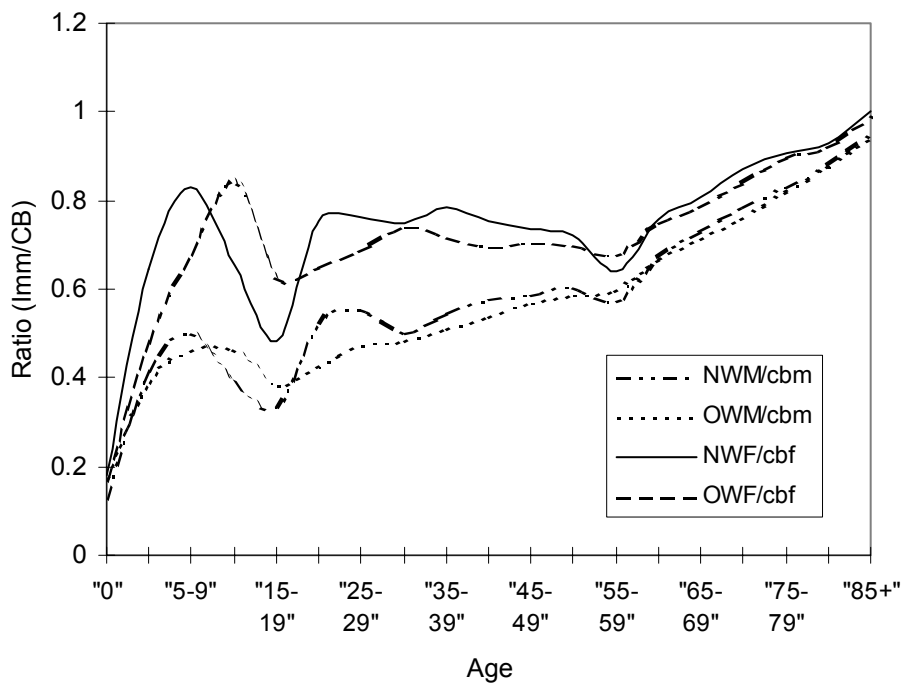
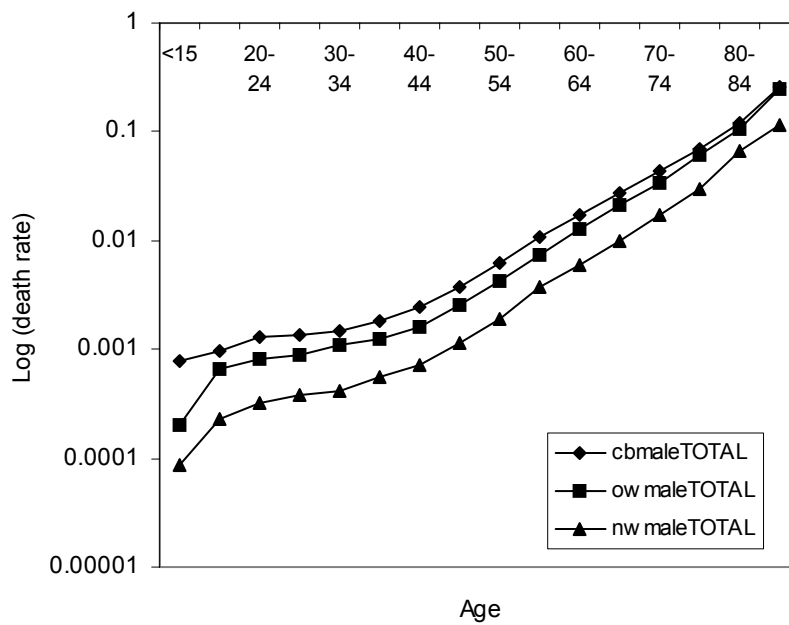


Figure 5b: Age Pattern of Male Overall Mortality: Canadian Born, Old and New Wave Immigrants (age regrouped)



Ratios of Male Age-Specific Death Rates from Total Mortality

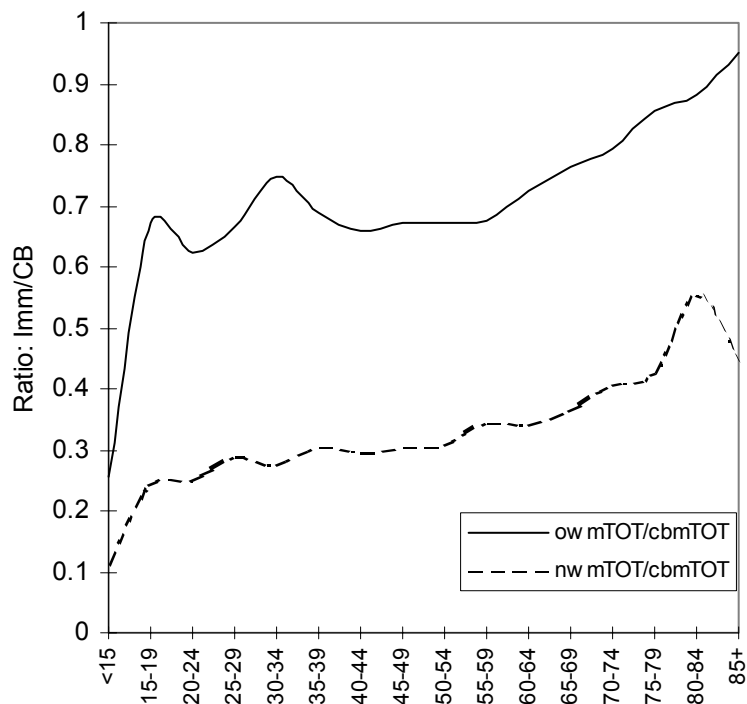
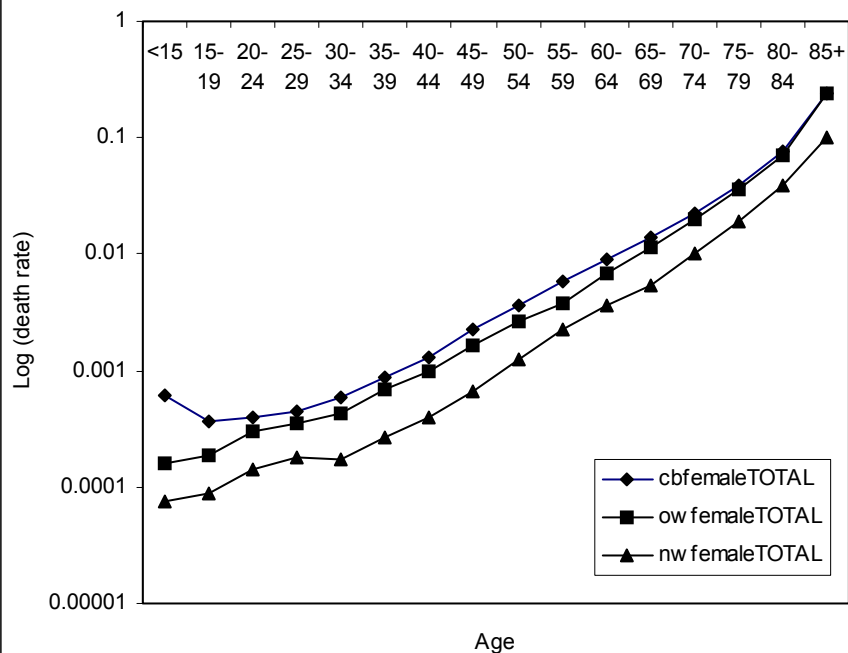
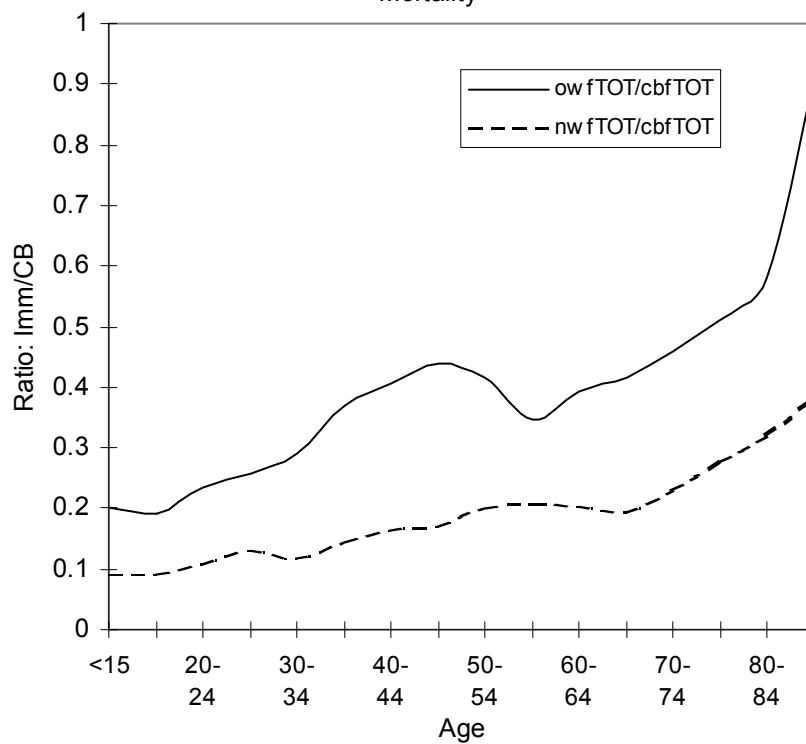


Figure 5c: Age Pattern of Female Overall Mortality:
Canadian Born, Old and New Wave Immigrants (age
regrouped)



Ratios of Female Age-Specific Death Rates From Overall
Mortality



4.5.4 Age-Specific Pattern of Mortality by Cause of Death

Chronic ailments, such as cancer, heart disease and diabetes, are partly determined by individual genetic/biological predispositions in conjunction with behavioural and environmental factors (Manton and Stallard, 1984a, 1984b; Ostefeld, 1967). On the other hand, external types of premature death, such as motor vehicle accidents, other accidents, homicide, and suicide, are more likely a function of the interaction of individual action and the social environment (Durkheim, 1951; Unnithan et al., 1994; Lester, 1992; Stack, 2000a, 2000b). For such causes, selectivity may play less of a role than the chronic/degenerative conditions in explaining the apparent mortality advantage of immigrants (Kaldor et al., 1990). These types of mortality are mostly dependent on immediate circumstances prevailing in the environment of action of the individual (e.g., work related hazards, inter and intra personal conflicts and troubles, etc.) For these reasons, one may surmise that migrant differences in age-specific death rates from major chronic conditions like cancer and heart disease will follow a similar pattern as noted in connection with overall mortality.

Figures 6a to 6h exhibit the male and female age patterns of cause specific mortality (i.e., heart disease, cancers, external causes, and “residual” causes) respectively for the Canadian born, Old Wave and New Wave immigrants. Corresponding age-specific mortality ratios (ratios of age-specific death rates, using the Canadian born rates as the denominators) are also included in these graphs. Note that for the purposes of this aspect of the analysis, ages below 15 have been collapsed under one age category: “under 15.”

With few exceptions, the age patterns of cause-specific mortality for immigrants generally conform to expectation. In general, the Canadian born show the highest death rates, and the New Wave migrants the lowest. The gaps in age-specific mortality differences are smallest between the Old Wave immigrants and the Canadian born. Recall

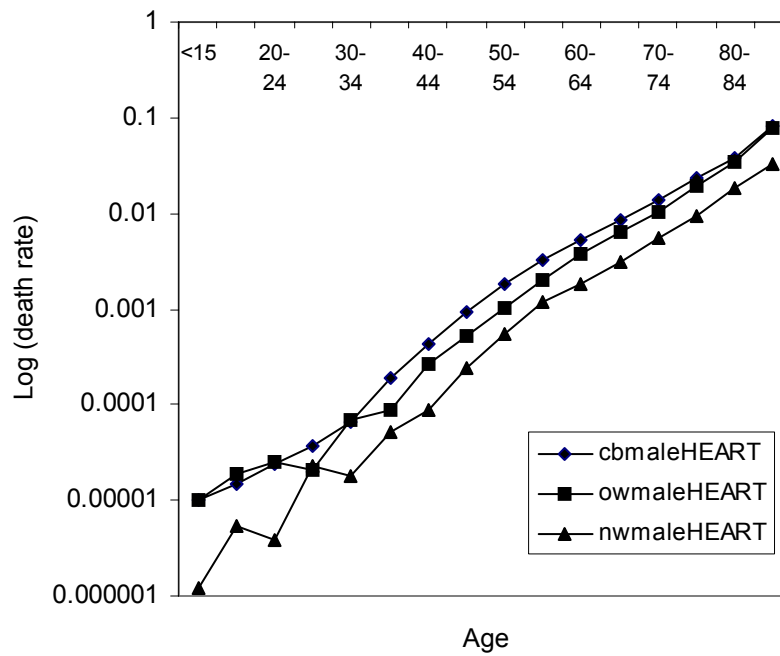
that this was also observed earlier in connection with overall mortality. The pattern of relative risk reflected in the ratio of death rates of the immigrants to those of the Canada born also reinforces the suggestion that there is a definite mortality advantage for the immigrants, though the benefit is significantly more pronounced among the New Wave foreign born. The male immigrant advantage in mortality risk, while not uniform over all age categories, is most evident in the cases of external and residual types of death, and after age 40, also in connection with heart disease and cancer.

The female age pattern of cause-specific mortality follows essentially the order of differences as their male counterparts. However, the relative risks tend to reflect an even more pronounced immigrant mortality advantage in relation to the Canadian born. For instance, in terms of heart disease mortality, the ratios in Figure 6b among women aged 30 to 64 are well below unity and give the appearance of being almost “flat” over this age range. But as also noted for males, there is a rising pattern of relative risks with increasing age, though the death rate ratios remain below unity until about age 85. In substantive terms this suggests that as female immigrants get older their risk of cause specific mortality rises and gradually approximates the risk levels of their Canadian born counterparts. However, this tendency is clearly more pronounced among the Old Wave female immigrants than among the New Wave females. The steepest rise over age in relative risk for female immigrants is in relation to external and “residual” types of mortality. In connection with cancer, after the age 40, their mortality ratios remain below unity, though for the Old Wave immigrant women there is a gradual rise in relative risk with advancing age. In the case of New Wave females their relative advantage in risk remains generally flat, at very low levels.

The information illustrated by these age patterns of cause-specific mortality helps to confirm the earlier observations regarding the variations in the age pattern of general mortality. Although some of the cause-specific evidence fails to conform totally with expectation inherent in the selectivity hypothesis as specified earlier, in virtually all cases the New Wave immigrants show a notably more advantaged mortality profile than either their Old Wave counterparts or their host population. On the other hand, while the Old Wave maintain some relative advantage in age-specific death risk, their mortality rates more closely approximate (and in some cases converge with) those of the Canadian born.

These patterns of differences in death risk suggest that the immigrant survival advantage is most pronounced during the early stages of immigrant settlement to the new country, and that with the passage of time in the new society, the advantage erodes gradually as immigrants experience varying degrees of acculturation, though never fully relinquishing their survival in relation to the Canadian born. Another important observation relates to the tendency for age-specific relative mortality risks to rise with advancing age, especially beyond about age 40. Given the imperfect correlation between age at death of immigrants and duration of residence in the host society, this suggests that immigrant mortality rates shift upwards towards the levels of the host society with increasing duration of residence. Finally, this analysis also suggests that the lower death rates of immigrants are partly determined by their selectivity---i.e. their self-selection from the population of origin on the one hand, health screening prior to gaining entry into Canada, and possibly, the additional effects of return migration by less healthy immigrants to their home countries.

Figure 6a: Age Pattern of Male Heart Disease
Mortality: Canadian Born, Old and New Wave Immigrants



Ratios of Male Age-Specific Death Rates from Heart
Disease

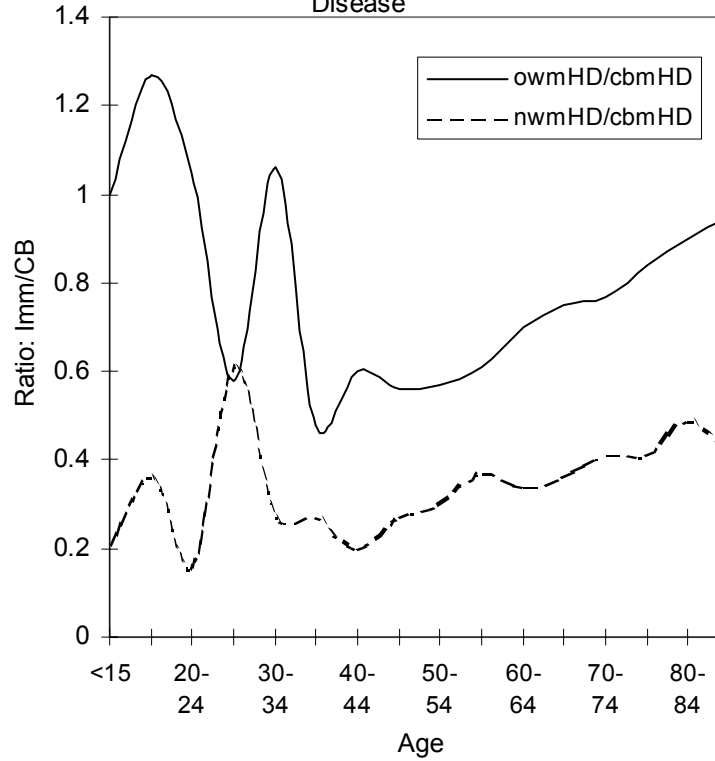
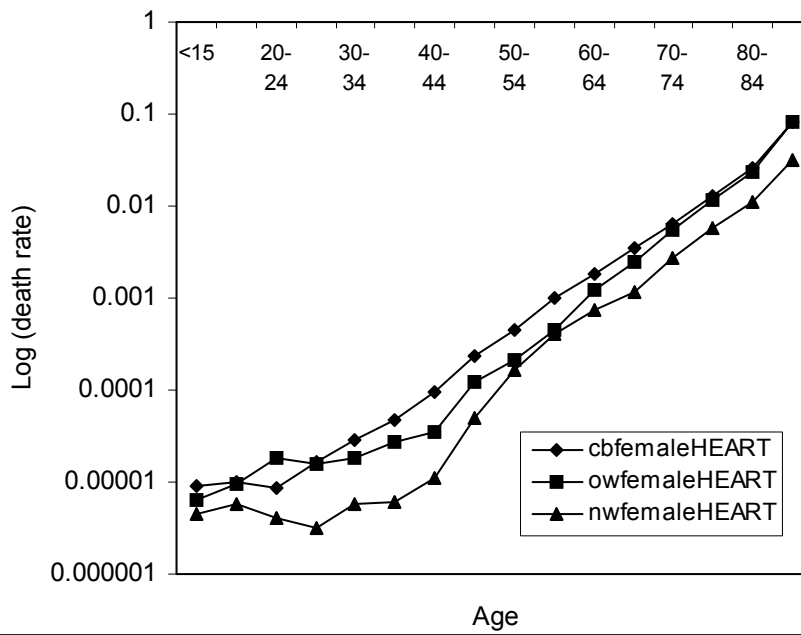


Figure 6b: Age Pattern of Female Heart Disease Mortality:
Canadian Born, Old and New Wave Immigrants



Ratios of Female Age-Specific Death Rates from Heart Disease

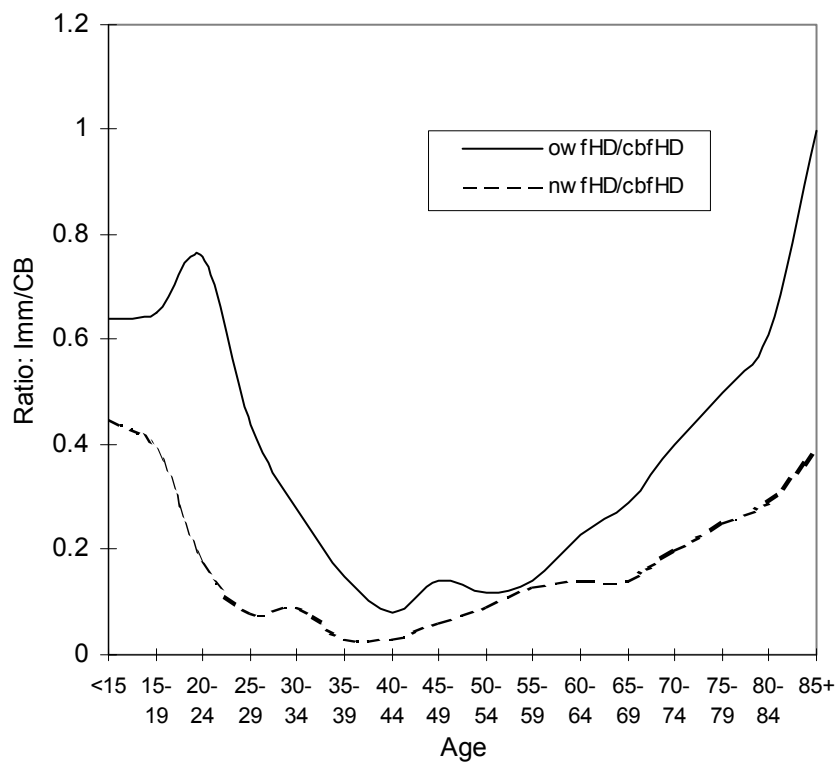
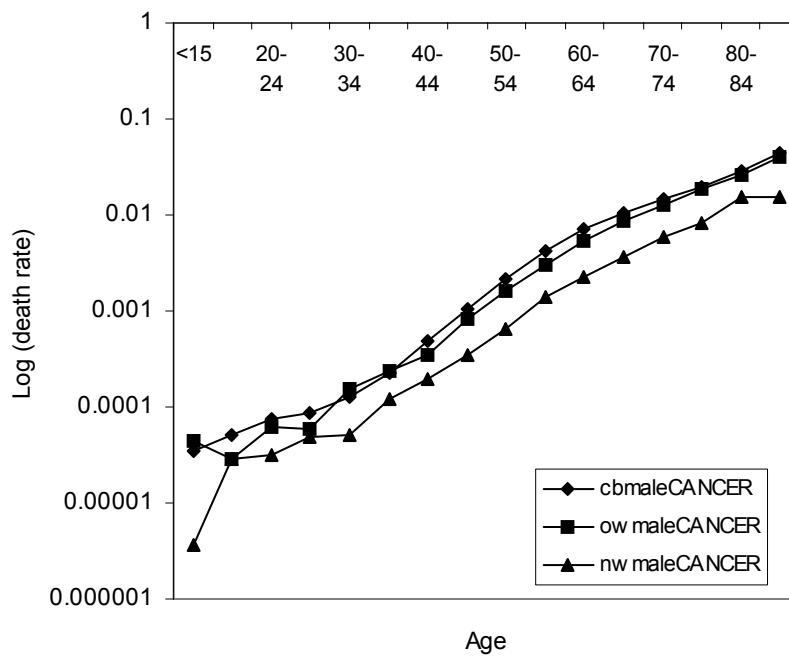
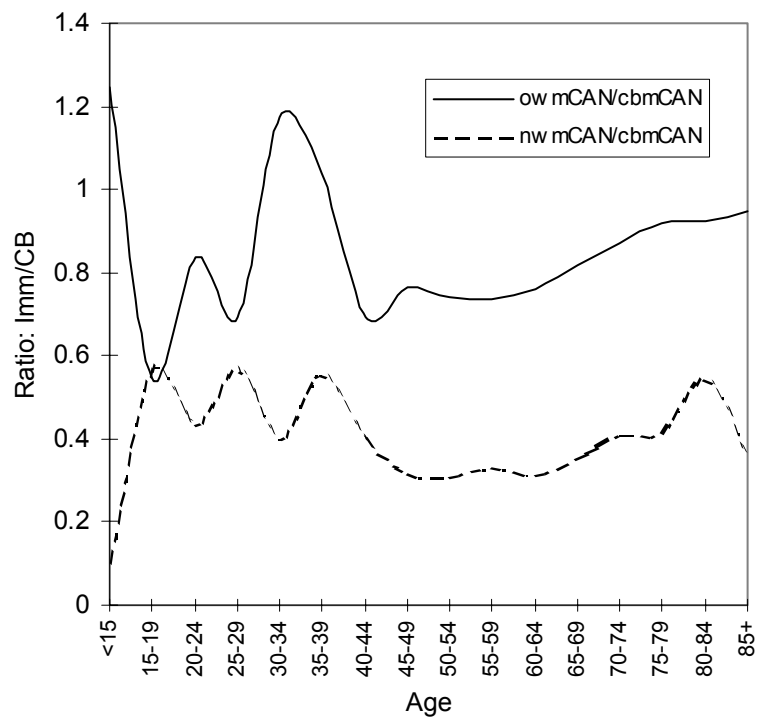


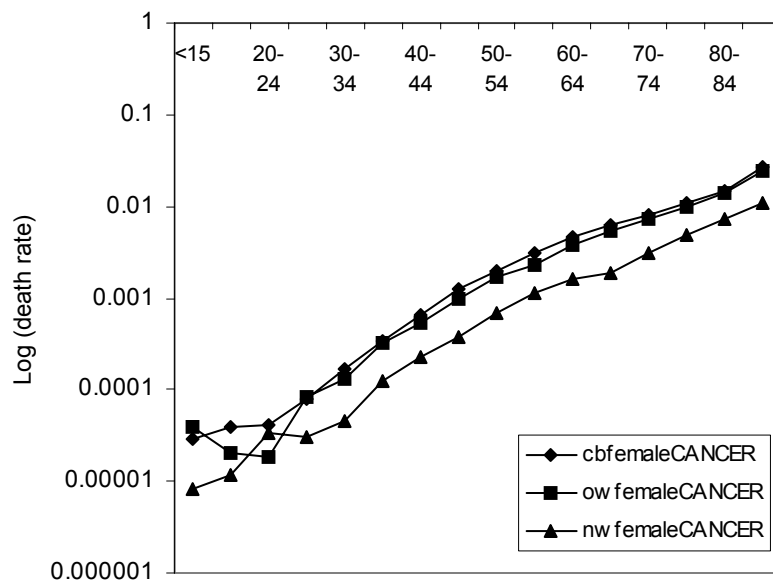
Figure 6c: Age Pattern of Male Cancer Mortality: Canadian Born, Old and New Wave Immigrants



Ratio of Male Age-Specific Death Rates from Cancer



6d: Age Pattern of Female Cancer Mortality: Canadian Born, Old and New Wave Immigrants



Ratios of Female Age-Specific Death Rates from Cancer

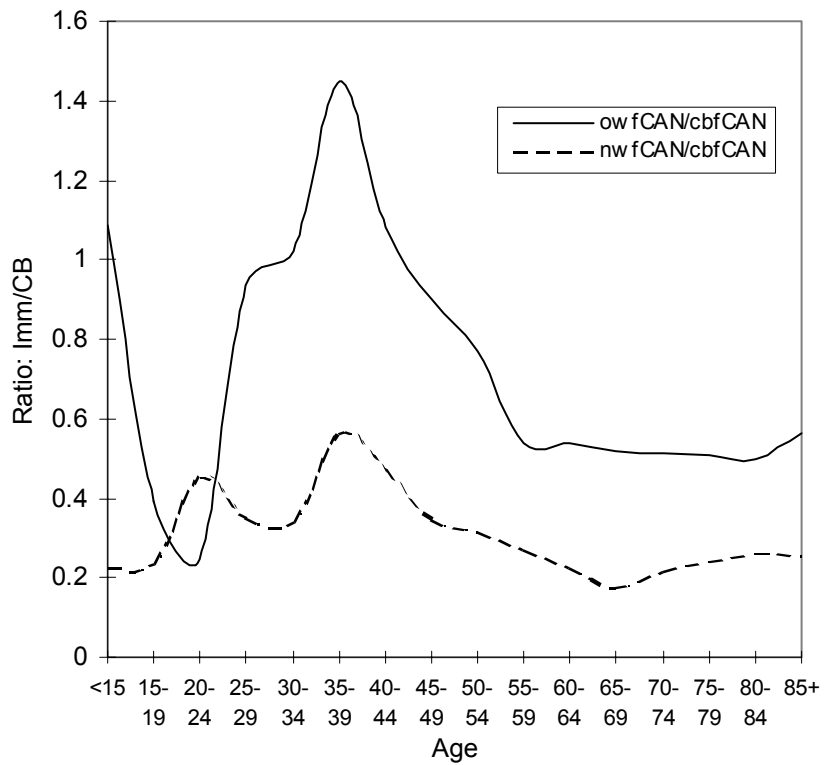
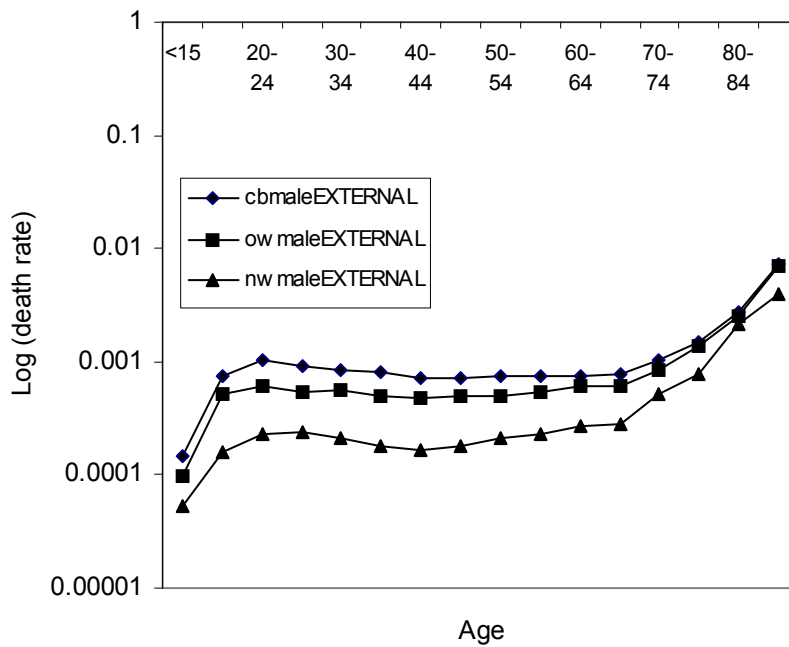


Figure 6e: Age Pattern of Male External Mortality: Canadian Born, Old and New Wave Immigrants



Ratios of Male Age-Specific Death Rates from External Conditions

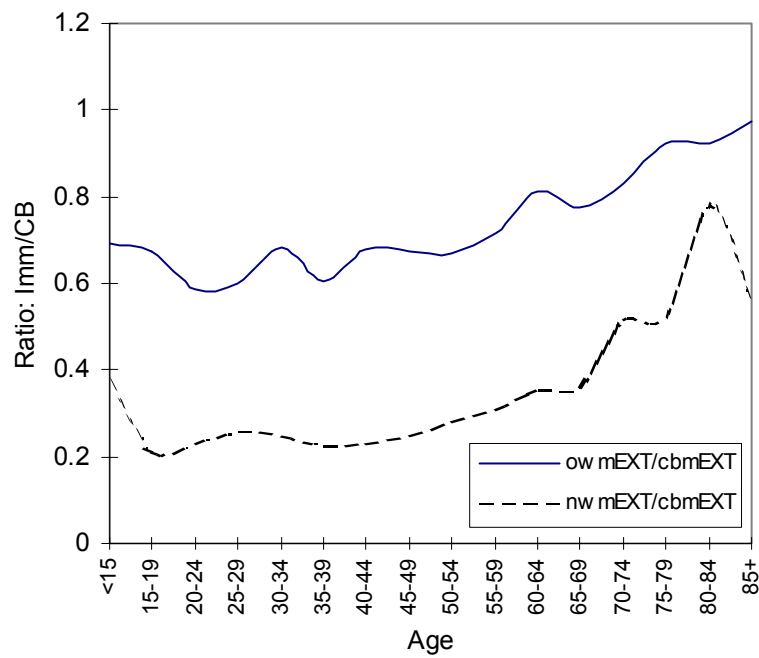
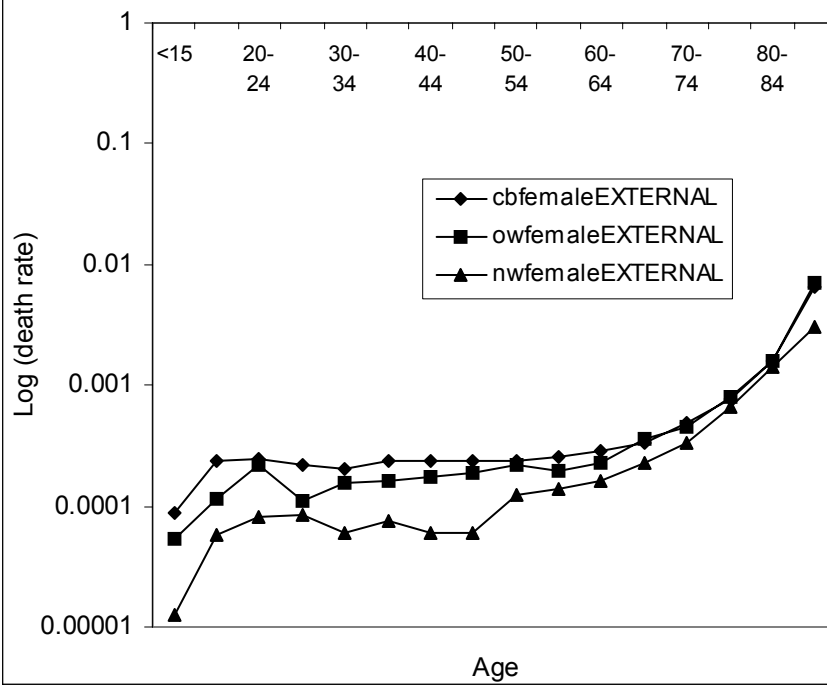


Figure 6f: Age Pattern of Female Mortality from External Conditions: Canadian Born, Old and New Wave Immigrants



Ratio of Female Age-Specific Death Rates from External Conditions

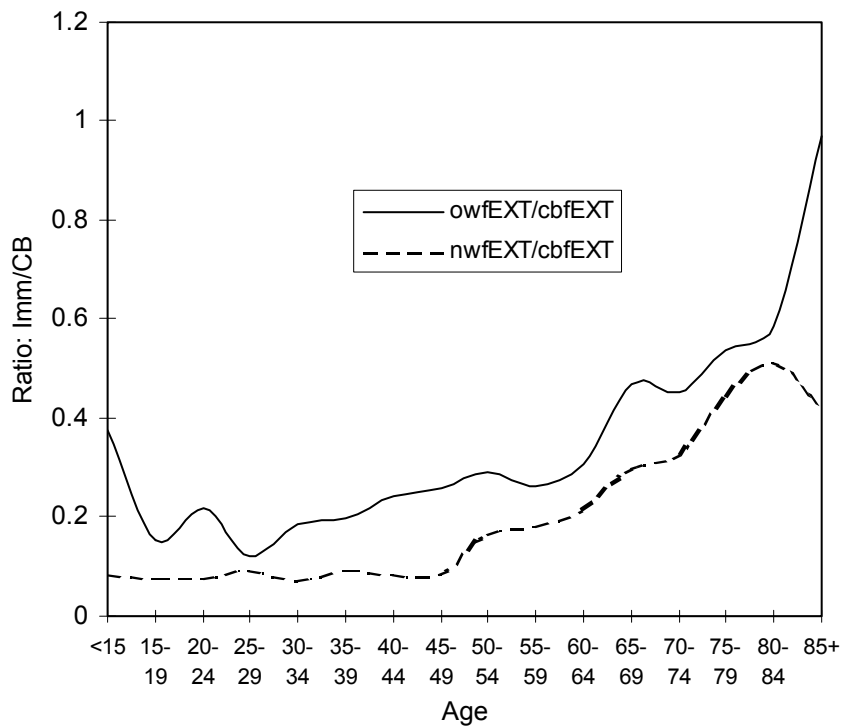
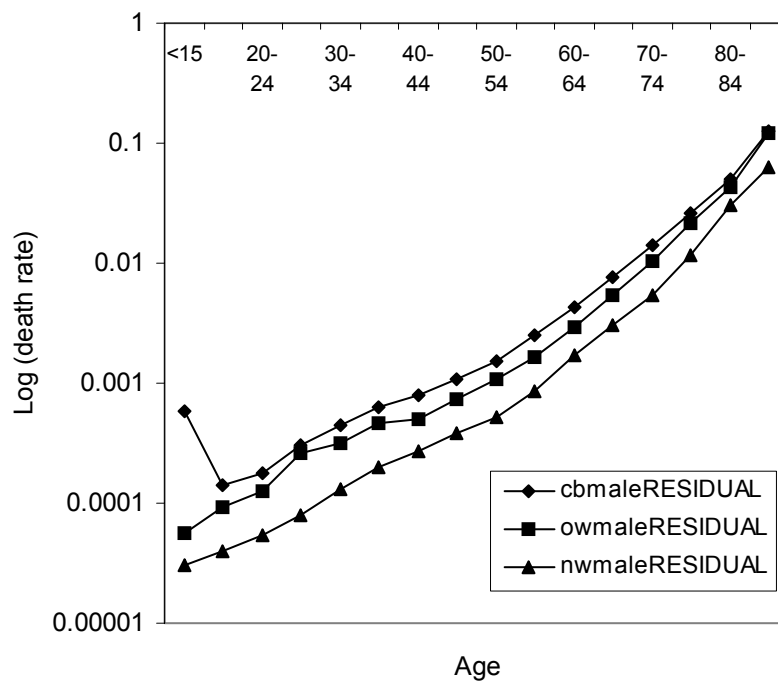


Figure 6g: Age Pattern of Male Residual Mortality:
Canadian Born, Old and New Wave Immigrants



Ratios of Male Age-Specific Death Rates from Residual
Causes of Death

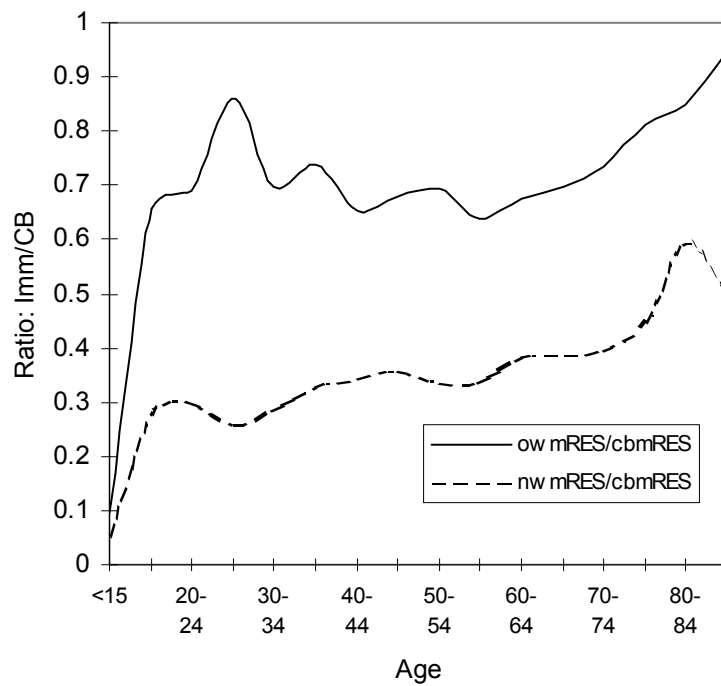
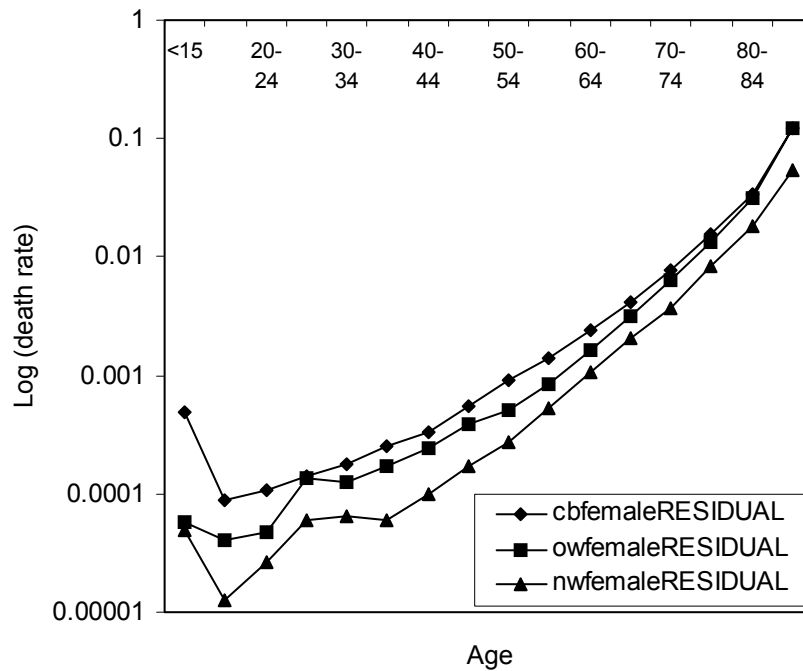


Figure 6h: Age Pattern of Female Mortality From Residual Causes of Death: Canadian Born, Old and New Wave Immigrants



Ratio of Female Age-Specific Death Rates from Residual Causes of Death

