To the Graduate Council:

I am submitting herewith a dissertation written by Billy M. Thomas entitled Correlates of Elderly Female Suicide: A Cross-National Ecological Study. I have examined the final copy of this dissertation for form and content and recommend it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Health Education.

Ian R. H. Rockett, Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

Associate Vice Chancellor
and Dean of the Graduate School

CORRELATES OF ELDERLY FEMALE SUICIDE: A CROSS-NATIONAL ECOLOGICAL STUDY

A Dissertation

Presented for the

Doctor of Education

Degree

The University of Tennessee, Knoxville

Billy M. Thomas

August 1995

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DEDICATION

To My Parents, Marlene and Charles,

With Much Love

"You can do or be anything you want!"

"...don't believe anything you

hear and only half of what you see!"

ACKNOWLEDGMENTS

I would like to express my deepest and most sincere thanks for the professionalism, knowledge, and guidance shared with me by my committee chair, Ian R. H. Rockett, Ph.D. The conceptualization of this project came from Dr. Rockett, which he cheerfully shared with me. He has shown me that there are more important aspects of an education than simply attaining a degree, such as the cultivation of a critical perspective, a scientific approach to problem solving, and the importance of patience.

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A special thanks is offered to Candra Phillips for serving as my own personal reference librarian and for helping me see that divorce is still an unrecognized

concept in Ireland and to Gail Powell, Ph.D. for taking the time to pour over the manuscript in its early stages and offer valuable literary suggestions. I would also like to thank my friends and colleagues from the Department of Health, Leisure, and Safety for their encouragement and support. Finally, to my closest friends, especially my wife Heather, let me say that this project would not have been possible without you. You helped me see the light at the end of long and enlightening tunnel. Cricket you were right. It *all* eventually gets done.

ABSTRACT

The purpose of this study was to examine the relationship between reported suicide rates for elderly females in 20 developed nations for the period 1988-1990 and social construction and social causation variables. Social construction variables represent factors that might exert an artifactual influence upon observed suicide rate differentials, while social causation variables represent potential social, demographic, and economic determinants of suicide.

Twelve social causation variables and five social construction variables were constructed for this analysis. Correlation coefficients were used to make a preliminary assessment of both the relationship between the outcome variables and the predictor variables, and of the presence of multicollinearity. Then regression analyses were conducted to determine the most parsimonious age-specific models for characterizing the multivariate relationships.

For neither of the age-sex groups examined (females aged 65-74 and 75 and over), did differences in reported cross-national suicide rates appear artifactual. For only social causation variables emerged as statistically significant predictors at the .05 level. In the 65-74 age group, gross national product per capita was the sole significant predictor: a $1,000 increase in gross national product per capita would be accompanied by an increase of 0.86 female suicides per 100,000 population. The only social construction variable included in the model was the annual average rate of deaths due to accidental poisoning. This variable was found to approach statistical significance ($p=.07$) as one component of an interaction term with the ratio of male to female life-expectancy at birth.

Among females aged 75 and over, no social construction variables entered the final model. The ratio of females aged less than age 15 to those between ages 15 and 64, Protestantism, and Catholicism reached significance at the .05 level. Female labor force participation was also indicated in the model, since it approached statistical significance (p=.09). The analysis indicated that if the ratio of females under age 15 to those aged 15-64 increased by 10 percent, there would be an increase of 84.6 female suicides per 100,000 population. Also, countries with predominantly Catholic and Protestant religions registered 32 and 42 fewer female suicides per 100,000 population, respectively, than the remaining comparison countries. Finally, as the percentage of females making up the labor force increased by one percent, the rate of female suicide increased by .61 persons per 100,000.

Study results led to the conclusion that allowing for both variation in case ascertainment procedures and potential case misclassification did not enhance our understanding of elderly female suicide rate variation among the 20 nations included in this study. However, the social construction issue should be investigated further using larger data sets and other sociodemographic groups.

TABLE OF CONTENTS

CHAPTER ONE: INTRODUCTION

I. The Problem 1
Views of Reported Rate Differences 2

II. Total and Age-Specific Rate Differentials Among Nations 4
Female Suicide: An International Perspective 6
A Sub-Population of Interest 7

III. A Brief History of International Suicide Research 8
Substantive Differences 11
Population Structure 11
Religion 12
Divorce 13
Female Labor Force Participation 14
Unemployment 14
Gross National Product 15
Alcohol Consumption 15
Choice of Method 16
Artifactual Differences 17
Social Causation and Social Construction 19

IV. Purpose of the Study 20

V. Statement of the Problem and Research Hypotheses 20

VI. Need for the Study 21

VII. Basic Assumptions 22

IIX. Delimitations 22

IX. Limitations 23

X. Definitions 23

TABLE OF CONTENTS, Continued

CHAPTER TWO: REVIEW OF LITERATURE

I. Introduction 25

II. Theories of Suicide 26
A Theoretical Framework: Social Construction and Social Causation 28

III. Ecological Correlates of Suicidal Behavior 29
Suicide and Homicide 30
Population Structure 31
Economic Factors 32
Social Conditions 35
Conclusion 39

IV. The Quality of Mortality Data 39
Reliability of Suicide Statistics 40
Assessing Reliability 44
Validity of Suicide Statistics 46
Sensitivity and Specificity 49
The Theoretical Upper-Limit of Suicide Statistics 51
Assessing Validity 51
Conclusion 55

V. Suicide Prediction 55

VI. Summary 56

CHAPTER THREE: DATA AND METHODS

I. Introduction 58

II. Ecological Methodology 58

III. Country Selection 62
Suicide Rate Reporting Practices 62
Level of Development 62
Population 63

TABLE OF CONTENTS, Continued

IV. Instrumentation....64

V. Data Description....64
The Dependent Variable....64
The Independent Variable....65
Social Causation Data....65
Social Construction Data....65

VI. Data Analysis....69
Assumptions of Multiple Regression Analysis....71
Studentized Deleted Residuals....73
Degree of Fit, Standardized....73
Leverage....73
Cook's Distance....74
Variance Inflation Factor....74
VII. The Model....75
Social Construction....75
Social Causation....75
Population Structure....76
Economic and Social Correlates....77

CHAPTER FOUR: ANALYSIS OF THE DATA

I. Introduction....81

II. Descriptive Statistics....81
The Dependent Variables....82
Social Construction....84
System Type....86
Annual Average Rate of Accidental Poisoning, Drowning, and Other Violence....87
Annual Average Rate of Accidental Poisoning....89

TABLE OF CONTENTS, Continued

Annual Average Rate of Accidental Drowning 89
Annual Average Rate of Death Due to Other Violence 91
Social Causation 93
Population Density 93
Urbanization 96
Ratios of Number of Males and Females Less than age 15 to Those Between ages 15 and 64 96
Ratios of Number of Males and Females Over age 64 to Those Between the ages 15 and 64 98
Gross National Product Pre Capita 101
Annual Average Divorce Rates 101
Primary Religion / Denomination 103
Annual Average Rates of Death due to Chrrhosis of Liver 106
Female Labor Force Participation 108
Ratio of Male to Female Life-Expectancy at Birth 108
Ratio of Female to Male Years Since Suffrage 108

III. Correlation Coefficients 111
The Relationship Between the Dependent and Independent Variables 111

IV. Regression Analysis 117
Results of Multiple Regression Analysis 120
Interpretations of Multiple Regression Analysis 122
Equation 4.1 123
Equation 4.2 125

V. Conclusion 125

TABLE OF CONTENTS, Continued

CHAPTER FIVE: FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

I. Introduction 127

II. Findings 128

III. Conclusions 130

IV. Recommendations 132

REFERENCES 134

APPENDICES 151

Appendix A1: ***Addresses from Foreign Consular Offices Located in the United States, 1994*** 152

Appendix A2: ***Data Variables and Their Sources*** 155

Appendix A3: ***Survey Requesting Information Regarding Type of System Responsible for Determining Cause of Death in Suspicious and/or Unnatural Deaths*** 160

VITAÉ 162

LIST OF TABLES

Table 2.1 - Spearman Rank Order Correlation Coefficients Comparing the Reported Annual Average Rate of Suicide to the Combined Rate of Accidental Drowning, Accidental Poisoning, Other Violence, and Suicide per 100,000 for Females in Twenty Developed Nations, 1988-1990 47

Table 2.2 - Annual Average Ratios of the Combined Rate of Accidental Drowning, Accidental Poisoning, and Other Violence to the Suicide Rate per 100,000 by Age, Sex, and Country, 1988-1990 52

Table 3.1 - Social Causation Variables, Sex-Specific Population of Interest, and Years of Examination 66

Table 4.1 - Descriptive Statistics 83

Table 4.2 - Type of System with Primary Responsibility for Determining Cause of Death in Suspicious and/or Unnatural Deaths by Country 88

Table 4.3 - Primary Denominations and Religions Found in Study Countries, 1985-1987 105

Table 4.4 - Correlation Coefficients Between Predictor Variables and Annual Average Rates of Suicide Among Females aged 65-74 and 75 and Over 115

LIST OF FIGURES

Figure 1.1 - Female Suicide Rates per 100,000 by Age and Selected Countries, 1990 3

Figure 1.2 - Female Suicide Rates per 100,000, by Age and Selected Country, 1988-1990 9

Figure 4.1 - Annual Average Rates of Suicide per 100,000 by Country, 1988-1990 85

Figure 4.2 - Annual Average Rates of Death Due to Accidental Poisoning per 100,000 by Country, 1988-1990 90

Figure 4.3 - Annual Average Rates of Death Due to Accidental Drowning per 100,000 by Country, 1988-1990 92

Figure 4.4 - Annual Average Rates of Death Due to Other Violence per 100,000 by Country, 1988-1990 94

Figure 4.5 - Annual Average Estimates of Population Density by Country, 1988-1990 95

Figure 4.6 - Percentage of the Total Population Residing in an Urban Setting by Country, 1988-1990 97

Figure 4.7 - Ratio of Persons Less than 15 Years of age to Those Between 15 and 64 by Country and Sex, 1988-1990 99

Figure 4.8 - *Ratio of Persons Over 64 Years of age to Those Between ages 15 and 64 by Country and Sex, 1988-1990* 100

Figure 4.9 - Annual Average Gross National Product per Capita in U.S. Dollars by Country, 1988-1990 102

Figure 4.10 - Annual Average Rates of Divorce per 1,000 by Country, 1985-1987 104

Figure 4.11 - Annual Average Rates of Death due to Cirrhosis of the Liver per 100,000 by Country and Sex, 1985-1987 107

LIST OF FIGURES, Continued

Figure 4.12 - Percentage of the Total Labor Force Composed of Females by Country, 1988-1990.....109

Figure 4.13 - Annual Average Ratio of Male to Female Life-Expectancy at Birth by Country, 1988-1990.....110

Figure 4.14 - Ratio of Female to Male Years Since Suffrage by Country (Year of Suffrage was Subtracted from 1989).....112

LIST OF ABBREVIATIONS

Australia	ATR
Austria	AUS
Canada	CAN
Denmark	DEN
Finland	FIN
France	FRA
Germany	GER
Greece	GRE
Ireland	IRE
Israel	ISR
Italy	ITA
Japan	JAP
Netherlands	NET
New Zealand	NZ
Norway	NOR
Spain	SPA
Sweden	SWE
Switzerland	SWI
United Kingdom	UK
United States	USA

CHAPTER ONE: INTRODUCTION

I. The Problem

Self-destructive behaviors have been a part of civilization since the beginning of time and have been viewed in a number of diverse perspectives, ranging from condemnation to acceptance and incorporation into cultural norms (Rosen, 1975). However, only since the publication of Henry Morselli's Suicide: An Essay on Comparative Moral Statistics, and Durkheim's Suicide have patterns of self-destruction been systematically analyzed in an effort to understand this phenomenon.

These and many other investigations into suicide illustrate international consistencies, as well as disparities with regard to the incidence of suicide. One prominent disparity, relating to reported age- and sex-specific suicide rates, is that rates among males increase with advanced age in most countries, while, two patterns have emerged among females. The first, a curvilinear pattern, is characterized by rate increases with age until approximately age 50, after which a decrease is evident. The second pattern reflects suicide rates that rise monotonically with increased age. These female patterns are most important to the purpose of this research.

MacMahon, Johnson, and Pugh (1963) were among the first to discuss international variations in reported rates of suicide among females. They examined rates reported for the years 1952-1954 and revealed that, in England and Wales, France, the Netherlands, Denmark, and the United States, male and female rate curves diverged with age. Male rates increased while female rates tended to decrease around middle age. However, in England and Wales,

female rates of suicide did not exhibit this decline until after age 70, and in France and the Netherlands, they did not decrease at all. The authors reported a more dramatic increase in suicide rates with advanced age among Japanese females. Similarly, Gibbs (1971) examined reported rate differences between the United States and Japan between 1956 and 1958. He reported that for both sexes in Japan and for males in America, reported rates of suicide increased with age.

Rockett and Smith (1989) have discussed these same patterns for the year 1980. The authors compared mortality data from the United States with mortality data from France, Japan, West Germany, and the United Kingdom. It was reported that the United States exhibited a unique decline among females in reported rates of suicide after 45-54 years of age. Baker, O'Neill, Ginsburg, and Li (1992) agree, stating that the reported rate for U.S. females for the period 1980-1986 peaked at approximately age 50. However, the U.S. male rate increased steadily with age after age 24. This female advantage has also been exhibited in other countries. According to the World Health Organization (WHO), females in Ireland, Norway, and Finland all registered decreases with advanced age in reported rates of suicide for 1990 (Figure 1.1). On the other hand, Israel, Spain, and Switzerland, like Japan, reported a positive relationship for females between reported rates and age (WHO, 1992, 1993, and 1994).

Views of Reported Rate Differences

Two principal perspectives, which may also apply to elderly females, have been proposed that might account for cross-national suicide rate variation. First, rate differences may be seen as a product of social, cultural, economic, or demographic factors, such as religion and divorce, which predispose people in a

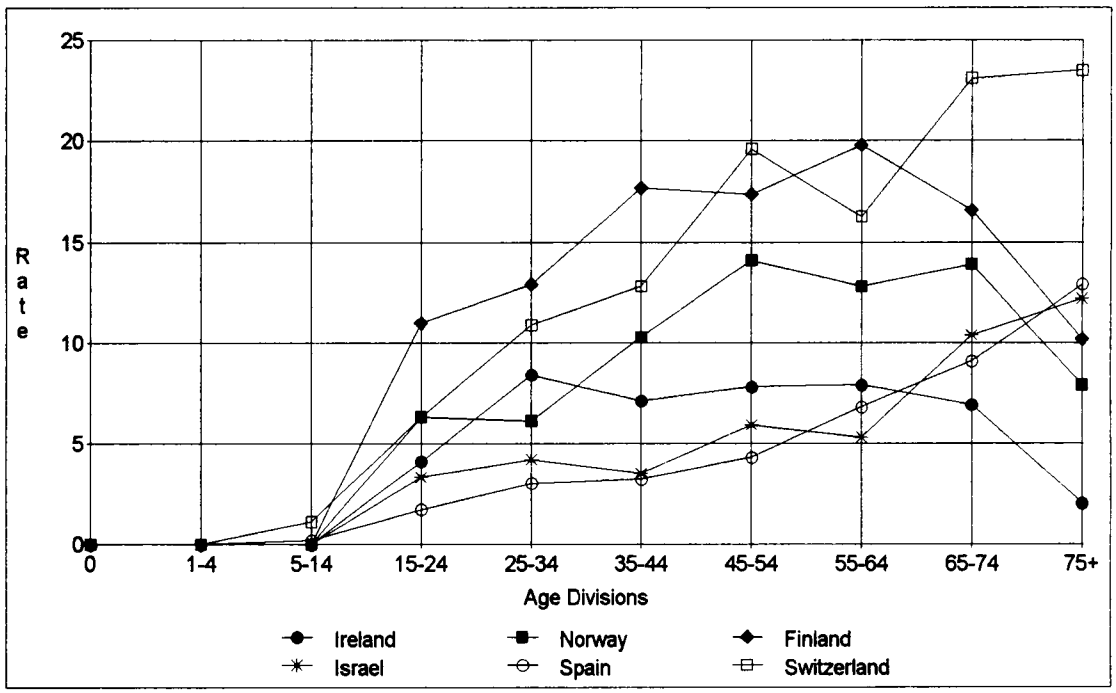


Figure 1.1*

Female Suicide Rates per 100,000 by Age and Selected Countries, 1990

*Source: World Health Statistics Annual, 1989 & 1991-1994

particular region to commit suicide. A second view discusses reported rates of suicide as being primarily associated with the manner in which suicide statistics are collected and reported. The procedure by which cause of death is determined and the possibility of suicides being misclassified into other cause of death categories (such as accidental poisoning or accidental drowning) are two examples of this latter view. These perspectives have been termed social causation and social construction, respectively (Pescosolido and Mendelsohn, 1986).

As yet there is no definitive answer to the question of whether variation in reported rates of suicide reflects true cross-national differences or if it is merely an artifact of data collection. All that can be accurately stated is that the reported rates of suicide differ internationally; some countries report suicide rate peaks among females around middle age while others exhibit consistent increases in reported rates. The present research is aimed at examining differences in reported suicide rates among two elderly females sub-populations, those aged 65 to 74 and 75 and over, in terms of both social construction and social causation.

II. Total and Age-Specific Rate Differentials Among Nations

Reported rates of suicide in various countries have been discussed by Diekstra (1990). The author has stated that Arab countries tend to report low rates of suicide, similar to those of Latin American countries, while Europe and those regions populated primarily by European descendants (such as Australia, the United States, and Canada) tend to report relatively high rates. Southern European countries usually have lower rates than Northern and Middle European countries. Stengel (1964) has discussed reported suicide rate

differentials published by WHO for the year 1959. Austria, Denmark, Finland, Hungary, Japan, West Berlin, and East Germany all reported rates of above 20.0 per 100,000. France, Sweden, Switzerland, and West Germany exhibited rates of 15.0 to 20.0 per 100,000. Rates of 10.0 to 14.0 per 100,000 were reported by Australia, Belgium, South Africa, England and Wales, the United States, and New Zealand. The lowest rates (those 0.0 to 9.0 per 100,000) were reported by Egypt, Northern Ireland, and the Republic of Ireland. Of countries reporting to the World Health Organization (WHO), and whose rates were available in the 1987 World Health Statistics Annual or on WHO data tapes for at least one year after 1979, reported suicide rates ranged from practically zero in Malta and Egypt, to approximately 1,000 per million population in the Falkland Islands (Diekstra 1988).

Fuse (1980) has described three patterns of suicide based upon the age of self-destruction, that appear useful in classifying nations: the Hungarian, Scandinavian, and Japanese models. The Hungarian model represents populations with suicide rates that increase steadily and sharply with age. Nations classified under the Scandinavian model exhibit suicide rates that increase with age until after age 60, at which time the rate begins to taper off, or decline. Finally, the Japanese model represents suicide rates that tend to be bimodal, with the first peak at 25-34 years of age and the second peak after age 55 or 60. Fuse also discusses rate variations by sex. Reported male rates of suicide outrank rates of suicide reported for females. However, a few countries report relatively high suicide rates among women. For example, in postwar Japan, suicide was the principal cause of death for females aged 20-29 and the second leading cause of death for females aged 15-19 and 30-34. Japan

appears to fit into the "East-Asian pattern" of suicide in which females traditionally manifest high rates. Other countries, such as Taiwan, Singapore, Thailand, and Hong Kong, also conform to this pattern.

Female Suicide: An International Perspective

Different patterns of female suicide are delineated here for the 20 industrialized nations selected in this study for the years 1988, 1989, and 1990 (World Health Statistics Annual, 1989, 1991, 1992, 1993, & 1994). During this three-year observation period, male rates of reported suicides exceeded those of females for each country. The highest rates among males were consistently reported by Finland (ranging from 46 per 100,000 in 1988 and 1989 to 49 per 100,000 in 1990). Denmark routinely reported the highest rates for females: 19 per 100,000 in 1988, 20 per 100,000 in 1989 and 16 per 100,000 in 1990. For both sexes, Greece reported the lowest rates for each of the three years. No suicides were reported for the age groups 0 and 1-4 years. However, for all countries, and each year, dramatic increases were evident for both sexes after ages 5-14. It is only at this point that differences between countries, with regard to age- and sex-specific rates, become evident.

Rates for females reported by the United States, Sweden, Norway, Ireland, Finland, Denmark, Canada, the United Kingdom, and the Netherlands tended to increase drastically after 5-14 years of age and decrease between the ages of 45-54 and 55-64. However, a few age- and year-specific exceptions to this were found. For example, the 1990 rate reported by Denmark showed a decrease between 55-64 and 65-74 years of age, followed by an increase in rate. For 1988, a similar pattern was reported by Canada; after a vast decline in reported rates between ages 45-54 and 65-74, female rates rose slightly. The same held

true for the United Kingdom for the same year and the Netherlands for 1989, where the increases after ages 65-74 were more dramatic.

A number of countries have reported increasing rates with advanced age in their female populations. Austria, France, Germany, Israel, Italy, Japan, Spain, and Switzerland all exhibited this pattern. For each country, the reported rate of suicide increased greatly after ages 5-14 and continued to increase throughout the life span. However, exceptions to this include Spanish females who experienced a slight rate decline between the ages of 25-34 and 35-44 for the year 1989, after which the upward curve continued. Israeli females experienced a rate decrease between 25-34 and 45-54 years of age for 1989, a pattern also exhibited between the age groups 35-44 and 55-64 for 1990. This decline was also reported by France in the latter age group for the year 1988, and Switzerland in 1990. Japan, Austria, and Germany exhibited more consistent increases in reported suicide rates for females after ages 5-14.

A Sub-Population of Interest

Reviewing the data, we see that two patterns distinguish suicide incidence between the sexes. Male rates increase with age, and female rates either increase with age or increase until around age 50 and then begin to decline. Dublin (1963) has discussed age and sex differences in reported rates of suicide in the United States for the year 1959. The sexes differed in that male rates increased with age. The female rate, on the other hand, peaked at approximately age 50, leveled off, then began to decrease. Yet, several countries, such as Austria, Bulgaria, France, Greece, Hong Kong, Hungary, Italy, Japan, Portugal, Singapore, and Spain have been cited as experiencing rate increases with age for both sexes (Lester, 1991). Similar findings can be

gleaned from WHO data for the years 1988, 1989, and 1990 (Figure 1.2). For each of these three years, Japan exhibited an elderly female rate pattern that increased dramatically with age, yet the United States experienced a decrease in rate after age 55-64. A similar pattern was previously described by Rockett and Smith (1989). Canadian, Finnish, and Irish females also experienced decreases in reported rates of suicide after middle age. Yet, like Japanese females, Spanish, Israeli, and French females displayed increasing rates with age (World Health Statistics Annual, 1989, 1991, 1992, 1993, and 1994). These rate variations are highly relevant to the present research. Because two distinct patterns are seen in the female populations of various nations, and because these differences become more pronounced with advanced age, it becomes feasible to examine reported rates of suicide in terms of social construction and social causation variables among the elderly population.

III. A Brief History of International Suicide Research

The logic of suicide and international variations between reported rates of suicide, have been in question for a number of years. In 1882, Henry Morselli's Suicide: An Essay on Comparative Moral Statistics (1975) was first published. The intent of his work was to examine the reasoning behind suicide and rate variations in association with demographic characteristics for various nations. His conclusions were somewhat Darwinistic, implicating social evolution and competition as prime factors in suicide.

Durkheim (1951) followed in the tradition of Morselli in examining suicide, but with quite different objectives. Durkheim's main goal in writing Suicide in 1897 was to demonstrate the need for an independent discipline of sociology (Douglas, 1967). In doing so, he developed a theory that still, to varying

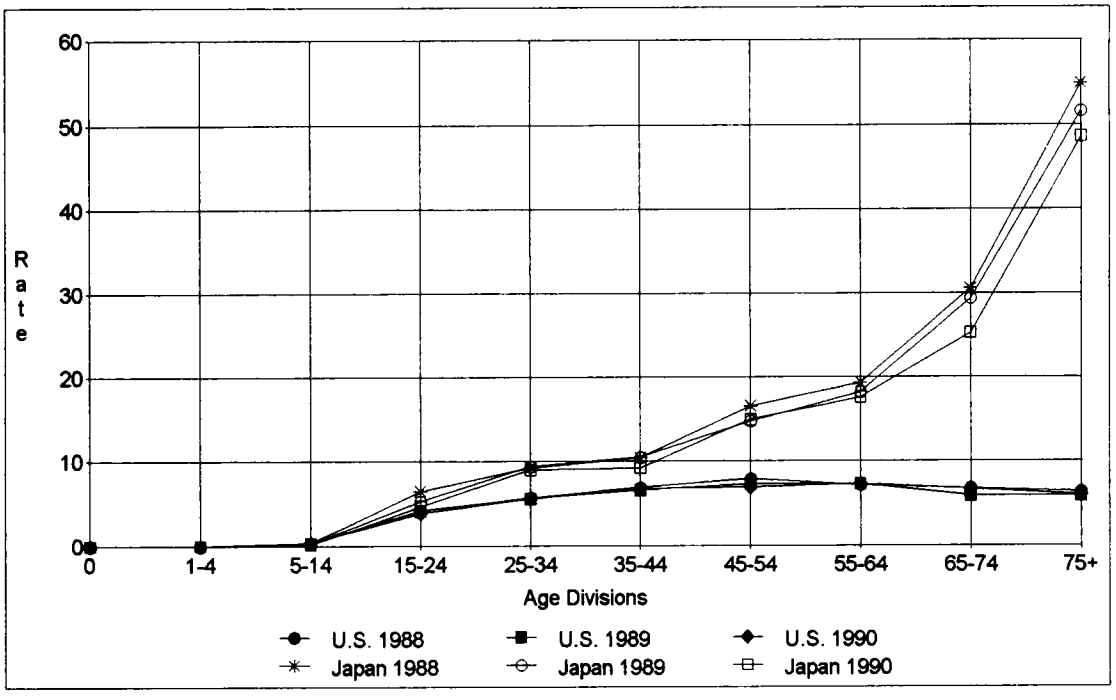


Figure 1.2*

Female Suicide Rates per 100,000 by Age and Selected Country, 1988-1990

*Source: World Health Statistics Annual, 1992-1994

degrees, serves as a theoretical framework in suicide research. He proposed that the level of suicide in a particular region was inversely related to the level of social integration and social regulation found in that region. First, he saw connectedness, or social integration, between the individual and his or her environment as a protective factor against suicide. He conceded that religion was the most prominent conduit toward this social unity or integration. Second, Durkheim hypothesized that the level of control, or social regulation, placed on the individual by his environment was important in determining suicide incidence. Anomie, or social normlessness, was believed to be a salient predisposing factor to Durkheim. In countries with fewer social regulatory structures, such as marriage and economic opportunities, the individual was believed to be more prone to act upon suicidal thoughts.

Both Durkheim and Morselli chose to examine demographic data. According to Shneidman (1976), this practice is a revered tradition in the field of suicidology; a tradition which continues today, as most studies examining suicide are completed on the macro-level (Stack, 1987b). This is considered a major deficiency by MacKinnon (1977). Shneidman (1976) agrees, believing that suicidology should abandon demographic analysis simply as a descriptive element in research and use such data to test relevant hypotheses, a practice that is now beginning to develop.

From historical investigations of suicidal behaviors, two schools of thought have emerged to help explain reported rate variations between different regions of the world. First, many authors believe international suicide rate differences to be substantive, based upon true cultural differences and population characteristics (for example., religion, economics, and population structure).

These types of variables have been termed social causation variables by Pescosolido and Mendelsohn (1986). Others, more skeptical of official statistics, claim that rate variations are merely a product of social construction (also termed by Pescosolido and Mendelsohn): the manner in which cause of death is determined makes reported suicide figures nothing more than artifacts of the data collection process. Examples of artifactual differences are best understood in relation to the reliability and validity of reported suicide rates.

Substantive Differences

A number of country-specific social causation variables have been attributed as factors accounting for differences in reported rates of suicide. Factors that appear to be associated with overall suicide rates, to varying degrees, include population structure, religion, divorce, female labor force participation, unemployment, alcohol consumption, and choice of method.

Population Structure

Ahlburg and Schapior (1984) examined the relationship between a relative cohort size (RCS), (defined as the ratio of the number of males aged 16-29 to those aged 30-64) and self-destruction. They reported that periodic shifts in the RCS examined had an impact on reported rates of suicide in the United States for both sexes for the years 1948-1976. With regard to the elderly, Lester (1973) examined two age dependency ratios from 28 nations: those less than age 15 to those between 15 and 64 years of age, and those over the age of 65 to those between 15 and 64. He found that in countries reporting a higher proportion of youth, suicide rates were low and homicide rates were high, yet in countries with a high proportion of elderly, suicide rates were higher than homicide rates. This offers some support for the idea that national population

composition and structure influence the variation in suicide rates between countries.

Two other variables relating to population dynamics and structure have also been examined in relation to suicidal behavior: population density and degree of urbanization (measured as the percentage of the total population considered urban). However, based on two studies, neither appear to have any influence on rates of self-destruction. For example, Lester (1989) examined both variables in an 18 nation study and found that neither density nor urbanization were significant predictors of suicide. Similarly, Sainsbury (1955) reported that overcrowding (a variable closely related to density and urbanization) in various London, England social groups and neighborhoods was not a significant predictor of suicide.

Religion

Religion has also been identified as a highly important determinant of suicide rates. Durkheim (1951) saw religion as a focal point in examining rate diversity, a tradition that continues today. Stack (1980) examined the relationship between suicide, Catholicism, and religiosity for all 50 U.S. states in 1970. He found religiosity (the proportion of individuals attending Catholic schools) to be more closely related to suicide ($r= -0.42$) than his measure of Catholicism (the percent of state populations that were Catholic, $r= -0.27$). After conducting a time series analysis of data from Sweden between the years of 1951 and 1980, he found that religious trends were unrelated to the general male or female suicide rate, but were related to the rates reported for younger individuals (Stack, 1991).

The impact that religion has on females 65 years of age or greater is, as yet, indemonstrable. According to Faupel, Kowalski, and Starr (1987), "sociology's one law" (Durkheim's assertion that Catholicism has a protective influence against suicide) remains unsolved. For example, Austria, a country whose population is predominantly Catholic (World Factbook, 1986, 1987, & 1989), experienced high rates of suicide, second only to Denmark in 1990 (World Health Statistics Annual, 1992).

Faupel et al. (1987) examined 18 variables, divided into either social integration or economic categories, in relation to suicide rates reported by 3,108 counties within the United States for the years 1974-1976. From their findings, the authors reported that for all counties, the proportion of the population that was Catholic was one of the most powerful predictors of suicide. Because the only age-specific variable used was the median age of each county examined, elderly females were unaccounted for.

Divorce

According to Monk (1986), divorced populations tend to exhibit high rates of suicide than widowed, single, or married populations. In the 1980 study by Stack, mentioned previously, it was reported that divorce was the strongest correlate of state suicide rates (r=0.76). Further, he concluded that once divorce was statistically controlled, Catholicism had no independent effect on self-destruction. Even though the rate of divorce is a traditional variable in the examination of suicide (Stack, 1987a), its impact on suicide among elderly females is unclear.

Female Labor Force Participation

Economic factors also appear to be important predictors of suicide. Stack (1987a) used two theories in examining the relationship between suicide and female labor force participation. The first was the status integration theory proposed by Gibbs and Martin (a derivative of Durkheimian theory). which suggests a positive relationship between suicide and economic conditions. The second was Sieber and Mark's accumulation-expansionist theory, which both suggests a negative relationship. Stack examined the association between female labor force participation and suicide in the U.S. between the years 1948-1980. The group chosen for analysis, females aged 20-39, represent those individuals most likely to have relatively small children in their care. Stack found that as the female labor force participation rate increased in post-war America, the reported suicide rate for this group doubled.

Unemployment

In Quebec between 1966 and 1981, annual changes in unemployment were also shown to be associated with a concomitant change in the same direction for reported suicide rates. From these findings, it was conjectured that economic fluctuations may be of prime importance with regard to suicide in Quebec during this time period (Cormier and Klerman, 1985). Similarly, Boor (1980) examined the observed rates of suicide and rates of unemployment in an eight-country study for the years 1962-1976, and reported a significant correlation between unemployment and suicide for the United States (r=0.79), Canada (r=0.51), Japan (r=0.53), and France (r=0.64). Unemployment was not, however, related to the suicide rates for older individuals of any country.

Gross National Product

Gross national product, like previously mentioned economic indicators, is often considered in light of suicidal behavior. Yet, as Yang (1992) has shown, other variables tend to be more important. The author examined suicide data and socioeconomic variables, per capita gross national product included, over a 44 year period for the United States and found that the divorce rate was the only variable to consistently impact the rate of suicide. On the other hand, Zimmerman (1987), also examining U.S. data, reported a moderate correlation (r=0.23) between reported rates of suicide and annual incomes between $10,000 and $19,000, a variable that perhaps could serve as a surrogate for national expenditures.

Alcohol Consumption

Relatively few investigations have examined the associations between alcohol consumption and self-destruction. However, Giesbrecht and Dick (1993) examined annual alcohol consumption patterns and unadjusted male and female mortality data for cirrhosis of the liver and 12 accidental and violent causes of death in six nations between 1965 and 1987. In most areas examined, an unlagged correlation (the relationship between different variables collected for the same period of time) between cirrhosis and alcohol consumption was not significant. Yet, they reported that the suicide-alcohol intake correlation was consistently significant. The authors do state, however, that "it is possible that acute complications [such as suicide] are affected more by external factors than chronic alcohol casualties" (p. 875) making any relationship between suicide and alcohol consumption a spurious one. Farber (1979) has speculated that one of the causative factors associated with high

suicide rates in France is an exceptionally high rate of alcoholism. Smart and Mann (1990) have also examined the impact of alcohol consumption on reported rates of suicide for Ontario, Canada. The authors reported that suicide rates for males, females, and the total population were strongly correlated with per capita alcohol consumption during the period 1963 and 1983. These correlations were markedly reduced during a period of alcohol consumption stabilization (1975-1983), where it was reported that female suicide rates decreased by 28 percent and male rates increased by 4 percent. One may be tempted to see alcohol consumption as having a larger impact upon female suicide rates than male rates, yet, external factors, such as high unemployment rates among females, and decreased usage of minor tranquilizers and barbiturates may be more important in determining risk.

Choice of Method

Finally, choice of method also appears to have some relationship with sex-specific suicide rate differentials. Capstick (1961) commented on three factors concerning choice of suicide method: method availability, the imitation of others who have committed suicide, and the psychological need associated with the choice of one method over another. He developed a scheme that divided type of suicide method into active (shooting, cutting, and hanging) or passive (drugs, gas, and poisoning), and reported that passive methods of suicide were more prominent among females.

Walsh, Walsh, and Whelan (1975) reported that manner of death had a significant influence on coroner decisions. For example, they found that individuals who died as a result of cutting, hanging, drugs, or gas were more likely to be classified as suicides than individuals who died by drowning,

jumping, or shootings, causes of death which may be more readily deemed accidental. In such cases, intent may be difficult to determine. This problem is compounded as the female ages. Thus, it would appear then that the potential for artifactual errors to influence suicide statistics should be greater among females than among males. Another complicating factor is that elderly deaths are less thoroughly investigated (Rockett and Smith, 1994) than deaths occurring in younger individuals; autopsy rates tend to decrease with age making misclassification of suicide more problematic in this population.

Artifactual Differences

Since ancient times, suicide has been considered the most negative form of death in many regions of the world. This view is believed to have some level of influence on the certification of suicide (Edland, 1968). Rosen (1975) stated that "societal responses to the act of self-destruction can be viewed as a spectrum ranging from outright condemnation on the one hand through mild disapproval to acceptance and incorporation into the sociocultural system on the other." (p. 3) Such diversity in social perception of suicide may aid in the social construction of suicide statistics. For example, O'Carroll, Rosenberg, and Mercy (1991) reported that coroners and medical examiners may be reluctant to certify cause of death as suicide for religious, financial, or political reasons. Such country-specific reluctance may impact reported suicide rate differentials.

A discussion of how different views of suicide potentially influence reported rates is warranted. Rockett and Smith (1989) have reported a suicide rate decline for American females after the age of 45-54 that contrasts with the upward trend observed among Japanese females. One can speculate that the vast differences in reported rates of suicide between these two countries are,

perhaps in part, due to varying cultural views of suicide. Japanese civilization may be more willing to accept suicidal behaviors as being a component of existence than the American culture.

For example, Iga and Tatai (1975) have discussed the methods, motives, and participants of suicide in Japan where suicide has a particular, social meaning. One may commit suicide following the "masters death," as a personal sacrifice, or for the purpose of expiating mistakes. Even though not held by all Japanese people, the basic philosophy is that of the Buddhist concept of Mujo-kan, a view of life as ephemeral, determined by the principle of eternal change. Existence on earth is Keso, or a false phase. The body is only temporary, and life on earth is meaningless and filled with suffering. This view of life, and essentially of death, could possibly have some level of influence on Japanese suicide rate increases with age among females. These views of suicide are not evident within the United States.

Others have also attributed rate differences to mechanisms of social order and perception. Monk (1986) stated that consistent differences between international rates of suicide, the persistent, yet changing sex differences, and varying age distributions all point to a strong influence from society and its arrangements. Durkheim also inferred suicide to be a social phenomenon because of the stability of rates over several decades (Sainsbury, 1972). Similarly, Kolmos and Bach (1987), after examining mortality data from Norway, Denmark, Finland, and Sweden, concluded that rate differentials between these countries appeared to be true differences. They also state that suicide misclassification, true suicides being mistakenly allocated to other cause of death categories, is responsible for only a small part of rate variation between

countries. Sainsbury (1972) agreed, suggesting that differences in reported rates appear to reflect societal differences, rather than procedures of reporting.

Some researchers have not been so optimistic, however. For example, Jobes, Berman, and Josselson (1987) have discussed potential sources of artifactual deviance in reported suicide rates. Examples include deficiencies on the part of those responsible for death certification, such as ignorance of procedure or terminology and the difficulty of determination of cause of death in cases of equivocal deaths (cases of death where true cause is unclear).

Social Causation and Social Construction

The question of why suicide rates vary between regions of the world and age- and sex-specific age groups has never been extensively examined on an international scale for any age-sex group, even though such rate differentials are evident. However, one study by Pescosolido and Mendelsohn (1986), examined both the substantive and artifactual views of suicide in unison. Even though this study relied solely upon U.S. data, the authors commented that no empirical evidence is yet available to deny or support the suspicions of suicide data quality.

To study these suspicions, the authors examined both social construction and social causation variables in relation to reported rates of suicide in 404 U.S. county groups. Social construction variables collected from the United States were those hypothesized as having an artifactual influence on reported rates. These variables included the type of system responsible for classifying cause of death, how officials came to hold office, and facilities available in the course of investigating death. Social causation variables, on the other hand, were those believed to represent the uniqueness of the regional culture. Examples include

religion, education, and marital status. According to the authors, official misreporting of suicides, based upon the social construction variables chosen, proved to be of little concern in their attempt to better identify social correlates of self-destruction.

IV. Purpose of the Study

The purpose of the present study was to examine the association between annual average suicide rates reported of elderly females in 20 developed countries for the period 1988-1990 and social construction and social causation variables believed to be associated with suicide among this sub-population, in an effort to better understand the nature and predictability of differences in reported rates.

V. Statement of the Problem and Research Hypotheses

As previously stated, the problem in this research was to gain a better understanding of why suicide rates differ between countries with particular attention paid to elderly female populations. Using the theoretical constructs set forth by Pescosolido and Mendelsohn (1986), the following competing hypotheses and the associated research question were constructed.

- ***Hypothesis One:*** Suicide rate differentials reported for the elderly female population of the countries examined are a product of social construction.
- ***Hypothesis Two:*** Suicide rate differentials reported for the elderly female population of the countries examined reflect differences in social causation factors.
- ***Research Question:*** For the countries examined, do social construction or social causation variables serve as the best predictors of suicide rates among females 65 years of age or greater?

VI. Need for the Study

A number of reasons may be offered to support the need for the current research into suicide rate differentials within the elderly female populations of industrialized countries. First, current research is deficient in a number of areas. For example, most research on suicide is descriptive. This limitation bolsters the need for completion of more extensive study aimed at prediction (MacKinnon, 1977), a sentiment also held by Shneidman (1976). According to Murphy (1983b), our ability to predict suicidal events is insufficient at this time. By completing analytic inquiry into suicidal behaviors our knowledge of precursors of suicide should increase. Finally, Snyder (1977) has suggested that investigations of suicide be conducted using a macro-level analysis of cultural data. By doing so, we are afforded a broader sociological view of possible correlates of self-destruction.

Another issue of importance with regard to empirical examinations of suicidal behaviors relates to the methods in which mortality statistics are collected and reported. According to Whitehead, Johnson, and Ferrence (1973), investigations into self-injury should take into account factors which potentially contribute to underreporting. Such factors include international variations between definitions and social perceptions of suicide, differences in ascertainment procedures, and the magnitude of social stigma toward self-destruction. By examining these issues, the researcher has a more valid view of rate differentials between regions of the world and stronger support for evaluating the influences of social causation and social construction variables on suicide statistics.

Finally, suicide should be viewed as a public health concern. According to WHO (1974), more than 1,000 individuals across the world take their own life each day. To rationally allocate scarce resources of suicide prevention, we must identify both the high risk groups and assumed determinants of suicide (Lui, Martinez, and Mercy, 1990).

VII. Basic Assumption

The use of official suicide statistics for scientific research has been criticized for a number of years. Many authors have dismissed their usefulness based upon differing ascertainment procedures, rate variability, and social stigma toward suicide. However, according to the literature, reported rates of suicide appear to be reliable and appropriate for use in international epidemiological research. This was found to be the case in the preliminary examination discussed in Chapter II (see the section titled "Assessing Reliability"). Thus, the present study was completed with the following assumption: suicide data reported to the World Health Organization for the years 1988-1990 were reliable.

IIX. Delimitations

Countries were included in this study if they fulfilled all of the following criteria.

1. The country reported suicide rates for females aged 65-74 and 75 and over to the World Health Organization for the years 1988, 1989, and 1990.
2. Annual average population estimates were greater than one million for the years 1988, 1989, and 1990.

3. The Overseas Development Council classified the country as developed based upon a per capita gross national product of $2,000 or greater and a physical quality of life index of 90 or above.

IX. Limitations

Limitations encountered in this study included the following.

1. Some data, previously examined in other research, is not available for all 20 countries or during the years under investigation.

X. Definitions

The following definitions were operationalized for purposes of this study:

1. ***Elderly*** - individuals aged 65 years of age and older.
2. ***Misclassification*** - the error of counting and classifying a death by suicide under another cause of death category (such as accidental poisoning, accidental drowning or other violence).
3. ***Physical Quality of Life Index (PQLI)*** - a measure developed by the Overseas Development Council aimed at summarizing many aspects of well-being. The PQLI is composed of infant mortality at age one, life-expectancy at age one, and literacy (Sewell, 1980).
4. ***Sensitivity of Suicide Certification*** - the percentage of suicide deaths that are certified as suicides.
5. ***Social Causation*** - the idea, proposed by Pescosolido and Mendelsohn (1986), that regional differences in social variables, such as religion, unemployment, and demographic characteristics are associated with regional differences in reported rates of suicide.

6. ***Social Construction*** - the idea, proposed by Pescosolido and Mendelsohn (1986), that regional differences in the manner in which suicide data are collected and reported are associated with regional differences in reported rates of suicide.
7. ***Specificity of Suicide Certification*** - the percentage of non-suicide deaths that are certified as non-suicides.
8. ***Systematic Misreporting*** - misclassification of true suicides into other cause of death categories resulting from trends in collection and reporting of data.

CHAPTER TWO: REVIEW OF LITERATURE

I. Introduction

Even though the correlates of self-destructive behaviors have been of interest to researchers since the 1800's, mainstream inquiry into the issue of suicide and attempted suicide originated in the mid-1950's (Egmond and Diekstra, 1990). Much of this research has incorporated three categories of variables: somatic, social, and psychological-psychopathological, with prediction being a primary concern. Researchers have examined the underreporting of suicide statistics (Malla and Hoenig, 1983), the overall validity and reliability of mortality data (O'Carroll, 1989), suicide misclassification (Kolmos and Bach, 1987), potential sources of error in coding suicides (Kelson and Farebrother, 1987), and the impact of differing ascertainment procedures on reported rates of suicide (Sainsbury and Barraclough, 1968). Research into the relationships between suicide and latitude, longitude, and the weather (Lester, 1986), the assassination of President John F. Kennedy (Biller, 1977), wartime suicide stories and suicide rate (Stack, 1988), and the quality of life in industrialized nations (Lester, 1990b) has also been completed.

A great body of research is available concerning suicide. However, little has been written specifically acknowledging rate variations among elderly female populations, relative to younger (McIntosh, 1992) or overall populations. In the following sections, theories of suicide, ecological correlates of suicide behavior, issues of data quality, and the prediction of suicidal events will be examined.

II. Theories of Suicide

Suicide theories abound. Yet, the origin of suicide, its cause and circumstances are still largely estranged from the researcher. However, Stack (1982) examined published sociological research between 1970 and 1980 and identified four common theoretical frameworks that were used in the examination of suicide: cultural explanations, economic approaches, modernization theory, and social integration. Other theories of suicide include biological, characterological, cognitive, psychodynamic, and sociological approaches (Carpenter, 1993), with the latter being of prime interest in this study.

Much of what has been written about theories of suicide can be attributed to two individuals: Sigmund Freud and Emile Durkheim. Freud's interest resided primarily in the psychological domain, while Durkheim took a sociological and, thus, more ecological view.

However, predating the work of both Durkheim and Freud, Morselli (1975) gave birth to the tradition of examining suicide on an international-comparative basis. He examined self-destruction in terms of cosmic or natural, biological, psychological, and social influences on the individual. From his examination of these factors, he was convinced of the nexus between competition and social evolution, and the inclination toward suicide. He theorized that "suicide is an effect of the struggle for existence and of human selection which works according to laws of evolution among civilized people" (p. 354).

Following Morselli, Durkheim (1951) viewed suicide as a product of social mechanisms, such as religion and divorce, which operated within a society. From this, he proposed that the level of suicide in a particular region was inversely related to the level of social integration and social regulation placed on

the individual by social norms. He defined these two components by discussing three types of suicide. Classified under the heading of social integration, altruistic suicide occurred when the individual was stripped of the "self" and engulfed by the essence of culture. Japanese Kamikaze fighter pilots during World War II are prime examples. Here, the individual was believed to be so integrated into his or her environment, life was gladly sacrificed for the good of others and country. At the other extreme, Durkheim discussed egoistic suicide. Characterized by low social integration, egoistic suicides occur "when man no longer finds a basis for existence in life" (p. 258). Society does not offer the connectedness between person and environment needed to prevent suicide.

Anomic suicides were discussed in relation to social regulation. With anomie being defined as social normlessness, anomic suicides occur in situations where man's activities are not regulated effectively by the social structure in which he lives. Durkheim believed this regulation necessary as the organism was unable to naturally restrain the self.

Recognizing many of the deficiencies in Durkheim's theory, Gibbs and Martin (1958) constructed the theory of status integration of suicide. The authors took Durkheim's social integration component and operationalized it into "stability and durability of social relationships within populations" (p. 141). They proposed to measure these constructs by examining social roles and compatibility of various roles. It was believed that role conflict within society was associated with the probability of suicide.

On the other hand, Henry and Short (1964) saw suicide as being related to social structure. They attempted to develop a common theoretical framework to incorporate knowledge and theories of aggression; suicide and homicide as

related to social status and the strength of the relational system (the relationship individuals have with each other through mechanisms such as marital status and urbanization). They hypothesized a positive relationship between suicide and social status, and a negative relationship between suicide and the strength of the relational systems found within a particular region.

Theories from diverse backgrounds have been used to examine suicide. For example, Lester (1990a) related the economic theory of choice to suicidal behavior. In examining mortality patterns in postwar Britain, Brenner (1983) incorporated the economic change model of mortality. Succinctly put, this model assumed that the salient factors in mortality patterns stem from changes in national economic stability. Lester also examined suicide in relation to a social deviancy theory (1993b) and critical mass theory (1993a). With regard to the ecological perspective, Douglas (1967) has discussed three categories of suicide theories: those that emphasize social action (for example, suicidal behavior), interdependence of social units as cause of social action, and the meanings (or values) involved in social integration as cause for social action.

A Theoretical Framework: Social Construction And Social Causation

The theoretical constructs used in this study are aimed at taking both substantive and artifactual properties of reported suicide rates into consideration. Pescosolido and Mendelsohn (1986) were the first to systematically examine the impact of both social causation and social construction variables on reported rates. Using 404 county groups in the Continental United States, they studied two hypotheses. First, they tested the hypothesis that coefficients of true social correlates of suicide, such as divorce and religion, were biased by systematic misreporting. A second hypothesis was

also examined: when official rates of suicide are adjusted to take into account misreporting, no relationship between social correlates and suicide would be evident. The authors also examined the potential influence of legal and organizational factors, such as the type of systems used to classify deaths (ie., coroner systems, medical examiner systems) and the appointment of officials responsible for determining cause of death, on reported rates of suicide. They concluded from their findings that, even though systematic misclassification does affect reported rates, this effect was minor and did not obstruct their ability to examine reported rates of suicide in light of social causation factors.

III. Ecological Correlates of Suicidal Behavior

Historically, a great deal of research has dealt directly with suicide and social causation, generating categories of factors which seem to be highly associated with self-destructive behaviors. Such categories include population structure, economic factors, and social conditions. Even though a plethora of research is available concerning correlates of suicide, it is difficult to compare many of these works, critically, in relation to the purpose of this study. According to Lester (1974), studies tend to use different samples of nations and only a few of the potential causative variables. Also, it is important to realize that, in most of these examinations, specific mention of the elderly female is absent or minor. A good example of this is a study conducted by McCulloch, Phillips, and Carstairs (1967). As part of a follow-up study, the author investigated the geographical aspects of suicide in Edinburgh, Scotland, during the period between January 1963 and December 1965. More than 30 variables were examined. After preliminary analysis of the data, the authors state that "since no differences in the sexes were obtained for age distribution and since the sex ratio was almost

at parity, we felt free to treat the sample as a whole." (p. 315) rather than adjusting for age and sex. The highest correlations found were between suicide and overcrowding and acts of self-poisoning and other forms of self-injury. Also, Jarvis, Ferrence, Whitehead, and Johnson (1982) conducted a study of self-injury in London, Canada. Data on thirty-nine variables were collected and factor analyzed. Four meaningful factors associated with self-injurious behaviors were reported: socioeconomic status, blue-collar familism, stability-mobility, and living arrangements. Specific mention of the elderly female was not made. The following sections will examine historical correlates of suicidal behavior, making specific mention of the elderly female when possible.

Suicide and Homicide

Suicide has often been examined in relation to other forms of injury. For example, it is often thought that suicide and homicide are, in some ways, associated. Accordingly, in 1974, Lester reported the findings of a cross-national study designed to investigate the relationship between the two. He concluded that homicide and suicide were associated with different variables; suicides were associated only with the number of psychiatric patients reported for each country, birth rate, and percentage of young persons in the society. Using data from 1970 for the United States, Lester (1985) explored the regional variations of homicide (outwardly directed violence) and suicide (violence directed inward). He reported a number of characteristics of cities that exhibited an inwardly violent status: less poverty, low population density, low percentage of blacks, cold climate, and being located in the north and west regions of the United States. Again, it is possible to characterize homicide and suicide using different variables.

Lester (1989) also studied the relationship between suicide and homicide rates for 1970 and 1980 in 18 industrialized nations in relation to a group of demographic and social variables. Five factors emerged from factor analysis. Factor I appeared to tap wealth, Factor II, youthfulness of the nations, Factor III female economic equality, Factor IV, population density and female social inequality, and Factor V, low urbanization and religiosity. The reported rates of suicide from his sample were correlated with both the youthfulness of the nation and female economic equality.

Quinney (1965) collected suicide and homicide data for 48 developed and underdeveloped countries between the years 1953 and 1960, as well as information relating to urbanization and industrialization. He found that suicide rates tended to be high and homicide rates low in nations with high levels of economic development. In countries with low levels of economic development, the opposite was seen. These findings applied to each age and sex category examined, one of which was the female, 60 years of age and over. However, these findings may be thwarted by the idea that rates, especially suicide rates, reported by less developed regions of the world may be deficient because of inadequate reporting systems.

Population Structure

The structure, as well as demographic characteristics, of various populations have been cited as important determinants of suicide. This association was recognized in 1955 by Sainsbury. The author examined ecological correlates of suicide in 29 boroughs in London, England. He discovered significant associations between unadjusted rates of suicide and the percentage of persons

living alone (r=0.56), and the percent of borough population composed of immigrants (r=0.37).

Ahlburg and Schapiro (1984) studied suicide more in terms of population census data when they examined reported rates of suicide in relation to a relative cohort size (RCS) defined as the ratio of the number of males aged 16-29 to those aged 30-64 in the United States for the years 1948 through 1976. They reported that a shift in RCS had an impact on rates of suicide among both sexes. Utilizing two dependency ratios (the ratio of the number of individuals less than age 15 to those aged 15-64 and the ratio of individuals over age 65 to those aged 15-64), Lester (1973) examined suicide and population structure in 28 nations. He found that with more young dependents in a nation, national homicide rates were higher than suicide rates. On the other hand, with more elderly dependents, nations generally reported higher suicide rates and lower rates of homicide. Lester has also examined other components of population structure, such as population density and the percentage of the total population considered urban. In a study of 18 nations, the author found that neither variable served as a significant predictor of the suicide rate (Lester, 1989). Yet, a variable similar to density and urbanization, overcrowding, was found to be significantly correlated with suicide in a London, England study completed by Sainsbury (1955).

Economic Factors

Economic components of a region, level of development, employment, and female labor force participation, have often been viewed as prominent correlates of self-destructive behaviors. Kushner's (1991) statement with regard to the United States, that since the 1890s, the idea that one price paid by society for

economic crises is an increase in reported suicides, has been widely accepted and has been generalized to other countries. Examining the relationship between injury mortality and socioeconomic development of all nations in the Americas, Africa, Asia, and Oceania, Wintemute (1986) found essentially no relationship between reported mortality rates from injury and socioeconomic development.

Araki and Murata (1987) investigated sex-specific seasonal trends of Japanese suicide data in relation to socioeconomic conditions. They found that suicide death rates for both sexes fell during periods of economic prosperity and rose during periods of economic crisis. Their findings suggested that changes in socioeconomic conditions have some influence on rates of suicide. This influence appeared to be greater on the male than on the female. It should be noted that this may not hold true for countries other than Japan or for different age groups. Zimmerman (1987), examining a more specific indicator of national development and well being. Using data from the United States, he found a relationship between suicide and per capita welfare expenditures ($r = -0.45$) for all 50 states and a -0.27 correlation between state suicide rates and the percentage of individuals aged 65 years or greater. However, after adjustment, welfare expenditures did not appear to be important with respect to state suicide rates. The author did, however, find a significant correlation between suicide and annual income between $10,000 and $19,000. Similarly, gross national product, the amount of total national expenditure, has also been incorporated into the study of suicidal behavior. However, Yang (1992) examined national expenditure per person, and found that it had no significant impact upon reported rates of suicide within the U.S.

A principal variable with regard to economic conditions has been that of unemployment. Boor (1980) collected reported suicide data from Canada, France, the Federal Republic of Germany, Great Britain, Italy, Japan, Sweden, and the United States. Unemployment data were also collected for the years 1962-1976. Significant correlations between the annual variation in suicide and unemployment were obtained for the United States, Canada, Japan, and France ($r = 0.79, 0.51, 0.53$, and 0.64, respectively). However, for older age groups, these two variables were not significantly related for any country. Perhaps this was the case because of mandatory or voluntary retirement in later life.

Contrary findings related to unemployment, however, have also been reported. Using data obtained for Quebec, Canada from 1966 to 1981, Cromier and Klerman (1985) looked at the association between unemployment and suicide. They found that yearly fluctuations in the reported rate of unemployment were associated with concomitant fluctuations in the reported rate of suicide. The largest percentage increase in suicide was reported among the 15-19 and over 64 age groups.

In a more broad-based study, Brenner (1983) examined economic, social, and environmental health risk factors in association with mortality statistics from postwar Britain. The mortality categories examined included infant mortality, cardiovascular, cerebrovascular, and heart diseases, cirrhosis of the liver, suicide, homicide, and motor vehicle accidents. All were based on unadjusted rates. He found that economic growth, and growth and stability of health services were beneficial to postwar mortality patterns in England and Wales, and Scotland, while a high rate of unemployment had a detrimental impact.

Yang (1992) hypothesized that a number of economic and social factors could influence reported suicide rates. These factors included per capita gross national product, unemployment, divorce, percent population Catholic, and the female labor force participation rate. United States' data were utilized for the period 1940 to 1984. For the overall rate of suicide, all independent variables were significant at the 5 percent level. However, after adjustment, the associations between suicide among white males and the gross national product, proportion of the population that was Catholic, and the rate of female labor force participation were not significant. Divorce and unemployment, however, did impact male rates of suicide. For white females, on the other hand, unemployment did not appear to have a significant effect on reported rates. Further, Yang reported that when real income on a per capita basis increased by one percent, the suicide rate decreases by .11 percent. The divorce rate seemed to be the strongest variable in terms of absolute influence on overall suicide rates for all social groups examined.

Social Conditions

Social conditions may be the most relevant factor with regard to environmental influences on the incidence of suicide (MacMahon, et al.,1963). This is undisputed given the consistent differences in suicide rates between countries, changing sex differences, and disparate age distributions (Monk, 1986).

One salient social condition discussed within the literature is female labor force participation. (This variable is often examined under the heading of economics, yet it also possesses a social equality facet. This latter view will be adhered to in the present study.) For example, Stack (1987a) examined suicide

data for females aged 20 to 39 between the years 1948 and 1980 in the United States. He found that as the number of females in the labor force increased, the suicide rate for this age group doubled. Yang and Lester (1988) hypothesized that the participation of married women in the labor force in the United States would be positively related to suicide rates (as one variable increased or decreased in value, the other does likewise), and that such participation would correlate negatively with reported rates of homicide (as one variable increases in value, the other decreases). The first hypothesis was accepted, but only for the reported rate of suicide among females. The authors also reported three variables that served as predictors of the female suicide rate: divorce, urbanization, and the amount of interstate migration.

Stack (1983) investigated data collected from 25 different countries and found that female equality tended to increase rates of suicide. Yet, when levels of development and gender equality were controlled, a high level of religiosity tended to decrease the suicide rate. Stack also reported that there was no evidence that elderly cohorts were more affected by levels of religiosity than younger cohorts.

With regard to European countries, Sainsbury, Jenkins, and Levey (1980) hypothesized that a set of social variables and changes in them would predict the size and direction of suicide rates. Previous works exploring the relationship between suicide and indicators of social integration and disorganization were examined, yielding 15 variables suitable for inclusion in their study. The authors report that the factors having the most influence in determining changes in the incidence of suicide in the European countries examined from 1961 to 1963,

were those relating to the changing status of women, increasing anomie or societal normlessness, and socioeconomic change.

Ecological comparisons have also been made between the United States and Hungary. Lester and Moksony (1989) collected data for both countries on seven variables for the year 1980. They included the overall crime rate, violent crime rate, and divorces per 1,000 for women greater than age 15. Other variables examined were the ratio of the total number of men to the total number of women, percentage of individuals aged 15-39, percentage of people 15-19 who did not complete elementary school, and the percentage of people aged 60-64 who did not complete elementary school. The data were then factor analyzed. The Hungarian data yielded one social indicator associated with the overall suicide rate: divorce. In analyzing U.S. data, the five social indicators found to be correlated with suicide were the crime rate, divorce rate, ratio of males to females, percentage of young adults, and lack of education in the elderly.

Durkheim was the first to systematically define religion as a key component in suicide completion. Others have followed in this tradition. For example, Stack (1980) examined suicide data from 1970 in all 50 U.S. states in relation to Catholicism, religiosity, and divorce. The concept of Catholicism was operationalized as the percentage of state populations that were Catholic and that of religiosity as the proportion of individuals who attended Catholic schools. Religiosity, a proxy for religious commitment, appears to be a better indicator than religious affiliation or church attendance (Nelson, 1977). Stack found that the rate of divorce showed the strongest correlation with suicide ($r = 0.76$). From his findings he remarked that "we can tentatively conclude that states with high

divorce rates, low proportions of Catholics, and low proportions of children enrolled in Catholic schools will have relatively high suicide rates." (p. 68)

Another study by Stack (1991) examined data on suicide rates from Sweden for the years 1951-1980 for the total population, all males, all females, and the age group 15-29 in relation to a second measure of religiosity: religious book production as a percentage of all books produced. It was reported in this study that religious trends were unrelated to the general male and female rates of suicide, but were related to the suicide rates of younger populations.

Finally, Giesbrecht and Dick (1993) examined annual alcohol consumption patterns and unadjusted male and female mortality figures for cirrhosis of the liver and 12 accidental and violent causes of death in six nations between 1965 and 1987. In most areas examined, an unlagged correlation (the relationship between different variables collected for the same period of time) between cirrhosis and alcohol consumption was not significant. Yet, the authors reported that the suicide-alcohol intake correlation was consistently significant. The authors do remark, however, that "it is possible that acute complications [such as suicide] are affected more by external factors than chronic alcohol casualties" (p. 875) making any relationship between suicide and alcohol consumption spurious in nature. Farber (1979) has speculated that one of the causative factors associated with high suicide rates in France is an exceptionally high rate of alcoholism. Smart and Mann (1990) have also examined the impact of alcohol consumption on reported rates of suicide for Ontario, Canada. The authors reported that suicide rates for males, females, and the total population were strongly correlated with per capita alcohol consumption during the period 1963 and 1983. These correlations were markedly reduced during a period of

alcohol consumption stabilization (1975-1983), where it was reported that female suicide rates decreased by 28 percent and male rates increased slightly by four percent. One may be tempted to see alcohol consumption as having a larger impact upon female suicide rates than male rates, yet, external factors, such as high unemployment rates among females, and a decline in the use of tranquilizers and barbiturates (two drugs which may interact negatively with beverage alcohol) may be more important in determining risk.

Conclusion

It is apparent from this review that only a few social causation variables have consistently been labeled as prominent. For example, divorce, religion, female labor force participation, alcohol consumption, unemployment, and population structure have been mentioned in a number of examinations and seem to offer the best theoretical foundations on which to build further research. Yet, with attention toward the elderly female sub-populations in this study, this theoretical structure may not be appropriate due to the inability to examine individual-level behaviors when using aggregate-level data. However, this study will examine traditional correlates of suicide in terms of the elderly female.

IV. The Quality of Mortality Data

The quality of mortality statistics has been an important issue in suicide research for some time. Lopez (1992) has commented on the positive aspects of utilizing official mortality statistics when investigating suicide rates. For example, the data are generally available, all ages and both sexes are included in mortality tabulations, deaths tend to be medically certified, and a common standard is applied when defining cause of death. Yet, a number of important questions remain unanswered.

Holinger, Offer, and Ostrov (1987) have listed two methodological problems with official mortality statistics which reflect violent deaths, including suicide. They are the under and over-reporting of suicides, and errors in mortality classification. Both problems involve misclassification. This occurs when cause of death is wrongfully allocated to a particular cause of death category. Misclassification is particularly problematic when it occurs systematically. Pescosolido and Mendelsohn (1986) believe systematic misreporting to be the most detrimental factor in data quality.

The reliability and validity of reported suicide statistics are also issues which must be evaluated when studying the quality of mortality statistics. Measures of reliability reveal the extent to which suicides are consistently reported over time and between populations. Validity, on the other hand, measures the accuracy of reported rates. Validity of reported statistics may be viewed in terms of two different properties: specificity and sensitivity. The specificity of suicide certification refers to the degree to which non-suicide deaths are registered as non-suicides. Misrepresentation of suicide statistics due to problems of specificity appears to be negligible, however (Sainsbury, 1983). On the other hand, the sensitivity of suicide certification refers to the degree to which true suicides are correctly registered. The problem of sensitivity is of major concern when evaluating reported suicide data.

Reliability of Suicide Statistics

Sainsbury (1983) has stated that the reliability of suicide statistics is subject to error through variations in the manner in which suicides are defined and reported. According to Egmond and Diekstra (1990), there appears to be little or no consensus as to the definition of suicide or attempted suicide. Monk (1986)

agrees, stating that estimates of the number of suicides in a region are influenced by problems relating to definition and acknowledgment of suicidal acts, thus leading to suicide underreporting.

Many attempts have been made to operationalize the concept of suicide. Bagley and Ramsay (1985), in a study of suicidal ideation and successes, defined suicidal behavior "as including the expression of suicidal ideas, acts of deliberate self-harm without a clear intention of self-killing, attempted suicide, and suicide itself" (p. 63). Suicide may also be defined as death from intentional self-inflicted harm. Yet, applying this definition is difficult due to problems associated with the assessment of intention. Determining intent requires a retrospective examination of information about the decedent's state of mind (O'Carroll, et al., 1991). This type of information is not always available. Yet, Durkheim emphasized the importance of including inferential judgments in determining cause of death (Virkkunen, 1974).

Underreporting of suicide statistics occurs when deaths that are truly due to suicide are not counted as such. A number of rationales have been offered for this occurrence. For example, underreporting may be due to a number of administrative characteristics surrounding data collection and analysis. Moans (1985) examined suicide data reported by Belgium for the periods 1968-1972 and 1978-1981. He found evidence of inconsistencies in reporting procedures between various geographical regions and over time. Similarly, a study was published in 1974 by WHO examining the potential bias in reported rates due to differential ascertainment procedures between countries. The authors, Brooke and Atkinson, obtained survey data from 24 countries. They concluded that there was a general lack of uniformity in the ascertainment process among the

countries examined. Differences were reported in a number of areas. The title of those responsible for making the cause of death decision, their qualifications and training, their appointment and control by superiors, whether they were full- or part-time employees, and resources available to them in making their decisions were some of the differences the authors reported.

Administrative and legal requirements surrounding death certification may also influence suicide reporting. Changes in the International Classification of Disease (ICD) are an example. The ICD serves as a guideline for classifying causes of death. In 1955, the ICD included no obscure classification. However, by 1965 obscure deaths formed their own category (Virkkunen, 1974). This change would appear to make it easier for those reluctant to certify death as suicide to misclassify these deaths. A question should be asked as to the impact of such change on reported rates of suicide. Also, prior to 1968, the ICD did not include an undetermined category. After its inclusion, self-inflicted deaths were not deemed as suicide unless the one certifying specified intentionality (O'Carroll, 1989) which, as already discussed, is a difficult task.

Even though a great body of literature discusses the uncertainties of suicide statistics, Sainsbury and Barraclough (1968) tend to be less concerned. They examined the potential influence of differing ascertainment procedures, on reported rates of suicide, among 11 countries. The suicide rates of immigrants from different countries were examined in relation to reported suicide rates for their country of birth. A product-moment correlation coefficient of 0.87 between the suicide rates of foreign-born individuals residing in the United States and the suicide rates of their birth country was reported. The authors concluded that differences in suicide rates occurred in spite of variation in reporting procedure;

that is, not all differences were artifactual. Lester (1987) examined the reported rates of suicide for 14 European countries between 1875 and 1975. He found a correlation of 0.42 between rates reported for each year, and stated that ascertainment has a minor impact on official suicide statistics.

Along with definitional and reporting concerns, there are also several potential sources of error associated with the manner in which deaths are coded (Kelson and Farebrother, 1987). In examining cancer mortality statistics, the authors concluded that diagnoses were limited by the failure of the recorder to mention the underlying causes of death, to correctly specify the nature and site of disease, and to properly sequence the diagnosis. In 1992, McKelvie (1993) examined 132 autopsies completed in an Australian hospital. In 12 percent of the total cases he found major discrepancies between the cause of death listed on the death certificate and the autopsy report. Voorde, Hooft, and Mulkers (1993) compared two sources of death registration in Leuven, Belgium, for the years 1981-1984. They examined death certificate information and files from the public prosecutors office, which, theoretically, should have contained the same data. They found that, even within the same geographical region, reporting bias was evident. For example, the incidence of suicide varied between the two sources by between 4 and 8 percent, while the content variation ranged between three and thirty-four percent.

With emphasis on the type of system responsible for determining cause of death, the World Health Organization (1974) reported differences between persons responsible for determining cause of death in England and Wales, Sweden, and Denmark. Inquests into unnatural causes of death were conducted by a coroner, who, for the most part, was not medically qualified. Within these

regions, the coroner applies legal criteria when determining cause. On the other hand, in Denmark and Sweden, officially appointed medical professionals determine cause like any other diagnoses. Likewise, ascertainment of death in Belgium is restricted to the medical profession (Voorde, et al., 1993), where deaths are coded provincially (Moans, 1985) and in Scotland, the Form Eleven (death certificate) is completed by any medical practitioner who attended the deceased during his or her last illness (Arrundale and Cole, 1991). Such differences may have a bearing on the reliability of suicide mortality data. As an example, according to both Monk (1986) and O'Carroll (1989), legal criteria for determining cause of death is based upon proof. On the other hand, a medical diagnosis of cause of death relies more heavily upon the balance of probabilities. Suicide rate validity may also be affected because of differing ascertainment procedures. Such disparities have the potential to decrease between-country comparability of suicide data.

O'Carroll (1989) has offered three potential reasons why suicide ascertainment procedures vary by region. First, medical examiners are rarely adequately trained to evaluate specific psychological and intentional factors related to a death. Second, intention requires "inside" information from family members and friends of the deceased, which is not always available for examination by investigators. Finally, the amount of data required by those responsible for determining cause of death as suicide may vary greatly.

Assessing Reliability

Speechley and Stavraky (1991) have discussed three ways of estimating suicide underreporting: the experimental, reclassification, and reformulation approaches. The experimental method tests the consistency with which medico-

legal officials determine cause of death in order to ascertain the level of agreement between true causes of death and information listed on the death certificate. Reclassification relies upon investigators with psychiatric expertise. Death certification records are examined to determine whether death could possibly have been due to a self-inflicted injury. Finally, reformulation involves the addition of various death classifications, which appear to be suspect for suicide misclassification, to the suicide classification. An example of this task is offered by Kolmos and Bach (1987). The authors examined 11,207 deaths in Norway, Denmark, Finland, and Sweden, of which 4,441 were reported as suicide. In an attempt to understand the potential of misclassification, suicide statistics were combined with accident and indeterminate categories, yielding a new combined rate of all three causes. The authors found that for females, the rank order of countries based upon the two indices (the suicide rate and the combined rate) did not change.

Similarly, to evaluate the potential for error caused by suicide misclassification in this study, the author completed a reformulation exercise. He used reported suicide rates, rates of accidental poisoning, accidental drowning, and the other violence category (composed of injury of undetermined intent and deaths due to acts of war) reported to WHO for the years 1988-1990 (WHO, 1989, 1991, 1992, 1993, and 1994). These classifications were chosen because they appear to be problematic with regard to suicide misclassification. Speechley and Stavraky (1991) have reported that suicide underreporting is probably higher among cases of drowning and poisoning. Rockett and Smith (1994) believe injury of undetermined intent to be suspect for systematic suicide

misclassification as well. Barraclough (1973) has also discussed the potential of this category to contain equivocal suicides.

The population of interest in the current study comprised individuals over the age of 64 years. Twenty countries were examined. For the years 1988-1990, suicide data were combined with accidental poisoning, drowning and data from the other violence categories to yield a combined rate. The other category was comprised only of undetermined injuries as no deaths due to acts of war were reported for any country in this study over the three year period. A two-tailed Spearman Rho correlation technique was utilized (Table 2.1). Computations were completed for the total elderly female population (ages 65 and greater), females 65-74 years of age, and females 75 years of age and over. Country rank did not change significantly when the suicide rate was compared with the combined rate. The lowest coefficients obtained were .95 for females 65-74 and 75 years of age or over. It would appear from these results that international comparisons of reported suicide rates for the elderly female are not rendered unreliable due to data misclassification.

Validity of Suicide Statistics

A number of issues have been proposed which potentially influence the validity of official suicide statistics. For example, individuals with restrictive attitudes toward suicide (views of suicide as a sign of weakness or an offense against religious dogma) who are responsible for determining cause of death tend to record fewer suicides (Kolmos and Bach, 1987). There is also the issue of preserving confidentiality (Lopez, 1992). Physicians may be reluctant to report particular causes of death that may be harmful to the memory of the deceased or to survivors. Causes of death which may be misreported for these

Table 2.1*

Spearman Rank Order Correlation Coefficients Comparing the Reported Annual Average Rate of Suicide to the Combined Rate of Accidental Drowning, Accidental Poisoning, Other Violence, and Suicide per 100,000 for Females in Twenty Developed Nations, 1988-1990

Age Group	Correlation Coefficient
Females 65+	0.96
Females 65-74	0.95
Females 75+	0.96

*Source: World Health Statistics Annual, 1989, 1991, 1992, 1993, and 1994

reasons include cancer, tuberculosis, suicide, and various sexually transmitted diseases. Whitehead et al., (1973) reported with regard to self-injury in London, Canada, that a number of factors may be responsible for suicide underreporting. Some of these are physician reluctance to certify cause of death as suicide, deaths involving a combination of pills and alcohol, the perceived seriousness of the case, age of the decedent, and the physician's lack of historical knowledge about the patient.

Maxwell (1986) has offered that the presence of particular religious and cultural factors within a population act as barriers to compiling valid suicide statistics as well. More specifically, coroners and medical examiners may be reluctant to certify cause of death as suicide due to religious, financial, or political reasons (O'Carroll, et al., 1991). A prominent example of systematic misreporting of suicide data due to personal views of self-destruction is summarized by Voorde et al., (1993) who reported that "the Nationale Raad of the Orde der Geneersheren [see citation], the highest medical disciplinary organ in Belgium, in 1984 accepted the principle of incorrect declaration of suicide deaths by physician to local registrar."

On a more positive note, Diehl and Gau (1982) surveyed 123 British general practitioners and housemen (medical residents), requesting that they certify cause of death based upon 15 fictitious cases of death provided by the researchers. They found that diagnostic groupings did not differ significantly with regard to region, type of practice, place of training, or sex of the participants. Walsh et al. (1975) examined the factors which potentially influenced Irish coroners to determine cause of death as being suicide, accidental or undetermined. They found that manner of death had a significant

influence on coroner decisions. For example, individuals who died as a result of cutting, hanging, drugs, or gas were more likely to be certified as suicides than individuals who died by other means. Finally, it was reported that those under the age of 40 were more likely to receive a verdict of suicide than older individuals especially those above age 70. These findings are of particular importance regarding the elderly female population.

Atkinson, Kessel, and Dalgaard (1975) examined the differences between the number of suicides reported by coroners in Denmark (a country which traditionally reports high rates of suicide) and England and Wales (which traditionally report low rates). English coroners and Danish medical officials were asked to examine 40 case records and determine cause of death. The authors reported that Danish officials consistently reported suicide as the cause of death more often than did English coroners.

The length of time that a country has been collecting mortality data may also be an issue when considering the validity of suicide statistics. For example, in Scotland, statutory registration of death began in 1855 (Arrundale and Cole, 1991). Yet, it has only been since 1933 that the United States did so (Lester, 1984). One may question the impact that a long history of death registration has upon the quality of suicide statistics as opposed to the efficacy of such registration by countries, which have had limited exposure to data collection procedure.

Sensitivity and Specificity

At present, there is no empirical evidence to deny or support the suspicions that have been raised concerning official suicide statistics (Pescosolido and Mendelsohn, 1968). However, it is generally agreed that suicide is

underreported (Barraclough, 1973). Underreporting of suicides is the primary concern when using official statistics, as over-reporting appears to be negligible (Sainsbury and Jenkins, 1982).

Accordingly, O'Carroll (1989) has estimated that specificity approximates 100 percent. This means that of individuals dying from some cause of death other than suicide are correctly identified as dying from some other cause. On the other hand, he reports that sensitivity estimates range from only 26 to 83 percent, meaning that only between 26 and 83 percent of individuals dying by suicide are actually classified as such. However, Kleck (1988) reported that, for the United States, the maximum likely undercount in reported suicides possible was 26 percent. Even though overcounting is likely to be extremely rare, Kleck stated that when overcounts of suicides were considered, undercounted suicides decreased to less than 10 percent.

One reason for the apparent failure of reported suicide statistics to be sensitive is the ample choice of cause of death categories available to those responsible for recording cause of death. A number of writers have discussed cause of death categories that are suspect for suicide misclassification. Doubtful causes of death may be placed in the suicide category, the undetermined category, or even an accidental category, with poisoning being the area of greatest concern (Atkinson, et al., 1975). Drowning and the unknown cause of death categories also appear problematic (Kolmos and Bach, 1987). Barraclough (1973) stated that the majority of causes assigned to the undetermined category are probably equivocal suicides. Speechley and Stavraky (1991) agree.

The Theoretical Upper-Limit of Suicide Statistics

Because of the potential for suicides to be misclassified, some statisticians suggest that suicide rates be combined with rates of other cause of death categories such as undetermined or accidental causes (especially accidental poisoning and accidental drowning) to arrive at a truer estimate of suicide incidence (Sainsbury, 1983). Malla and Hoenig (1983) examined death certificates registered in Newfoundland for the period 1974-1978. One hundred and three suicides were recorded, plus 104 cases in which no cause of death was mentioned. Of these, 14 were determined by the investigators to be unequivocal suicides and 58 undetermined or uninvestigated causes of death. By adding the newly discovered unequivocal suicides to the previous suicide count, the reported rate increased from 3.8 to 4.25 per 100,000.

Assessing Validity

To further examine the potential for misclassification in the elderly female population for the period 1988-1990, the annual average ratio of the combined rates of suicide, accidental poisonings, accidental drownings, and the other violence category to suicide rates were calculated for elderly females in each country (Table 2.2). The purpose of examining ratios is to examine the possible range of suicide underreporting (Rockett and Smith, 1995).

Data reported by WHO are compiled from death registration systems within each country. The International Classification of Disease is used to schematically classify causes of death based upon available information. One classification system (known as external cause or E codes) is routinely used by WHO to categorize injury deaths. This system, in emphasying the nature of the

Table 2.2*

Annual Average Ratios of the Combined Rate of Accidental Drowning, Accidental Poisoning, and Other Violence to the Suicide Rate per 100,000 by Age, Sex, and Country, 1988-1990

Country	*Females 65+*	*Females 65-74*	*Females 75+*
Australia	0.4	0.3	0.4
Austria	0.2	0.1	0.2
Canada	0.7	0.6	0.9
Denmark	0.2	0.2	0.2
Finland	0.5	0.5	0.5
France	0.4	0.2	0.5
Germany	0.4	0.2	0.5
Greece	1.4	1.3	1.4
Ireland	0.9	0.8	1.3
Israel	1.1	0.6	1.6
Italy	0.4	0.3	0.5
Japan	0.4	0.3	0.4
Netherlands	0.2	0.1	0.2
New Zealand	0.4	0.2	0.7
Norway	0.3	0.2	0.3
Spain	0.4	0.3	0.4
Sweden	0.4	0.4	0.4
Switzerland	0.2	0.1	0.2
United Kingdom	0.9	0.8	1.0
United States	0.5	0.4	0.8

*Source: World Health Statistics Annual 1989, 1991, 1992, 1993, and 1994

event, is most useful for prevention purposes. Non-injury deaths are classicied according to the nature of the condition (N-codes). Homicide (E55) is an example of external cause coding of death. The actual nature of the mortal event may have been a contusion or asphyxiation.

First, age- and sex-specific suicide rates (E54) were collected, along with data regarding accidental poisonings (E48), accidental drownings (E521) and other violence (E56) for the years 1988-1990, the latest data years available. The data for each cause of death category were averaged to allow for annual fluctuations, thus offering some stability to the data. The ratio of the combined rates of accidental poisoning, accidental drowning, and the other violence categories to the rate of suicide was computed for each country included in the study. This was done to examine the theoretical upper-limits of suicide rates. The range of these ratios of the combined rate to the suicide rate of these countries was considerable. For the total elderly female population, it ranged from 0.1 found in Austria, Denmark, the Netherlands, and Switzerland, to 1.4 for Greece. This means that, if all deaths categorized as accidental drownings, poisonings, and other violence were indeed suicides, the suicide rate for the elderly female in the former countries would increase by only 20 percent. The Greek rate for the same population, on the other hand, would increase by 140 percent. The data offered for Greece is in congruence with Phillips and Ruth (1993) in that underreporting is most likely to occur in countries that report low rates. As stated earlier, of the 20 countries examined for the years 1988-1990, Greece reported the lowest rates for both sexes.

To better understand these ratio of suspicious cause of death categories to suicide among the elderly female, sex- and age-specific ratios for all 20 nations

were also computed and examined. The mean annual average ratios of accidental poisoning, drowning, and other violence, taken separately, to suicide for both sexes and ten age divisions, over all countries, were utilized to offer a relative impression of potential misclassification. Because no suicides were reported for either sex for the age groups 0 and 1-4, ratios could not be computed. However, the remaining age divisions yielded some interesting findings.

For all countries, both sexes, and each of the three ratios examined, estimates for the age group 5-14 greatly exceeded estimates reported for any other age division. This is no surprise given that relatively few suicides are reported at ages less than 24 years. However, when this age group was dropped from examination, clear patterns became evident. The annual average mean ratio of the rate of poisoning to the rate of suicide, for all countries, was higher for males than their sex counterpart until age 45-54, after which the female ratio remained consistently greater than the ratio for males, with the greatest increase coming after the age of 65-74. After age 45-54, the male ratio continued to decrease steadily with advanced age. The ratio of other violence to suicide exhibited a similar pattern, however, the decrease among males was less precipitous. The sex-specific ratio for accidental drowning to suicide yielded a quite different pattern, however. Male estimates greatly exceeded female estimates at age 25-34 and tended to remain fairly constant until age 55-64 when an increase, followed by a decease in ratio, was evident. The female ratio, on the other hand, increased prior to age 35-44 and consistently increased with age, exceeding the male estimate prior to ages 65-74.

From this examination, three principles may be discussed: 1) for each ratio examined, male estimates tend to decrease with advanced age, 2) female estimates increase with age, and 3) among females, for all ratios examined, this increase is greatest among the elderly. From this we may speculate that, if the ratios examined are indicators of suicide misclassification, data reflecting female specific statistics appears to be most prone to suicide misclassification, particularly among the aged. Because reported ratios differed markedly among poisoning, drowning and other violence, there would appear to be a need to examined these rates separately within the present study rather than examining the combined rate of all three.

Conclusion

The quality of reported suicide statistics has raised questions in relation to the validity of international comparisons of suicide statistics (Malla and Hoenig, 1983). However, most conclusions based upon epidemiologic examinations of reported rates are probably valid (Speechley and Stavraky, 1991). Sainsbury and Barraclough (1968) agree, stating that national and international suicide statistics are accurate enough to be of scientific value, if properly critiqued.

V. Suicide Prediction

As stated earlier, the prediction of self-destruction has been a primary objective in suicide research. However, there are a number of problems with such endeavors. Suicide is, statistically, a rare event (Murphy, 1983b). This makes the suicidal act difficult to predict (Lester and Yang, 1992). According to Murphy, (1983a) with low base rates, (20 or 30 per 100,000) even a test with extremely high specificity and sensitivity will include far too many false-positive results.

Much of the research surrounding the predictability of suicide has been completed on clinical populations. In a meta-analysis by Egmond and Diekstra (1990), it was reported that while approximately one half of the 176 groups or samples examined in their analysis were completed on entire populations, only 15 percent of the studies utilized greater than 300 subjects. Incidentally, they report that very few of these works incorporate, explicitly, the terminology and criteria set forth by the International Classification of Disease, Ninth Revision (ICD-9) or the Diagnostic and Statistical Manual, III (DSM-III).

Prediction of suicide is an area of continued social concern (Farberow and MacKinnon, 1975), thus warranting its application on an international scale. Pokorny, (1993) states that improvements in base rates, sensitivity, and specificity help significantly in efforts at prediction, issues which receive attention in the present study.

VI. Summary

Three common themes emerge from this review of the literature. First, issues relating to the collection and reporting of mortality statistics are of importance given the concern surrounding the quality of reported suicide data. It would seem that this concern is heightened when examining the elderly female population. Secondly, demographic, economic, and social indicators appear to have an influence on reported suicide rate differentials both within and between different regions of the world.

Given that very little research has been completed which specifically examines reported rate differentials in the elderly female population, traditional variables may not prove to be key elements associated with suicide among this population. The following issues will be examined in this study: 1) the quality of

officially reported suicide rates in the elderly population, 2) sociocultural influences on suicide rate variation, and 3) the predictability of suicide.

CHAPTER THREE: DATA AND METHODS

I. Introduction

The purpose of this chapter is to describe the methodology used in this study. Discussed is the ecological research method, the manner by which countries were selected for the study, the process of locating data sources, data collection, the statistical manipulation of the data, and the regression model.

II. Ecological Methodology

Geographical or ecological epidemiology may be defined as the description of spatial patterns of the incidence of disease and mortality (English 1992). Simply put, ecological studies examine the incidence of disease in terms of population characteristics as opposed to individual characteristics. This method has also been defined as the use of areal data as a substitute for individual data (a problem later discussed), the development of spatial or regional differentiation with regard to disease patterns, and as a tool used in the examination of the impact of the environment on behavior (Moksony, 1990). Morgenstern (1982) listed four types of ecological study design: exploratory, multiple-group comparisons, time trend analysis, or a hybrid of the three.

Like other methods of research, ecological investigations possess both advantages and disadvantages. Because of their aggregate data structure ecological studies exploit large differences in exposure among populations, avoid individual exposure measurement constraints, and are relatively simple and cheap. Also, large biases (the systematic disparity between truth and what is actually measured) may not be a problem in many ecological studies (Piantadosi, Byar, and Green, 1988). English (1992) has reported that

ecological studies are less prone to effects of random error (the introduction of chance into variable measurement and reporting), yet are more prone to the problem of confounding.

Random error is not especially problematic in ecological studies because of the aggregate nature of the data examined and the assumption that random error will increase or decrease variable indices equally across regions. Confounding, on the other hand, occurs when an extraneous variable is associated with both the disease or injury of interest (in this case suicide) and an exposure (such as unemployment). This problem within the ecological framework is exacerbated by the lack of control that researchers have over such variables and the difficulty of identifying potential confounders.

Ecological investigations also exhibit problems not found in individual-level research. For example, predictor variables tend to be more highly correlated at the aggregate-level than at the individual-level of analysis, leading to multicolinearity (Morgenstern, 1982). In multiple regression analysis, multicolinearity occurs when some of the independent variables are highly correlated with each other (Last, 1988). Such correlation has the potential of producing inaccurate coefficient estimates and therefore generating biased research findings. Finally, an investigator who attempts to examine a problem ecologically is not at liberty to randomize exposures and examine the exposure effect on some outcome variable. Therefore, care should be taken to identify, measure, and control potential confounders when conducting an ecological analysis (Greenland and Robins, 1994b).

Other methodologic deficiencies of the ecological design have been discussed. A salient topic which arises frequently is the utility of study findings.

Geographical studies cannot determine the behavior of individuals (English, 1992; Robinson, 1950) due to the fact that all members of a particular region are assigned the same level of exposure. Thorndike (1939) has commented that if the ecological correlation coefficient between two variables, say A and B, is equal to K, the individual-level correlation between the same variables, a and b, is usually not equal to K and is indeed much closer to zero. Yet, Goodman (1953) has speculated that under special circumstances regression analysis between variables, based upon areal or group-level data, may be used to infer or predict individual behavior. Firebaugh (1978) has discussed similar possibilities, but, in general, this is not the case.

Making individual level statements based upon aggregate level data has been termed the ecological fallacy. An ecological fallacy is committed when a researcher overstates research findings by inferring individual behavior based upon the findings of ecological analysis (MacKinnon, 1977). This issue was first addressed by Robinson (1950). His seminal work illustrated the problematic nature of using aggregate level data to infer individual level behaviors.

A slight disagreement with regard to the substantiveness of ecological investigations has recently developed between Cohen (1994) and Greenland and Robins (1994b). Cohen believes that "the view that any ecological study should be rejected automatically is indefensible." (p. 768). On the other hand, Greenland and Robins have stated that the utility evident in ecological studies is of less value than that found in individual-level studies. Similarly, Piantadosi (1994) has argued that "it is impossible to study ecological analyses very carefully and come away with much confidence in them." (p. 763) Regardless of the constraints evident in ecological analysis, Greenland and Robins (1994a)

make an important point in stating that the major problem with ecological studies is not their limitations, but a lack of knowledge of these limitations. Geoffrey Rose (Cited in Susser, 1994) offers more support for the ecological method arguing that research which concentrates solely upon individual-level risk factors for disease is remiss in its attention toward aggregate-level risk reduction.

The ability to test hypotheses using aggregate-level data has also been called into question. It has been said that the aims of ecological methodology are to generate hypotheses, and to evaluate the effectiveness of intervention programs directed toward group-level behaviors (Morgenstern, 1982). This view is limiting given that both aims are descriptive in nature and others have discussed the need for analytic work in the area.

Along with deficiencies associated with ecological studies, methodology must also be considered. For example, the lag time between an exposure and disease must also be taken into consideration. Lag time represents the amount of time needed for a significant relationship to occur between a disease and a particular exposure. This issue has been given very little attention by researchers. Thus, with regard to suicide statistics, little consensus has been reached regarding appropriate lag times between the predictor and outcome variables. However, Richardson (1987) suggested that a 15-year lag be incorporated between cigarette sales and mortality. Examining the influence of state expenditures on public welfare in the United States, Zimmerman (1987) incorporated a two-year lag between the independent variables explored and the reported rate of suicide. He found no relationship between the two. Brenner (1983) was able to determine optimal lag times for a number of variables used in his study of mortality in postwar Britain. A

relationship between unemployment and nearly all causes of death, including suicide, was demonstrated for practically all regions examined using a one-year lag between the variables. He also studied the relationships without incorporating a lag time. In this case, dependent and independent variables were collected from the same time period. For England and Wales, a significant lag of 10 years was reported. This lag was reduced to six years for Scotland. The author concluded that "the peak lags between unemployment and mortality rates are two to three years in many industrialized countries." (p. 617) Given these findings, it is clear that optimal lag times differ across countries and independent variables.

III. Country Selection

Country selection was based upon three criteria. These were suicide rate reporting practices, level of development, and population. For each of these, with the exception of level of development, annual averages were used to provide for more stable data than could be obtained using data from a single year.

Suicide Rate Reporting Practices

To be chosen for inclusion in this study, a nation was required to have reported suicide data to WHO for the years 1988, 1989, and 1990. Data included the number of reported suicides and population estimates for females 65 years of age and over. Triennial data were averaged to stabilize the data.

Level of Development

Level of development was measured for the year 1978 by the Overseas Development Council (ODC) (Seawell, 1980). Countries were considered developed if they reported a per capita gross national product of at least $2,000

(based upon estimates from 1978) and a Physical Quality of Life Index (PQLI) of 90 or above.

Gross national product may be defined as a measure of total domestic and foreign output claimed by a country (Todaro, 1977). Put another way, per capita gross national product is equal to the value of goods and services produced during a period of time per person. Anderson (1991) has discussed the utilization of gross national product estimates as a measure of money flow in an economy and as a measure of welfare, value, success, or economic progress made by a particular region. He also commented on the misleading nature of gross national product in that it fails to take into account unpaid domestic labor (individuals working within a household), non-money transitions outside the household (barter exchanges for goods), or the value of existing possessions.

The Physical Quality of Life Index was developed by the Overseas Development Council in response to the need for a non-income measure that capitulates many aspects of well-being (Seawell, 1980). The three indicators that compose the Physical Quality of Life include infant mortality, life expectancy at age one, and literacy. Each indicator is represented in a composite index designed to measure the national level of progress in meeting basic human needs. This is completed by computing the mean of the three indicators.

Population

To examine only large populations and to stabilize the data, countries with a annual average population (based upon estimates for the years 1988-1990) of one million or more were included in the study.

IV. Instrumentation

Surveys were either mailed to the Foreign Consular Offices located within the United States, to intergovernmental agencies, or were electronically mailed (via the Internet) to persons believed to be able to respond, for each of the countries included in this study. The survey was designed to ascertain the type of system responsible for determining manner of death in cases of suspicious or premature death . Addresses to each office were obtained through The Foreign Consular Offices in the United States, 1994 (United States Department of State, 1994). A list of these addresses as well as other sources of data are available in the Appendix (A1 and A2, respectively).

To determine the availability and location of potential aggregate-level data sources, a literature review was conducted through the main library at the University of Tennessee, Knoxville. The Index of International Statistics (Congressional Information Services, Inc., 1993) was used to locate data publications. After securing relevant publications, an examination of listed variables was completed to determine the possibility of their inclusion into this study.

V. Data Description

The Dependent Variable

The dependent variable in this study was the three-year arithmetic mean (based upon data reported for the years 1988, 1989, and 1990) of the reported elderly female suicide rates for all 20 countries examined. "Elderly" is demographically defined as those individuals 65 years of age or older. The number of reported suicides and population estimates for elderly females were accessed from the World Health Statistics Annual (WHO, 1989, 1990, 1991,

1992, and 1993). Two age-specific estimates were computed; one for females aged 65-74, the other for females over the age of 74.

The Independent Variables

The independent variables used in this study were distinguished and categorized under the rubric of social causation and social construction based upon the need to examine, separately, variables which 1) potentially impact the quality of suicide statistics and 2) may serve as cultural predictors of reported suicide rates in the elderly female population.

Social Causation Data

Social causation variables were collected from a number of various sources. Age- and sex-specific data for elderly females were used where available. See Table 3.1 for a list of variables used. Some variables were collected for the years 1985-1987 to allow for a lag between exposure and suicide. Because of their nominal characteristics, the components of the religious variable, Catholic, Protestant, and Other, were transformed into dummy variables for further analysis.

Social Construction Data

It has been suggested by Rockett and Smith (1994) that international studies of suicide take into account issues of data quality. Therefore, two indicators of social construction were selected. First, survey data were used to examine the influence that differences in type of system (for example, coroner, medical examiner) responsible for determining cause of death might have on officially reported suicide rates. Like religion, dummy variables were constructed to represent the components of this variable. See Appendix A3 for a copy of this survey. Second, the annual average rates of accidental drowning, accidental

Table 3.1

Social Causation Variables, Sex-Specific Population of Interest, and Years of Examination

Population Structure

Variable:	**The annual average ratio of males less than age 15 to those between the ages of 15 and 64.**
Population of Interest:	Males
Data Years:	1988, 1989, and 1990
Variable:	**The annual average ratio of females less than age 15 to those between the ages of 15 and 64.**
Population of Interest:	Females
Data Years:	1988, 1989, and 1990
Variable:	**The annual average ratio of males over the age of 64 to those between the ages of 15 and 64**
Population of Interest:	Males
Data Years:	1988, 1989, and 1990
Variable:	**The annual average ratio of females over the age of 64 to those between the ages of 15 and 64**
Population of Interest:	Females
Data Years:	1988, 1989, and 1990
Variable:	**The annual average estimate of population density**
Population of Interest:	Total population
Data Years:	1988, 1989, and 1990

Table 3.1, Continued	
Population Structure	
Variable:	**The annual average percentage of the total population considered urban**
Population of Interest:	Total population
Data Years:	1988, 1989, and 1990
The Economic Indicator	
Variable:	**Annual average per capita gross national product**
Population of Interest:	Total population
Data Years:	1988, 1989, and 1990
The Social Indicators	
Variable:	**Primary religion**
Population of Interest:	Total population
Data Years:	1985, 1986, and 1987
Variable:	**The annual average rate of divorce**
Population of Interest:	Total population
Data Years:	1985, 1986, and 1987
Variable:	**The annual average percentage of the total labor force composed of females**
Population of Interest:	Total population
Data Years:	1988, 1989, and 1990

Table 3.1, Continued	
The Social Indicators	
Variable:	**The annual average ratio of male to female life-expectancy at birth**
Population of Interest:	Total male and female populations
Data Years:	1988, 1989, and 1990
Variable:	**The annual average ratio of female to male years since suffrage**
Population of Interest:	Total male and female populations
Data Years:	1989 serves as the base year
Variable:	**The annual average rate of death due to cirrhosis of the liver**
Population of Interest:	Females aged 65-74 and 75 and over
Data Years:	1985, 1986, and 1987

poisoning, and other violence were examined in association with reported rates of suicide. These data were included because, as discussed in Chapter Two, the validity of suicide data has been called into question. Other variables representing social construction, such as those examined by Pescosolido and Mendelsohn (1986), were not included in this study because of acquisition difficulties.

VI. Data Analysis

Three statistical software packages were used in this analysis. First, to explore the robustness of the data, the program Progress was used. The robustness of the data serves as an indicator of how contaminated the data set is in terms of outliers. Outliers are defined as cases which report estimates far from the mass of the remaining cases. Such an examination was needed, as erroneous data sets have the potential of producing untrue or biased regression coefficients. Second, descriptive statistics were computed with the use of The Statistical Package for the Social Sciences for Windows (SPSS) (SPSS Inc., 1993). Means, standard deviations, variances, maximum and minimum values were computed to help describe the data. SPSS was also used to calculate the statistical relationships between predictor and outcome variables (to assess their zero-order relationships) and among the predictor variables (to examine the possibility of intercorrelation) examined in this study. Two correlation techniques were utilized. First, coefficients between nominal level data points were garnered through the use of the Spearman Rank-Order Rho technique. Variables treated in this manner include the dummy variables constructed for the survey data and primary religion. The relationship between interval level data points, on the other hand, were examined through the Pearson Product-Moment

technique. Both tests were two-tailed, and statistical significance was determined as the .10 level of probability. Finally, variable selection and multiple regression analysis were completed with the aid of Number Cruncher Statistical Systems (Hintzel, 1992).

Variable selection was completed to produce the parsimonious model offering appropriate predictors of suicide. The object here was to choose the combination of variables whose R^2 could not be improved by the addition or replacement of another variable. The R^2 statistic is an indicator of goodness of fit. It is an estimate of how much of the variance between the observed and predicted values of the outcome variable is explained by a particular model. This was completed for three separate categories of analysis. The first category examined annual average rates of accidental poisoning in conjunction with the remaining predictor variables including survey data. This category of analysis excluded other violence and accidental drowning. The second analysis replaced poisoning data with drowning data, while the third analysis examined only the other violence rate. Each category of analysis was completed for females aged 65-74 and 75 and over.

Variable selection was completed using three separate types of variables. First, only the main effects were examined. Main effects are variables which have not been combined (or multiplied) into interaction terms. Second, variable selection was completed utilizing only two-factor interaction terms. The only two-factor interaction terms utilized were those which combined the rate of poisoning with the remaining predictor variables. Other interaction terms were not examined due to a large number of interaction terms that would have had to

be computed (374). Such a large number of combinations could not be adequately handled by available computer technology.

The variables chosen as appropriate correlates of suicide for each age group (females 65-74 and 75+) were then combined and variable selection was completed. Significant correlates of this stage of analysis were then subjected to multiple regression analysis to yield resulting equations for each age division. After examining the quality of the data reported by each nation (by looking at the diagnostics discussed below), if a particular case was determined to be an outlier, that case was deleted and the entire variable selection process was repeated.

Multiple regression analysis was utilized to determine the best correlates of the annual average rates of suicide among females aged 65-74 and 75 and above. This analysis was used to construct an equation which best depicted the associations between the predictor variables, both social causation and social construction, and the outcome variables for both age divisions. In order to determine variable efficacy within this analysis, it was necessary to examine the assumptions of the multiple regression technique by examining regression residuals. Any violations of these assumptions has the potential to decrease the accuracy of reported coefficient estimates.

Assumptions of Multiple Regression Analysis

Asher (1984) has discussed two assumptions of multiple regression. The first, that the variables are measured without error, is an issue to be considered during the data collection process. Data must be collected without error if adequate findings are to be generated. The second assumption, that the regression model is correctly specified, is one primarily driven by theory and

previous research. Model appropriateness is dependent upon the inclusion of all pertinent variables while excluding superfluous ones that do not add to the strength of the resulting regression equation.

Glantz and Slinker (1990) have offered three additional assumptions: 1) both the dependent and independent variables are normally distributed, 2) the standard deviation of the outcome variable about its mean for any value of the independent variable is the same for all values of the predictor variables (the equal variance assumption), and 3) all members of the population are statistically independent of each other. Each of these assumptions revolve around regression residuals. Residuals are defined as the distance between observed values and predicted values of variables utilized in the study.

One cause of a lack of statistical strength with regard to these assumptions is the possibility of one case (in this study a country) reporting data that are highly dissimilar from the remaining data. Regression analysis utilizing these nations may be biased. These cases are known as outliers and may skew the data in a manner which negates their usefulness. Four regression diagnostics, each examining some property of the regression residuals, will be generated to examine the possibility of this outlier effect: Studentized deleted residuals, degree of fit standardized, Cooks distance, and hat diagonals. These diagnostics are not mutually exclusive and should not be used to identify outliers individually. For purposes of this study, if two diagnostics are found to be above the cutoffs used for a particular case, further examination will determine whether or not to delete the data point. The variance inflation factor will also be examined as a measure of multicollinearity within the study variables.

Studentized Deleted Residuals

To examine the potential for a particular case to be an outlier, studentized deleted residuals were calculated. Raw residuals may be used to identify potential outliers, however, because these residuals are on a scale congruent with study-specific variables, it is difficult to determine a "large" value. Therefore, standardization (or normalization) is required. In this situation, standardization is achieved through dividing a residual by its particular standard error, with the i^{th} observation deleted. This statistic tends to follow a t distribution. In this study, cases falling outside plus or minus three standard deviations were examined further as potential outliers.

Degree of Fit, Standardized

The degree of fit, standardized, is defined as the number of estimated standard errors that the fitted value of a predicted outcome changes if the i^{th} data point is deleted (William Seaver, Department of Statistics, the University of Tennessee, personal communication). In other words, a case with a relatively high estimate indicates that, if deleted, the regression model would change substantially. In the present study, any estimate for this statistic beyond plus or minus one standard deviation will be examined further as problematic.

Leverage

The concept of leverage represents the potential for a particular data point to exert a strong influence upon regression results, either positively or negatively. Leverage captures the impact an observation has on the independent variables. If the relationships between independent variables are affected the regression equation and significance can be distorted. The expected average value of the hat diagonal, the statistical estimate of leverage, can be calculated as (k + 1)/n

where k is the number of independent variables in the regression equation and n is the sample size, in this study, 20. By convention, twice this expected value indicates an observation that has leverage and warrants further investigation. The cutoff of 2(k + 1)/n will be used here.

Cook's Distance

Statistical techniques discussed thus far are methods used to locate points that do not appear to be consistent with the residual patterns, with fit, and the mass of independent variables in multiple regression. Cooks distance is a bit different in that it has the ability to assess the actual influence of a data point upon the equation by calculating how much the regression coefficients change when a particular point is deleted. This statistic tends to follow an F distribution. Thus, estimates that fall above one, and especially above four or five, should be investigated further as potential outliers (Glantz and Slinker, 1990).

Variance Inflation Factor

The final diagnostic of data appropriateness is the variance inflation factor. The variance inflation factor is a measure of redundant information examined within multiple regression. Collinearity can increase standard errors for regression coefficients, deflate partial t values, give false signals of nonsignificance when one uses p-values, distort the actual size and sign of coefficients, and bias model predictability. This estimate is the single most useful diagnostic when assessing multicollinearity (Glantz and Slinker, 1990). Values of the variance inflation factor which exceed four will be examined further. Even though intercorrelation or multicollinearity has been assessed by examining correlation coefficients, this method will be used in multiple regression analysis as a more precise indicator.

VII. The Model

Based upon published research on correlates of suicidal behaviors, two competing hypotheses have been constructed for examination. First, it is hypothesized that social causation variables have a deleterious impact upon reported rates of suicide among elderly females. Second, the hypothesis that social causation variables are primarily responsible for variations in the reported rates of elderly suicide is examined. A question is also offered concerning the best predictors of suicide among the two age groups included in the study. Based upon these hypotheses, the following potential predictors were considered.

Social Construction

Two indicator of social construction were used in this study. First, survey data were collected regarding the type of system in each country responsible for determining manner of death. Second, the individual rates of accidental poisoning, accidental drowning, and other violence were used to examine the potential of suicide data to be misclassified into other cause of death categories. These variables were included because of the need to consider the quality of reported suicide data.

Social Causation

Even though a number of variables have been conceptualized as correlates of suicide for either the total male or total female population of many regions, the elderly female population has been largely ignored. This lack of investigation is the primary reason for including traditional variables in this study. These variables appear to be the best correlates of suicide. After adjustments for age

and sex, many of these variables should remain significant correlates of reported suicide rates, while other variables should lose their effect.

Population Structure

Ahlburg and Schapiro (1984) constructed a measure of relative cohort size (RCS): the ratio of U.S. males aged 16-29 to males aged 30-64. By examining data reported from 1948 to 1976, it was reported that shifts on this RCS had an impact on reported rates of suicide in both sexes. No mention of the elderly was included in this study. Lester (1973), on the other hand, examined two age dependency ratios in 28 nations including information concerning the elderly. The ratios of those less than 15 years of age to those 15-64 and the ratio of those over the age of 64 to those 15-64 were studied. He reported that as the proportion of elderly individuals within each country increased, the rate of suicide increased. Yet, as the proportion of youth increased, suicide rates diminished. Similarly, in a 1988 study, Lester reports that among the 17 nations examined, national age composition and female labor force participation were two important correlates of the suicide rate. Two seemingly unimportant predictors, however, are population density and urbanization. Each variable has been shown to have an insignificant influence on reported rates of suicide in the U.S. (Lester, 1989). However, another study of U.S. data by Yang and Lester (1988), revealed three significant predictors of suicide among females: divorce, urbanization and interstate migration. For other nations, and with specific regard to the elderly female sub-population, the influence of density and urbanization, or lack there of, has not fully been demonstrated. Thus, this study will consider the impact of population structure on reported rates of suicide among the elderly female. Population structure is composed here of population density,

urbanization, the ratios of the number of males and females aged less than age 15 to those aged 15-64 and the ratios of the number of males and females over the age of 64 to those aged 15-64.

Economic and Social Correlates

Religion is mentioned extensively throughout the literature as a significant correlate of suicide. Stack (1980) investigated the relationship between suicide and Catholicism and religiosity for all 50 U.S. states for 1970. He operationalized Catholicism as the percentage of state populations who were Catholic, and religiosity as the proportion of individuals attending Catholic schools. The former may be an appropriate measure in this study, but the latter should not apply to elderly females. He found that as the proportion of Catholics decreased, the divorce rate for the states increased. He also reported that with a decreasing proportion of children enrolled in Catholic schools, suicide rates increased within the states. However, upon controlling for divorce, Catholicism exhibited no independent influence upon suicide.

In a second study by Stack (1991), dealing with religion and suicide in Sweden between the years of 1951 and 1980, the author stated that religious trends during this period were unrelated to the overall male or female rate of suicide. Such trends were, however, related to the rates reported among youth. Religiosity was conceptualized here as the percentage of total book production made up of religious books. In this study, the primary religion reported by each nation was collected for analysis.

Economic issues, usually in the form of unemployment and labor force participation, have also been used to predict rates of suicide, the latter of which was examined here as a social variable. Thus, the only economic indicator

included in the present study was gross national product per capita. Yang (1992) has suggested, however, that other variables, such as divorce, may be more important. In a study of the U.S. between 1940 and 1984, the author examined socioeconomic variables and suicide and found that gross national product per capita was not a significant predictor. However, another seemingly related variable, annual income, has been correlated with suicide ($r = 0.23$) by Zimmerman (1987) in a study of U.S. state welfare expenditures. Gross national product will be examined here to offer an abbreviated insight into the influence of economics on reported rates of suicide.

Divorce has also been mentioned extensively in previous works. According to Monk (1986), suicide is generally higher among divorced individuals than those who are married, single, or widowed. Sainsbury (1955) examined the relationship between suicide and socioeconomic and demographic variables for 28 metropolitan boroughs in London, England, and found that percentage divorced was significantly related to suicide ($r=0.56$). Thus, divorce rates for each country was included in the present study.

In a time of growing concern over female equality, it is important to examine this aspect of life in relation to elderly female suicide. Yang and Lester (1988) used data reported by the United States to examine the relationship between female labor force participation and the reported rate of suicide. They believed that the female labor force participation of married women was positively associated with the female suicide rate. This belief was confirmed. Stack (1987) reported a similar finding, based on United States data for the period from 1948 until 1980. The female age group 20-39 was used because of the potential of this group to have young children in their charge. Over the

observation period, as the female labor force participation of this age group increased, their suicide rates doubled. This is not, however, believed to be the case for the elderly female. Because of mandatory or elective retirement, present in many countries, female labor force participation should have little impact on the dependent variable. This variable was, however, examined as a current indicator of gender equality (or inequality).

Gender equality has primarily been examined in the literature through the use of female labor force participation and unemployment estimates, both economic in origin. Neither is believed to be a correlate of elderly female suicides. As a historical proxy of female equality, the ratio of years since suffrage for females to years since suffrage for males was also computed as an indicator of current gender equality or inequality. The ratio of male life expectancy to female life expectancy at birth was also examined. This variable also served as a current measure for gender equality.

Finally, Giesbrecht and Dick (1993), after examining alcohol consumption patterns and mortality data, reported a significant unlagged correlation (the relationship between different variables collected for the same period of time) between the two for six nations between 1965 and 1987. The relationship between liver cirrhosis and alcohol consumption was not significant in most regions. However, the authors reported a consistent correlation between suicide and alcohol intake. Smart and Mann (1990) have reported similar findings for Ontario, Canada during the period between 1963 and 1983. Farber (1979) has speculated that one of the principal factors associated with high suicide rates in France is a high rate of alcoholism. Because of a lack of age-adjusted data regarding alcohol consumption, the death rate among elderly

females from liver disease and cirrhosis of the liver will be examined as a surrogate for alcohol consumption. According to Kemp and Carstairs (1987), cirrhosis of the liver is a widely used measure of chronic alcoholism within populations.

CHAPTER FOUR: ANALYSIS OF THE DATA

I. Introduction

The purpose of this study was to examine selected social construction and social causation variables as correlates of suicide among elderly females. The purpose of the chapter is to discuss the analysis undertaken to achieve this goal. First, a description of each variable will be presented to offer between country similarities and differences. Second, correlation coefficients between the dependent and independent variables will be utilized to assess the associations between each. Finally, the results of multiple regression analysis will be presented to offer that parsimonious set of variables which best predicts annual average rates among elderly females.

II. Descriptive Statistics

Data collected for this study were dichotomized into social construction and social causation variables. Social construction variables are variables that could produce artificial cross-national differences in reported suicide rates due to the manner in which suicide data are collected and classified. Those incorporated into this study were type of system in each country having the primary responsibility for determining cause of death in suspicious and/or unnatural circumstances, and the respective annual average rates of accidental poisoning, accidental drowning, and the other violence per 100,000 among females aged 65-74 and 75 and over. These mortality categories were distinguished because they each appear to be prone to suicide misclassification.

Social causation variables, on the other hand, were thought to be correlated with reported suicide rates by virtue of their direct environmental influences.

These variables were divided into three areas: demographic, economic, and social indicators. Demographic variables included population density, urbanization, the ratios of the number of males and females less than 15 years of age to those between the ages of 15 and 64, and the ratios of the number of males and females over the age of 64 to those between the ages of 15 and 64. Only one economic variable was utilized: gross national product per capita. Finally, five social indicators were examined: primary religion, rate of divorce, the ratio of male to female life-expectancy, the ratio of female to male years since suffrage, rates of death due to cirrhosis of the liver among females aged 65-74 and 75 and over, and the percentage of the total labor force composed of females. Triennial data were used for all variables, except primary religion and survey data on type of system, to stabilize the data. See Table 4.1 for a listing of descriptive findings and List of Abbreviations for a list of country abbreviations used on the following charts.

The Dependent Variables

The dependent variables in this study consisted of annual average suicide rates, computed from the data years of 1988-1990, for two female age groups: those between the ages of 65 and 74 and those over the age of 74. Data on both variables and each year were found in the World Health Statistical Annual, 1989, and 1991-1994.

Annual average rates of suicide per 100,000 among females aged 65-74 ranged between 4 found in Greece to a high of 33 reported by Denmark. For older females, Ireland and Japan exhibited the most extreme estimates (3 and 52 per 100,000, respectively). The Irish suicide rate was closely approached by that of Greece, with 4 suicides per 100,000.

Table 4.1

Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Suicide Rates				
Females 65-74	14.10	8.08	4.40	33.40
Females 75+	15.90	12.46	3.20	51.60
Divorce Rate	1.78	0.90	0.00	2.80
Urbanization	75.06	11.40	56.50	90.60
Population Density	116.03	110.35	2.20	363.70
Female Labor Force Participation	37.92	7.04	24.20	52.40
Ratio of Male to Female Life-Expectancy	0.92	0.01	0.89	0.95
Deaths Due to Cirrhosis				
Females 65-74	23.64	14.98	7.80	69.20
Females 75+	29.89	21.59	9.90	95.10
RCS 1 : <15:15-64				
Male	0.31	0.08	0.23	0.55
Female	0.30	0.07	0.23	0.52
RCS 2 : >64:15-64				
Male	0.19	0.03	0.15	0.26
Female	0.24	0.04	0.16	0.32
Rate of Death Due to Poisoning				
Females 65-74	17.51	30.39	0.30	135.70
Females 75+	36.49	65.98	0.00	226.70
Rate of Death Due to Drowning				
Females 65-74	21.11	45.99	0.30	206.70
Females 75+	42.55	114.16	0.30	517.30
Rate of Death Due to Other Violence				
Females 65-74	27.89	39.60	1.00	136.00
Females 75+	44.28	66.43	0.70	212.70
Ratio of Female to Male Suffrage	0.72	0.28	0.11	1.00
Gross National Product Per Capita	$16,976.70	$5,924.01	$5,383.30	$29,906.70

Rates between 5 and 10 per 100,000 were found in Canada, the United States, New Zealand, the United Kingdom, Norway, Australia, and Italy. Among younger women, each of these nations, with the exception of Norway whose rate was 13 per 100,000, reported suicide data within this range as well, along with data from Ireland and Spain. Rates of 12 per 100,000 were found in both Israel and the Netherlands. Rates between 15 and 20 per 100,000 were evident in Sweden, Finland, and Germany (see Figure 4.1).

Among females over the age of 75, five nations, namely Finland, Spain, the Netherlands, Sweden, and Israel, reported rates ranging between 11 and 20. Annual average rates between 20 and 30 per 100,000 were reported in France and Switzerland, in Japan and Austria for younger females, and in Germany for the older age group. For younger females, Denmark was the only nation to report an annual average rate greater than 30 (33.4 per 100,000), while for females 75 years of age and older, three countries, Denmark, Austria, and Japan, reported data above this figure (30, 34, and 52 per 100,000, respectively). Austria, France, Germany, Israel, Italy, Japan, the Netherlands, New Zealand, Spain, and Switzerland each reported rates varying positively with age. The most extreme examples were found in Austria and Japan, where the rate increased from 23 to 34 among older Austrian females and from 28 to 52 per 100,000 in Japan. The remaining nations exhibited rates which decreased between the ages of 65-74 and 75 and over.

Social Construction

For some time, researchers have examined the validity of reported rates of suicide, calling their cross-national comparability into question due to the

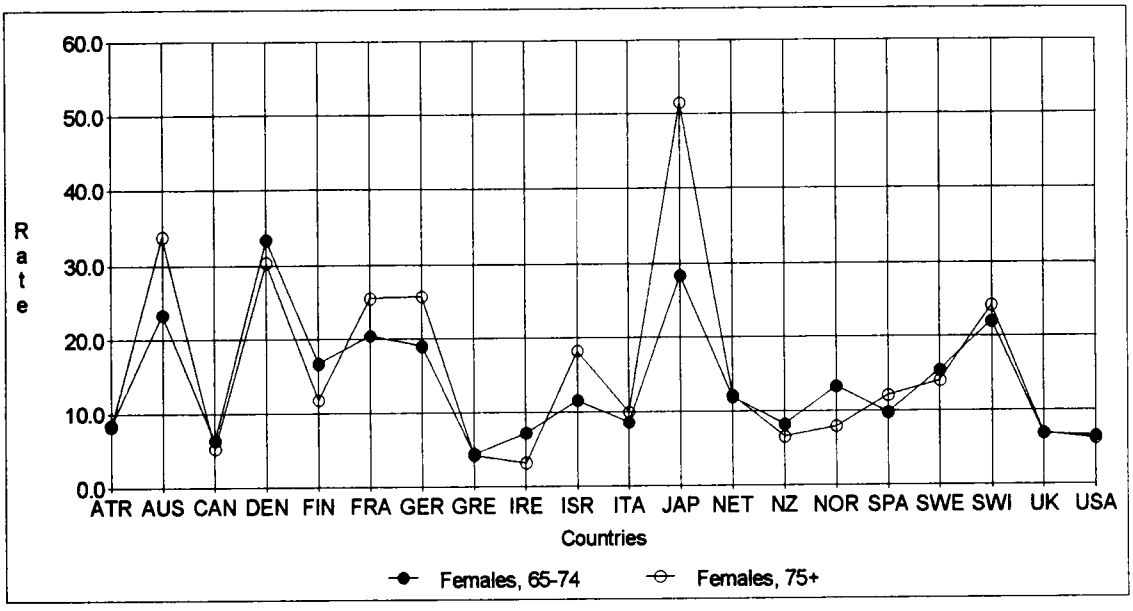


Figure 4.1*

Annual Average Rates of Suicide per 100,000 by Country, 1988-1990

*Source: World Health Statistics Annual, 1989 and 1991-1994

potential for suicides to be wrongfully classified under other causes of death. This concern is also due to differing procedures of ascertainment (cause of death determination) evident between regions of the world. Both of these issues have the potential for producing artifactual suicide data. As suggested by Rockett and Smith (1994), these concerns must be addressed when examining reported rates. It is for this reason that both ascertainment and misclassification were included in the study.

System Type

In order to determine the type of system within each country having the primary responsibility for determining cause of death, a brief survey was conducted. The survey requested official representatives from each country to indicate one of the following systems as having this responsibility: 1) coroner system, 2) medical examiner system, 3) judiciary, 4) police, or 5) other (mixed) system (see Appendix A3 for a copy of the survey).

Survey questionnaires for each nation, with the exception of the United States, were mailed to foreign consular offices located within the United States. Addresses to each were collected from Foreign Consular Offices in the United States, 1994 and are available in Appendix A1. Of the 19 surveys sent, nine nations responded: Austria, Finland, the Federal Republic of Germany, Greece, Israel, Italy, the Netherlands, Switzerland, and the United Kingdom. The Democratic Republic of Germany was not quarried due to its reunification with the Federal Republic of Germany in 1989. The remaining nations were questioned through either one of their inter-governmental agencies or via electronic mail and the Internet. See Appendix A2 for a detailed discussion of these sources.

Of the 20 nations examined, Canada, France, the Netherlands, Sweden, and the United States all reported that causes of death were determined by means other than those prescribed by coroner, medical examiner, judiciary, or police systems. The reason for this may be that these nations have a hybrid system. This was found to be the case within the U.S. Three systems, coroner, medical examiner, and police, were equally represented (see Table 4.2). Coroner systems were reported by Australia, Ireland, New Zealand, and the United Kingdom, yet, the principle responsibility of cause of death determination was given to the medical examiner in Austria, Japan, Norway, and Spain. Finland, Israel, Italy, and Switzerland reported this responsibility as being with the police. Finally, only two nations, Germany, and Greece, responded that judicial systems were utilized to determine cause of death.

Annual Average Rate of Accidental Poisoning, Drowning, and Other Violence

As discussed in Chapter Two, the validity of reported rates of suicide is often called into question. One major concern stems from the possibility of true suicides being misclassified under other cause of death categories. According to the literature, the categories of accidental poisoning, accidental drowning, and other violence appear to be highly suspect. In order to examine this concern, the rates of death, per 100,000, reportedly due to accidental poisoning, accidental drowning, and other violence among females aged 65-74 and 75 and above were examined. Data were collected from the World Health Statistics Annual, 1989 & 1991-1994.

Table 4.2

Type of System with Primary Responsibility for Determining Cause of Death in Suspicious and/or Unnatural Deaths by Country

Country	*Type of System*
Australia	Coroner
Austria	Medical examiner
Canada	Other
Denmark	Other
Finland	Police
France	Other
Germany	Judiciary
Greece	Judiciary
Ireland	Coroner
Israel	Police
Italy	Police
Japan	Medical Examiner
Netherlands	Other
New Zealand	Coroner
Norway	Medical Examiner
Spain	Medical Examiner
Sweden	Other
Switzerland	Police
United Kingdom	Coroner
United States	Other

Annual Average Rate of Accidental Poisoning

Among females aged 65-74, reported annual average rates (per 100,000) of poisoning ranged from zero reported by both Israel and Ireland to a high of 136 found among American women. The U.S. maintained its extreme position for females aged 75 and older (227 per 100,000). However, the lowest rates for this age group came from New Zealand. Twelve nations, Australia, Austria, Denmark, Finland, Greece, Ireland, and Israel along with, the Netherlands, New Zealand, Norway, Sweden, Spain, and the United Kingdom reported rates for both age groups below 13 per 100,000. The Canadian rate fell below this level also, but only for older females. This figure was down from a rate of 21 among younger females. The opposite was found to be true in Spain where the rate increased with age from 12 to 23 per 100,000.

Reported poisoning rates ranging from 19 to 28 were exhibited by females aged 65-74 in the United Kingdom, Italy, and France. The British rate increased only slightly into older age. However, the French rate increased from 21 to 91 per 100,000. The Italian rate increased to only 46. The most extreme rate differential was found among German females where the rate for those 75 and over (207 per 100,000) was only slightly less than that reported by the U.S. for the same age group. This figure was up from 41 among younger German females. Japan reported a rate of 35, which increased to 53 per 100,000 among older women (See Figure 4.2).

Annual Average Rate of Accidental Drowning

Reported rates of accidental drowning among females of both age groups were highly congruent in Australia, Austria, Canada, Denmark, Finland, Israel, Ireland, the Netherlands, New Zealand, Norway, Sweden, and Switzerland, all

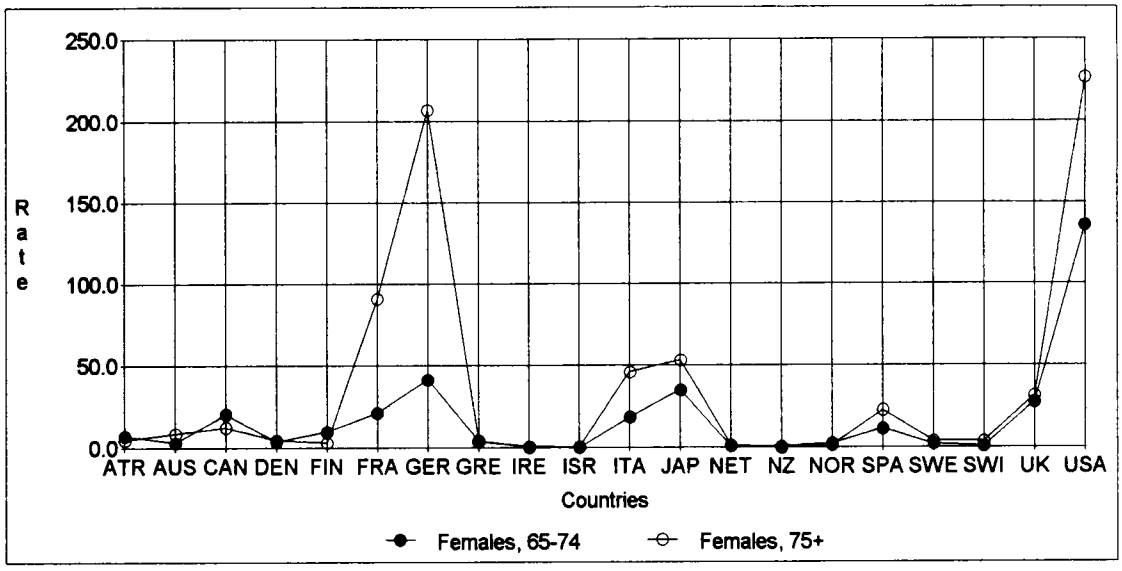


Figure 4.2*

Annual Average Rates of Death Due to Accidental Poisoning per 100,000 by Country, 1988-1990

*Source: World Health Statistics Annual, 1989 and 1991-1994

falling below 11 per 100,000. The rate among younger women in the United Kingdom also fell below this limit, however, a higher rate of 21 was reported among older females. Slightly higher, yet similar data were found in Greece, Italy, and Spain for both ages ranging from 13 to 33 For females 65-74 years of age, France and Germany reported rates of 17 and 29, respectively. The United States reported rates of 58 and 94 for females 65-74 and 75 and over, respectively. The highest rates for both age divisions, were exhibited by Japan. For younger females, a rate of 207 was reported. This figure increased to 517 with advanced age (See Figure 4.3).

Annual Average Rate of Death Due to Other Violence

Australia, Austria, Canada, Denmark, Finland, Germany, Ireland, the Netherlands, New Zealand, Norway, and Switzerland each reported rates of death due to other violence below 12 per 100,000 for both age groups. Israel also fell within this range, but only for younger women (6). This rate increased to 24 with advanced age. Rates between 14 and 20 were evident in Spain and Switzerland for both age groups. A slightly higher estimate came from Italy (24.0) among younger females, increasing to 54 with increased age. The remaining nations, France, Germany, Japan, the United Kingdom, and the United States reported estimates over 50 per 100,000. However, less disparity between the ages was found in the United Kingdom, increasing to 118 from 109 with advanced age and the United States (from 59 to 63, per 100,000, with advanced age) than with the remaining nations.

For example, estimates among females 65-74 were estimated at 72 and 69 among French and German females 65-74 years of age. Yet, these rates increased drastically to 168 and 166,

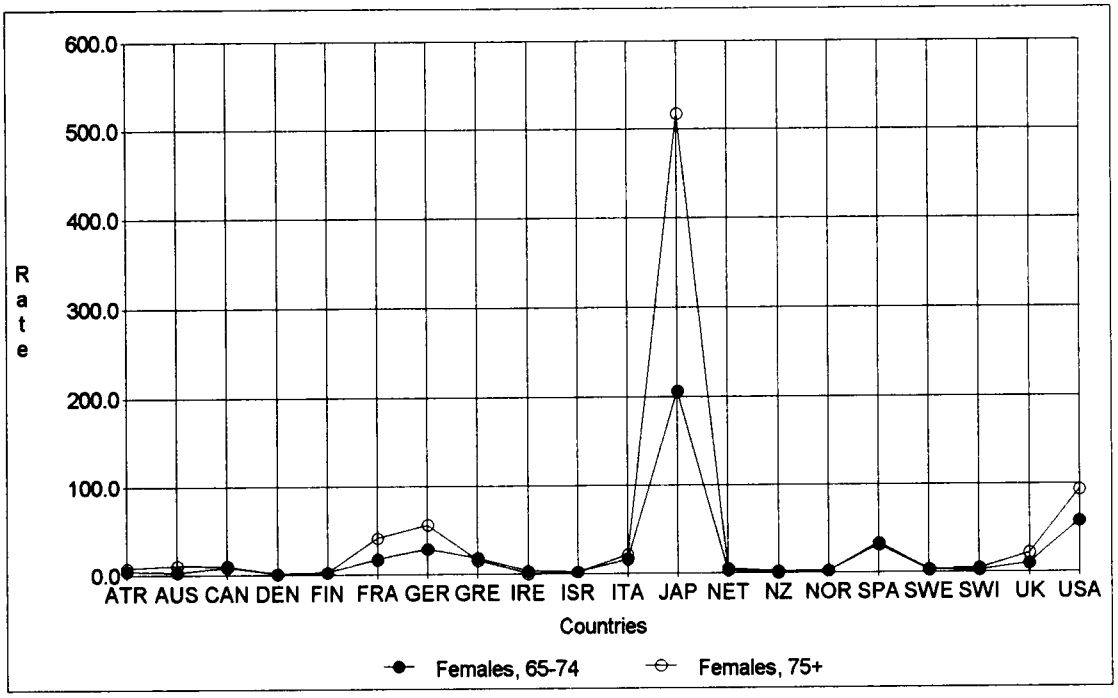


Figure 4.3*

Annual Average Rates of Death Due to Accidental Drowning per 100,000 by Country, 1988-1990

*Source: World Health Statistics Annual, 1989 and 1991-1994

exhibited by Japan (213, up from 136among the younger women) (See Figure 4.4).

Social Causation

Population Density

Population density was defined as the number of individuals per square kilometer. Estimates were computed by dividing annual average population data, collected from the World Health Statistics Annual (1989 and 1991-1994) by the 1990 estimate of surface area reported by the United Nations (1992). Using the 1990 data was deemed appropriate because of the consistency of national boundaries, with the exception of Germany, for which allowence was made.

Population density ranged from a low of two individuals per square kilometer in Australia and two in Canada to a high of 364 per square kilometer in the Netherlands followed by 324 reported by Japan. Relatively high densities were also found in Israel, Germany, and the United Kingdom, ranging from 219 to 236 per square kilometer. Four nations, France, Denmark, Switzerland, and Italy, reported data between 102 and 191, followed by lower estimates coming from Austria, Spain, and Greece (91, 77, and 76 per square kilometer, respectively).

The remaining nations, Ireland, the United States, Sweden, Finland, Norway, and New Zealand were each below 51 individuals per square kilometer. Ireland reported 50 per square kilometer followed by 26 from the United States. Sweden, Finland, New Zealand, and Norway reported data between 20 and 10 individuals per square kilometer (Figure 4.5).

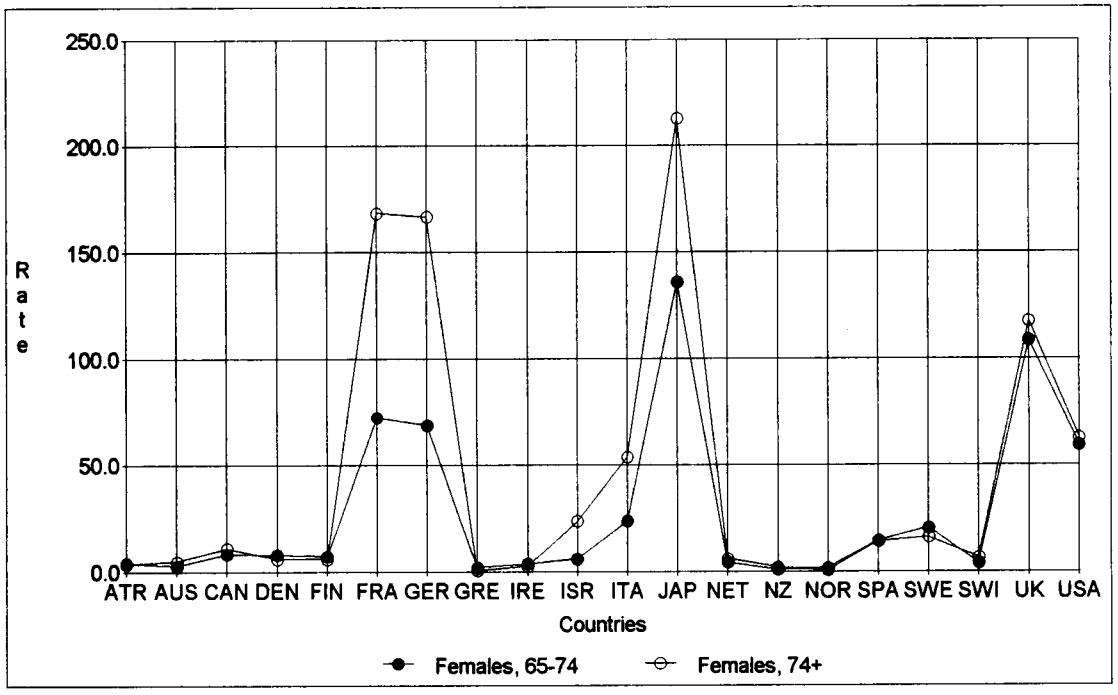


Figure 4.4*

Annual Average Rates of Death Due to Other Violence per 100,000 by Country, 1988-1990

*Source: World Health Statistics Annual, 1989 and 1991-1994

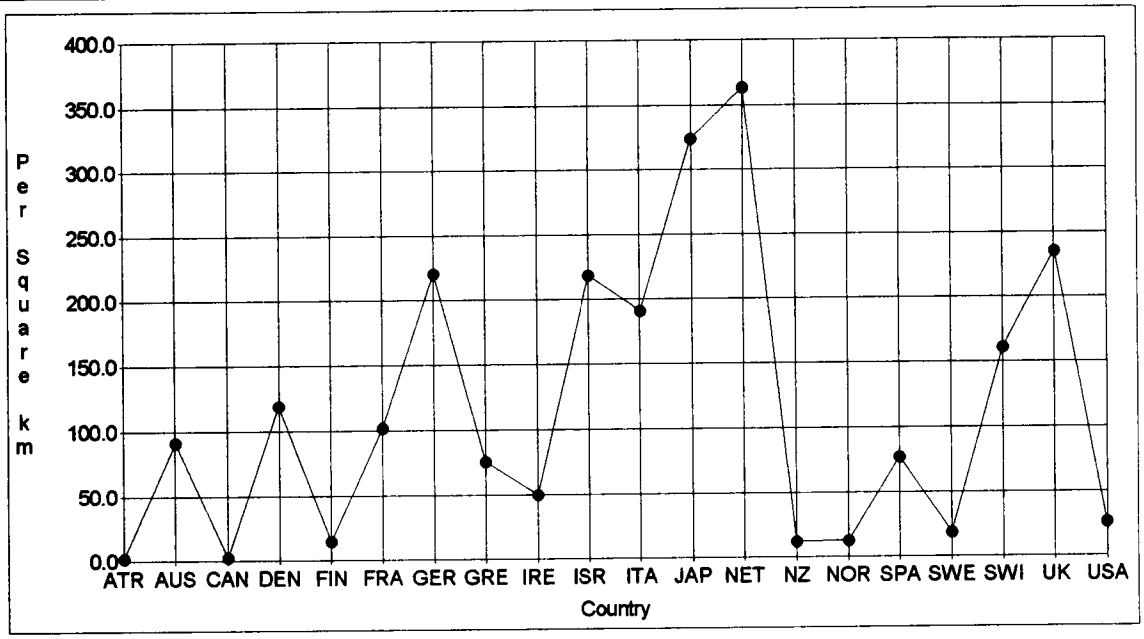


Figure 4.5*

Annual Average Estimates of Population Density by Country, 1988-1990

*Sources: See Appendix A.2

Urbanization

Urbanization was defined as the percentage of national populations living in areas designed as urban. Each nation included within the study reported urban percentages above 50 percent. Israel was the most urbanized with slightly more than 90 percent (90.8) of its population considered urban dwellers. Relatively high estimates were also found in the United Kingdom, the Netherlands, Australia, Denmark, Germany, New Zealand, and Sweden. The Netherlands and the United Kingdom reported similar estimates of 89 percent followed by 86, 85, and 84 percent found in Australia, Denmark, and Germany. New Zealand and Sweden also reported similar urbanization levels (84 percent).

Estimated urbanization levels between 77 and 76 were exhibited by Japan, Spain, and Canada, while the United States, Norway, and France reported levels ranging between 72 and 75 percent. These estimates were trailed by those from Italy (68 percent) and Greece and Switzerland (61 and 60 percent. respectively). Finally, the lowest levels were found for Finland, Austria, and Ireland, which exhibiting levels between 56 and 60 percent (Figure 4.6).

Ratios of Number of Males and Females Less than Age 15 to Those Between Ages 15 and 64

To assess the impact of age composition upon reported rates of suicide, the ratios of the number of individuals less than 15 years of age to those aged 15 to 64 were computed for both sexes. Ratios among males ranged from 0.23 in Germany to 0.55 in Israel. These countries each remained polarized with regard to ratios among the female population (0.23 and 0.51, respectively). For males, the German ratios were followed by those for Switzerland, Italy, Denmark, Austria, the Netherlands, Sweden, Finland, Norway, and the United Kingdom,

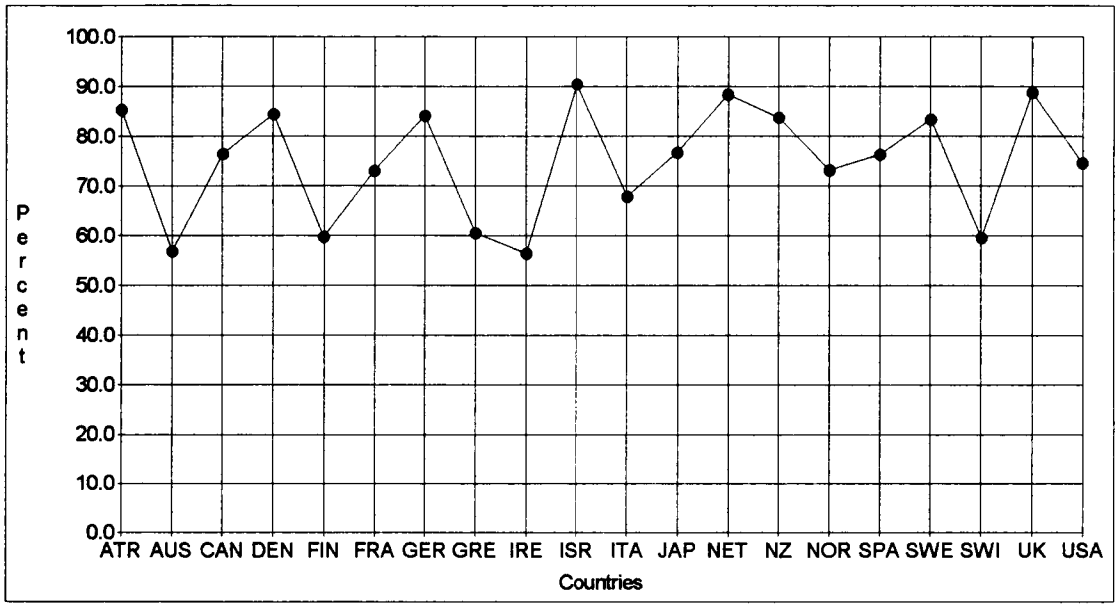


Figure 4.6*

Percentage of the Total Population Residing in an Urban Setting by Country, 1988-1990

Source: World Tables, 1992

ranging between 0.26 and 0.30. For females, each country, with the exception of Switzerland and Italy, who reported estimates of 0.24 and 0.25, respectively, also exhibited data within this interval along with Greece and France. For both sexes, ratios between 0.30 and 0.35 were found in Canada, the United States, Australia, and New Zealand, as well as in Greece and Spain specifically for males. Finally, Ireland reported estimates of 0.46 and 0.45 for males and females, respectively (Figure 4.7).

Ratios of Number of Males and Females Over age 64 to Those Between the ages 15 and 64

In order to assess the potential influence of the number of elderly individuals within each nation upon suicide, relative to the youth population, ratios of the number of males and females over age 64 to those between 15 and 64 years were computed. Among males, estimates ranging between 0.15 and 0.20 were found in Australia, New Zealand, Israel, Canada, Japan, the Netherlands, Ireland, the United States, Finland, Spain, Switzerland, France, and Germany. Yet, among females, only the countries of Israel, New Zealand, Australia, and Canada fell within this range. Seven nations, Japan, Ireland, Greece, the United States, the Netherlands, Spain, and Italy exhibiting female ratios between 0.20 and 0.25. Among males, similar data were found in Germany, Greece, Denmark, Austria, and Norway. Slightly higher ratios came from the United Kingdom and Sweden, each reporting a ratio of 0.26. For females, Finland, Switzerland, France, Denmark, the United Kingdom, Germany, Austria, and Norway exhibited data between 0.25 and 0.30, followed by a ratio of 0.32 found in Sweden (See Figure 4.8).

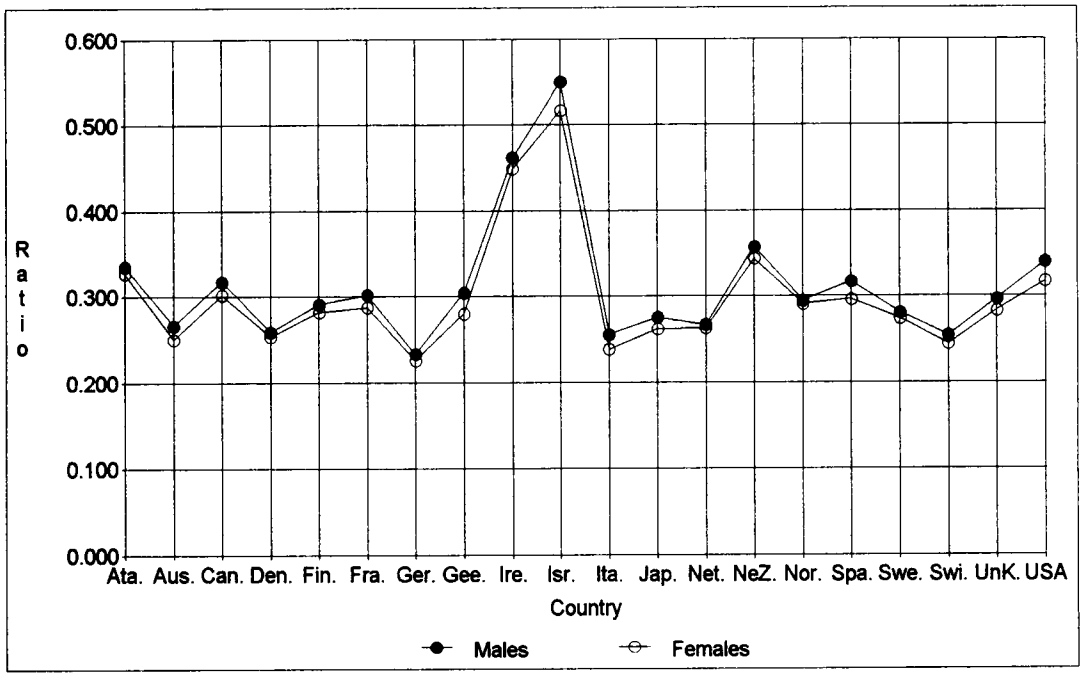


Figure 4.7*

Ratio of Persons Less Than 15 Years of age to Those Between 15 and 64 by Country and Sex, 1989-1990

*Source: World Health Statistics Annual, 1989 and 1991-1994

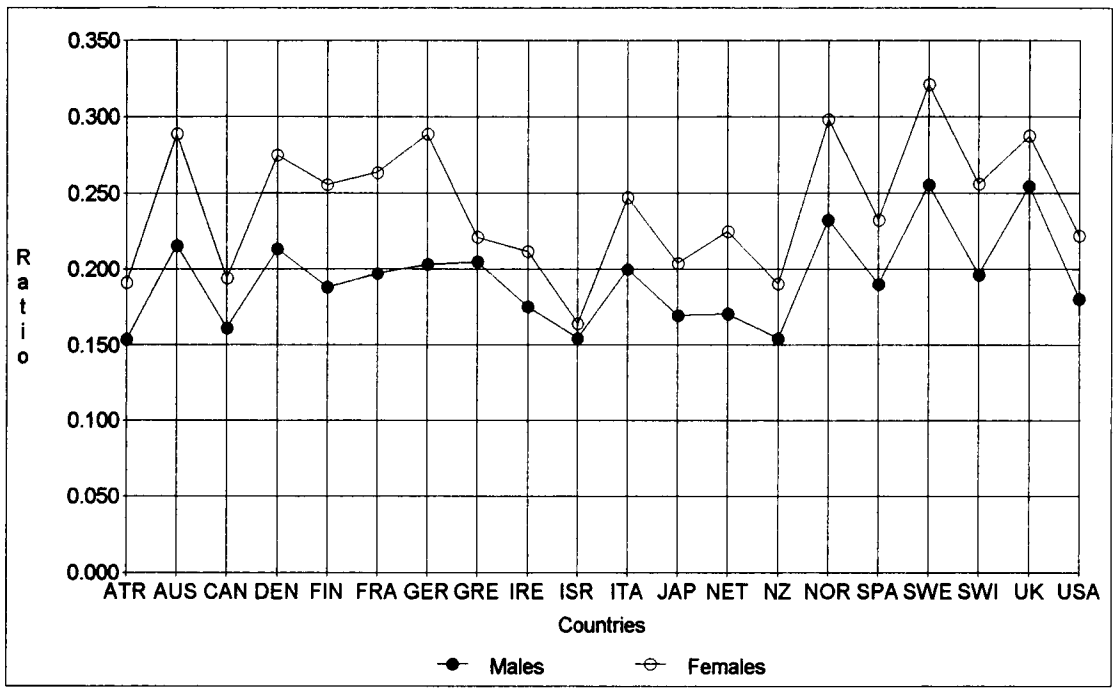


Figure 4.8*

Ratio of Persons Over 64 Years of age to Those Between ages 15 and 64 by Country and Sex, 1988-1990

*Source: World Health Statistics Annual, 1989 and 1991-1994

Gross National Product Per Capita

Gross national product (GNP) per capita is a measure of the value of goods and services produced in a particular region per person over a particular period of time (Amacher, 1993). For this study, GNP per capita was the annual average for the years 1988-1990 (World Tables, 1992).

Each country examined reported a GNP per capita greater than $5,000. The lowest level was found in Greece, that of $5,383 followed by $9,057, $9,413, and $9,893 in Ireland, Spain, and Israel, respectively. Estimates between $10,000 and $15,000 were exhibited by New Zealand ($11,427) and the United Kingdom ($14,450). Six countries, Australia, Italy, the Netherlands, Austria, France, and Canada, reported per capita data ranging between $15,000 and $20,000. The remaining countries, Germany, Denmark, the United States, Norway, Sweden, Finland, and Japan, experienced relatively high GNP per capitas over the period of examination ($20,000 and $25,000). The highest level was found in Switzerland where an average of $29,907 was reported (see Figure 4.9).

Annual Average Divorce Rates

Divorce has, historically, served as an important predictor variable when examining correlates of self-destruction and was, thus, examined here. Divorce data ranged from an annual average low of zero in Ireland, where as of 1992, divorces were still illegal (Facts on File, 1992), to 3 per 1,000 in Denmark.

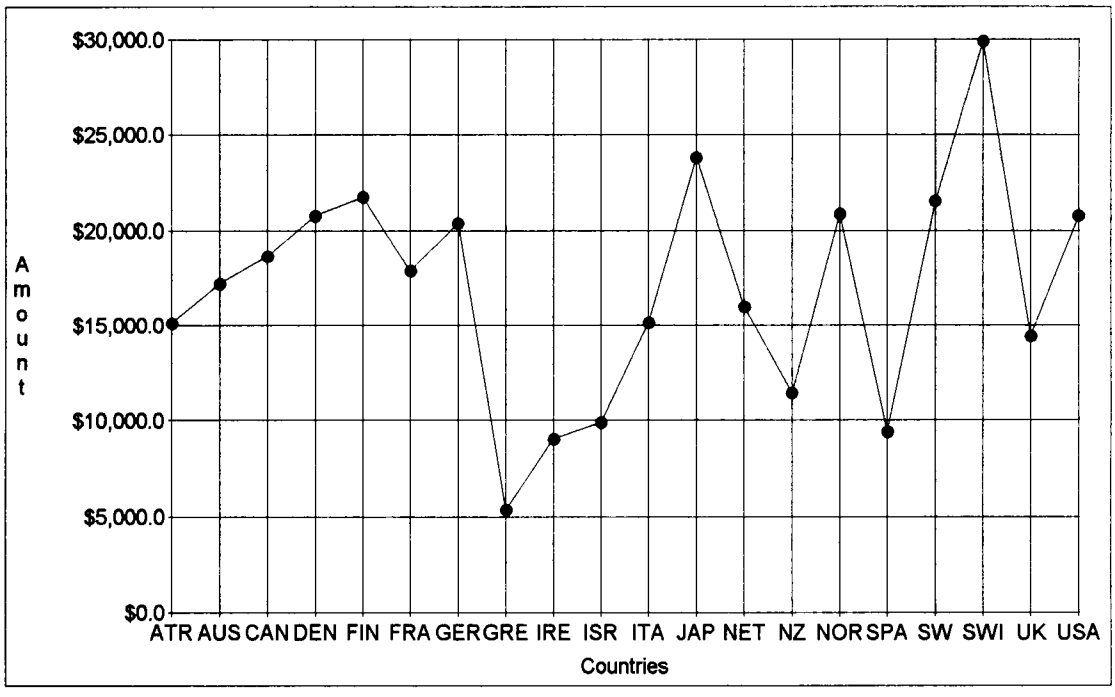


Figure 4.9*

Annual Average Gross National Product per Capita in U.S. Dollars by Country, 1988-1990

*Source: World Health Statistics Annual, 1989 and 1991-1994

Similarly high rates were found in the United Kingdom, New Zealand, and Canada, where each reported rate was equal to three per 1,000. These nations were followed by the United States, Germany, Sweden, the Netherlands, Norway, and Finland where two divorces per 1,000 reportedly occurred over the years 1985 to 1987, the period of interest. France, Switzerland, and Israel also reported divorce data of 2 per 1,000. The lowest rates, with the exception of data from Ireland, were found in Japan (0.9), Greece (0.8), Italy (0.3), and Spain (0.2) (Figure 4.10).

Primary Religion / Denomination

Seven principal religions/denominations were evident in the nations examined: Roman Catholic, Greek Orthodox, Protestant, Anglican, Evangelical Lutheran, Christian, Judaism, and Shinto or Buddhism. Because of similarities in doctrine, each religion was categorized into either Roman Catholic, Protestant, or other. Roman Catholic and Protestant religions were equally represented, each being reported by nine nations. Austria, Canada, France, Ireland, Italy, the Netherlands, Spain, Switzerland, and Greece (who reported Greek Orthodox) were categorized as practicing the Roman Catholic religion, predominantly. Two primarily Anglican countries, Australia and the United Kingdom, along with four countries reporting Evangelical Lutheran as their primary religious doctrine, Denmark, Finland, Norway, and Sweden were classified as Protestant. Germany and the United States were also considered Protestant countries, as well as New Zealand where the Christian religion was reported. Finally, Judaism was reported by Israel and Shinto or Buddhism by Japan. Both countries constituted the other category (See Table 4.3).

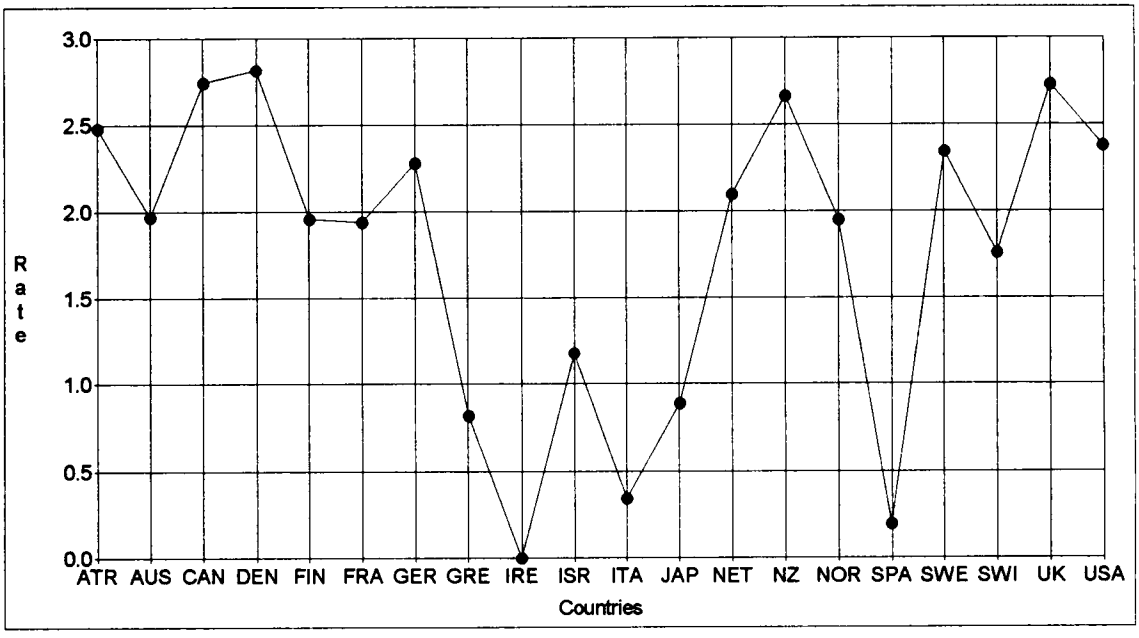


Figure 4.10*

Annual Average Rates of Divorce per 1,000 by Country, 1985-1987

*Sources: See Appendix A2

Table 4.3*

Primary Denominations and Religions Found in Study Countries, 1985-1987

Country	*Denomination*	*Primary Religion*
Australia	Anglican	Protestant
Austria	Roman Catholic	Roman Catholic
Canada	Roman Catholic	Roman Catholic
Denmark	Evangelical Lutheran	Protestant
Finland	Evangelical Lutheran	Protestant
France	Roman Catholic	Roman Catholic
Germany	Protestant	Protestant
Greece	Greek Orthodox	Roman Catholic
Ireland	Roman Catholic	Roman Catholic
Israel	Judism	Other
Italy	Roman Catholic	Roman Catholic
Japan	Shinto or Buddist	Other
Netherlands	Roman Catholic	Roman Catholic
New Zealand	Christian	Protestant
Norway	Evangelical Lutheran	Protestant
Spain	Roman Catholic	Roman Catholic
Sweden	Evangelical Lutheran	Protestant
Switzerland	Christian	Roman Catholic
United Kingdom	Anglian	Protestant
United States	Protestant	Protestant

*Source: World Factbook, 1986, 1987, and 1988

Annual Average Rates of Death due to Cirrhosis of Liver

The annual average rate of death due to cirrhosis of the liver among females between the ages of 65 and 74 ranged from 8 per 100,000 in Ireland to a high of 69 in Italy. The second highest rate in this population was found in Spain (44) followed by 40 per 100,000 reported by Austria. For the 75 and older females, the lowest rate came from Ireland (8) with 95, the high estimate, characterizing Italy.

For females aged 65-74, rates ranged from 10 to 14 per 100,000 in New Zealand, the Netherlands, Norway, Sweden, the United Kingdom, and Australia. Each of these nations, with the exception of Sweden and the Netherlands, also reported data within this range for females over the age of 74 (Figure 4.11). For the latter age group, Switzerland, the Netherlands, Sweden, and Finland reported data between 17 and 20 per 100,000, while five nations, the United States, Canada, Denmark, France, and Israel fell within the interval of 21 and 28 per 100,000. These nations were followed by Greece and Germany, reporting 40 and 47, respectively.

For younger females, cirrhosis death rates between 21 and 25 per 100,000 were exhibited by Greece, Canada, Israel, and the United States. These rates were only slightly higher than corresponding rates for Switzerland (16), Denmark (20), and Finland (15). Germany, France, and Japan were among the nations reporting the highest cirrhosis death rates (32, 32, and 34 per 100,000, respectively). The majority of nations exhibited rates that rose with age. By contrast, the French rate decreased with age. A similar decrease was evident for the United Kingdom, Australia, and the United States.

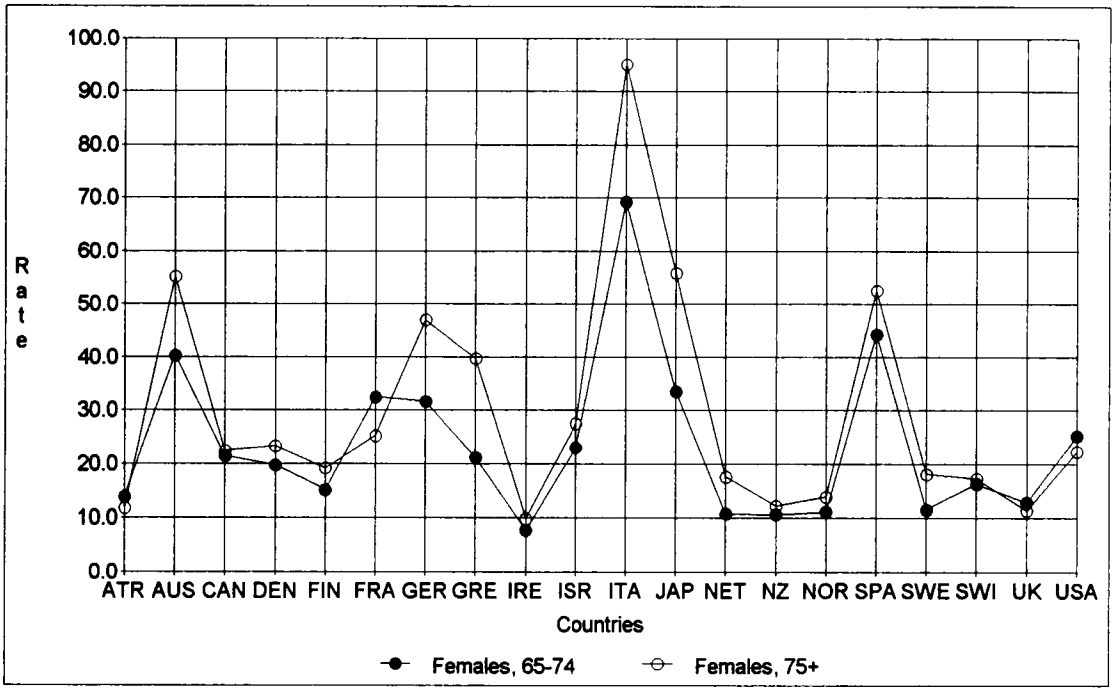


Figure 4.11*

Annual Average Rates of Death due to Cirrhosis of the Liver per 100,000 by Country and Sex, 1985-1987

*Source: World Health Statistics Annual, 1989 and 1991-1994

Female Labor Force Participation

Female labor force participation rates ranged from a high of 53 percent in New Zealand, to 24 percent reported by Spain. Just above the Spanish rate were the rates for Greece and Ireland (26 and 29 percent, respectively). Italy, France and Canada reported similar data. Israel, Switzerland, Japan, Australia, and the United Kingdom reported rates between 30 and 40. Rates for Austria, Norway, and Germany were marginally higher. The U.S., Sweden, Denmark, and Finland all had rates between 40 percent and 47 percent (See Figure 4.12).

Ratio of Male to Female Life-Expectancy at Birth

The ratios of male to female life-expectancy at birth ranged from a low of 0.89 in Canada to 0.95 in Israel. Ratios just below 0.91 were found in France and Finland, both of which experienced a ratio of .90. In Switzerland, a ratio of 0.91 was found followed by 0.92 in Spain, Germany, Austria, Norway, Italy, the Netherlands, Australia, New Zealand and Japan. Data from Denmark, Sweden, Ireland, and the United Kingdom ranged from 0.92 to 0.93 with an estimate of 0.94 coming from Greece (Figure 4.13).

Ratio of Female to Male Years Since Suffrage

To offer an indication of historical gender equality, the ratio of female to male year of suffrage was computed. Relatively low suffrage ratios were found in eight nations. Spain exhibited a ratio of 0.12 followed by Switzerland, France, and Greece ranging between 0.20 and 0.40. Low ratios, those between 0.50 and 0.70, were also found in Italy, the United States, Germany, and Japan. Six nations, Norway, Denmark, Sweden, the United Kingdom, Austria, and New Zealand fell between 0.80 and 0.90 while three nations, the Netherlands, Canada, and Australia exhibited ratios between 0.90 and 0.99. Finally,

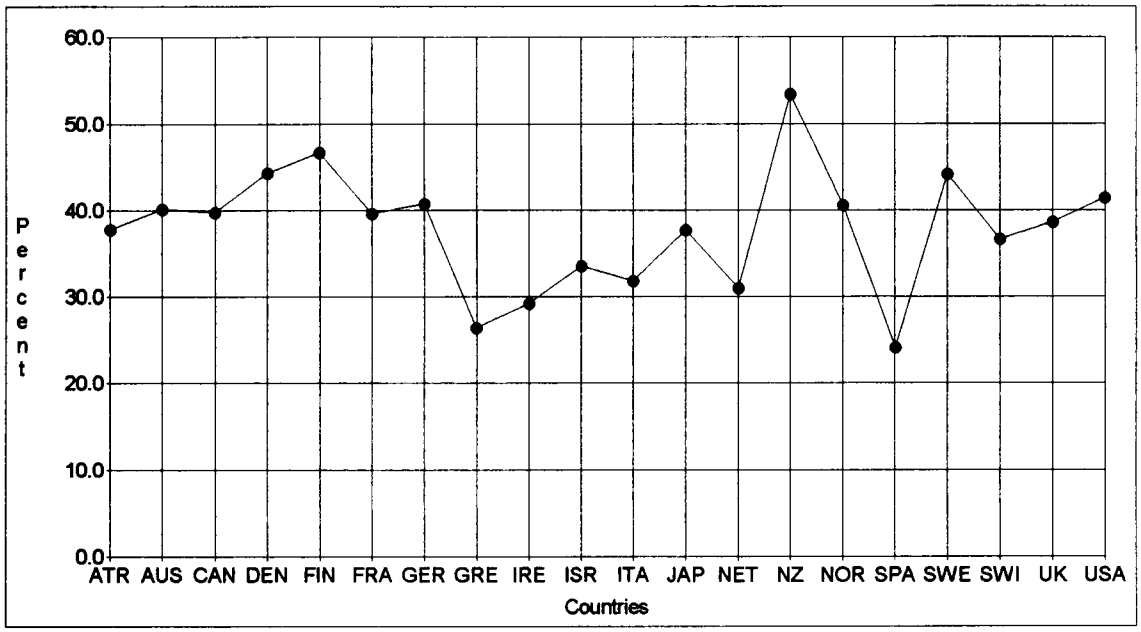


Figure 4.12*

Percentage of the Total Labor Force Composed

of Females by Country, 1988-1990

*Source: World Tables, 1992

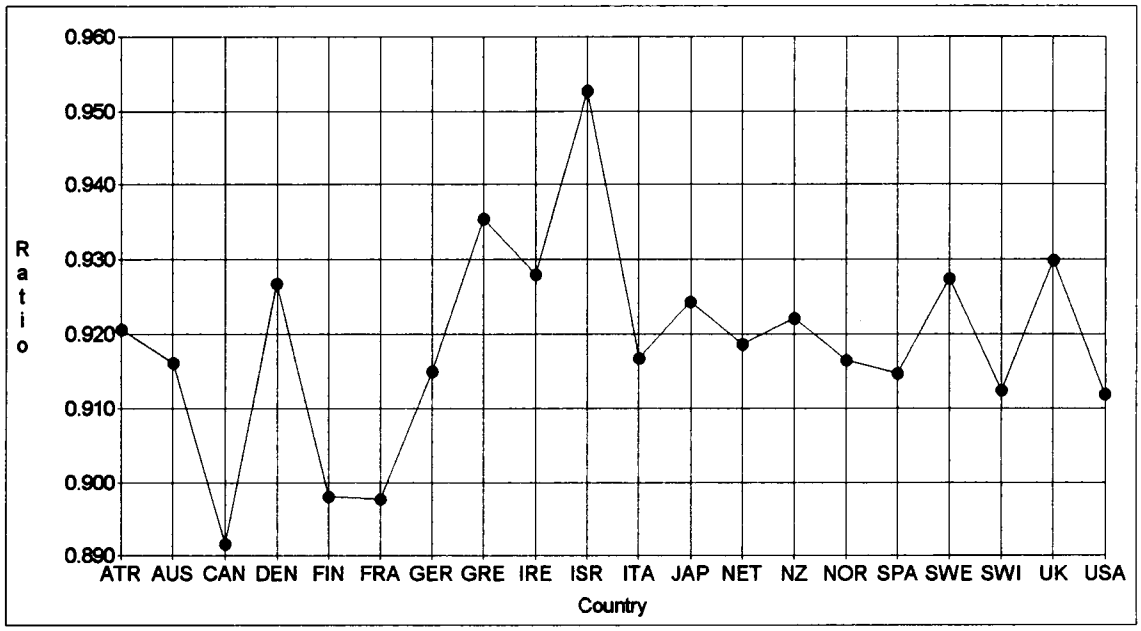


Figure 4.13*

Annual Average Ratio of Male to Female

Life-Expectancy at Birth by Country, 1988-1990

*Sources: See Appendix A.2

three nations exhibited ratios of one, indicating no discrepancy between year of suffrage for males and females: Finland, Ireland, and Israel (Figure 4.14).

III. Correlation Coefficients

Correlation coefficients were computed to show the social construction and social causation variables, and the annual average rate of death due to suicide among females aged 65-74 and 75 and above, and to examine the potential for intercorrelation among the various selected predictor variables.

Two statistical methods were utilized. First, for nominal level data (survey data and primary religion) a Spearman Rank-Order Rho technique was used to compute the correlations between these variables and the dependent variable. In order to compute these coefficients, the five possible survey responses to type of system adjudicating on suicide (coroner, medical examiner, judiciary, police, and other), and the three categories of the primary religion variable (Catholic, Protestant, and Other) were transformed into four and two dummy variables, respectively, to represent either the presence or absence of a particular response within each country. For the remaining independent variables, the Pearson Product-Moment procedure was carried out. Both tests were two-tailed and statistical significance was defined as .10 or less.

The Relationship Between the Dependent and Independent Variables

Each dependent variable was correlated with 19 predictor variables. Age-specific variables were used when possible. For females between 65 and 74 years of age, the primary correlates at the .10 level of probability included the ratios of the number of males and females less than age 15 to those between 15 and 64 ($r = -0.41$, $p=.07$ and -0.39, $p=.09$, respectively) and the ratio of the number of females over the age of 64 to those 15-64 ($r = 0.39$, $p=.09$). These

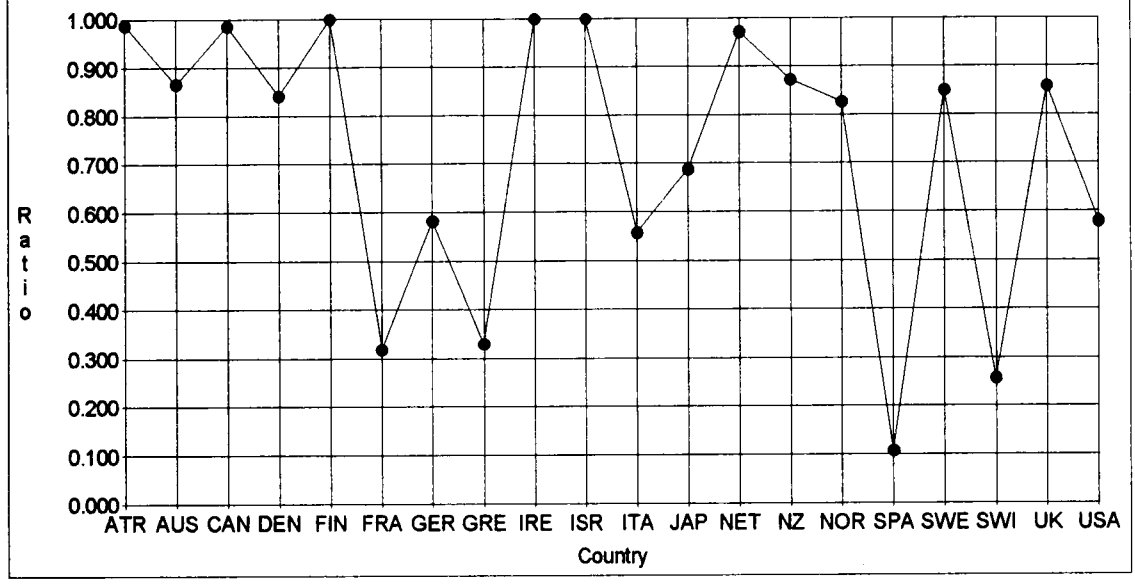


Figure 4.14*

Ratio of Female to Male Years Since Suffrage by Country

(Year of Suffrage was Subtracted from 1989)

*Sources: See Appendix A.2

correlations indicate that as the number of males and females less than age 15 in the populations examined increased, the rate of suicide decreases. On the other hand, as the number of females over the age of 64 increased, suicide rates did likewise. These finding are in agreement with data reported by Lester (1973). Another significant correlate with suicide among this sub-population was the presence of a coroner system ($r = -0.43$, $p=.07$). Apparently, regions having coroner systems in place also report lower rates of suicide. The only other social construction variable of interest with relation to suicide was the rate of accidental deaths due to poisoning. Even though this coefficient was non statistically significant ($r= -0.14$, $p=.55$), its negative sign indicates a potential problem with suicide misclassification. This sign was not evident for accidental drowning or other violence and was deleted from further analysis. Finally, a significant correlation was found between suicide and per capita gross national product ($r = 0.62$, $p=.00$). Given the sign of the coefficient, we may say that, for the nations examined, as national levels of personal expenditure increased, so did the reported rate of suicide among females aged 65-74.

The economic variable was also found to be a significant correlate of suicide among older females along with population density ($r = 0.49$, $p=.03$). As the density estimate increased in the sample of nations included in this study, so did the rate of suicide. Four social construction variables were found to be significant. First, the annual average rate of deaths due to accidental drowning ($r=0.66$, $p=.00$) and the annual average rate of deaths due to other violence ($r=0.56$, $p=.01$) were correlated with suicide among older females at the .05 level. Annual average increases in these rates were seen in conjunction with increases in reported rates of suicide among older females. Even though

significant correlations were found, they did not appear to indicate a problem with misclassification because of their positive sign. Secondly, the presence of a coroner system (r = -0.48, p=.08) or a medical examiner system (r=.43, p=.06) were found to be associated with suicide (Table 4.3).

It is of interest to note that historically important variables did not appear to have an influence upon suicide within this elderly population. For example, religion often serves as a significant correlate of suicide, however, this was not found to be the case here as the relationships between primary religion and suicide rates for both age groups were not statistically significant. The Spearman Rank-Order Rho coefficients between the rate of suicide among females 65-74 and the Catholic (r= -0.16, p=.49) and Protestant (r=0.01, p=.96) dummy variables were not found to be significant. Equally insignificant coefficients were calculated for older females. Divorce, another variable often thought of as important when examining correlates of suicide data, was also found to be an unimportant correlate of suicide among the age groups examined. Pearson Product-Moment coefficients for females aged 65-74 and 75 and over were estimated at 0.17 (p=.48) and -.00 (p=.97), respectively. Differences between what was found here and what the literature suggest may be due to a number of factors. For example, the collection of nations included in this study are somewhat different from those indicated in previous work. Also, few investigations has concentrated on females aged 65-74 or 75 and over. These statistics indicate that, when examining these sub-populations, traditional variables may need to be abandoned in favor of more important factors. Yet, appropriate variables can only be determined after further research has been completed.

Table 4.4

Correlation Coefficients Between Predictor Variables and Annual Average Rates of Suicide Among Females aged 65-74 and 75 and Over

Variables	*Females, 65-74*	*Females, 75+*
Divorce Rate	0.17	-0.01
Urbanization	-0.04	0.00
Primary Religion*	0.19	0.22
Population Density	0.30	0.49
Female Labor Force Participation	0.31	0.14
Ratio of Male to Female Life-Expectancy	-0.08	0.02
Deaths Due to Cirrhosis		
Females 65-74	0.12	*
Females 75+	*	0.36
RCS 1 : <15:15-64		
Male	-0.41	-0.31
Female	-0.39	-0.32
RCS 2 : >64:15-64		
Male	0.19	0.03
Female	0.39	0.18
Ratio of Female to Male Suffrage	-0.07	-0.15
Dummy Variables		
Catholic	-0.16	-0.11
Protestant	0.01	-0.21
Coroner	-0.41	-0.40
Medical Examiner	0.29	0.43
Judicry	0.26	0.15
Police		0.01
Gross National Product Per Capita	0.62	0.49

* Coefficients not computed

Table 4., Continued

Correlation Coefficients Between Predictor Variables and Annual Average Rates of Suicide Among Females aged 65-74 and 75 and Over

Variables	*Females, 65-74*	*Females, 75+*
Rate of Deaths Due to Accidental Poisoning		
Females, 65-74	-0.14	*
Females, 75+	*	0.12
Rate of Deaths Due to Accidental Drowning		
Females, 65-74	0.32	*
Females, 75+	*	0.66
Rate of Death Due to Other Violence		
Females, 65-74	0.23	*
Females, 75+	*	0.56

* Coefficients not computed

Correlation coefficients were also examined as an initial assessment of multicollinearity. Multicollinearity occurs when two predictor variables are highly correlated with each other, meaning that they possibly represent similar properties. The coefficient cutoff used in this study was 0.90. This cutoff was used as a first attempt to identify highly intercorrelated predictor variables. Variables with lesser, yet high correlation coefficients (for example, 0.85) were retained. This was felt appropriate given that further analysis for multicolinearity was completed via an examination of the variance inflation factor. If any two predictor variables were correlated (r = 0.90 and over), a decision was made concerning the deletion of one variable from further study.

Correlation analysis of the independent variables used in the present study indicated a serious problem of multicolinearity with some of the demographic variables. First, the correlation coefficient between the ratios of the number of males and females aged less than 15 to those between 15 and 64 was found to be 0.99. Secondly, the correlation between the ratios of the number of males and females over the age of 64 to those between 15 and 64 was also above 0.90 (r = 0.91). Because of this high intercorrelation, these variables appeared to represent the same thing. For this reason, it was decided to delete the male ratios from further study, as the female population is most important to the purpose of this study. Other predictor variables were also intercorrelated, but to a lesser degree, and were retained for further use in this analysis.

IV. Regression Analysis

The data in this study were initially examined through the use of robust regression techniques (least squares regression and least median squares) in order to identify the potential of contaminated data. Least squares regression

was used because it has the capability to minimize the distances between observed and predicted values of outcome and predictor variables, allowing for more accurate identification of outliers. Least median squares was useful due to its ability to handle data sets with over 50 percent of the data contaminated. Contaminated data sets are those exhibiting cases which are consistent outliers. These cases have the capacity to decrease the accuracy and appropriateness of the regression model. Robust regression allows a large number of samples to be drawn from the data set, treating the data set as a population. For each sample, diagnostics are calculated and outliers are thus identified. Over each sample analysis, the cases that are consistently flagged as potentially problematic are those which should be handled as contaminated. This contamination may be due to erroneous data entry, transposition of decimal points, or exceptional phenomena occurring within a particular country. Such phenomena include natural disasters, strikes, or the inclusion of dissimilar countries (Rousseeuw and LeRoy, 1987). To rule out the possibility of data entry errors in the present study, each data point was reviewed for correctness.

Robust regression requires the use of no more than 20 variables at a time. To achieve this in the present study, variable selection was completed to identify the one model whose R^2 could not be greatly improved by the inclusion or the replacement of an one data point. The R^2 statistic is defined as a representation of how much of the variance between cases is explained by a particular regression model. The "Select" method of variable examination was utilized because of the need to calculate an R^2 statistic that could not be improved by the addition or substitution of additional variables into a particular model (McHenry, 1978). Other methods of inclusion, such as the stepwise method,

lacked this ability. Variable selection was completed for each age division. For older females, the only variables examined in this manner were the social causation variables in addition to survey data. Poisoning, drowning and other violence data were not included because of their positive relationship with the suicide rate for this population. However, among females 65-74, the poisoning rate was incorporated because of it was found to be negatively correlated with suicide. Selected variables were then examined using robust regression. This analysis demonstrated no major problems of contaminated data for either age group, thus, the deletion of any particular nation was not deemed necessary.

The next step in this process was to once again, select the best model for both age divisions. This process was divided into three stages. First, only the main effects were examined. Main-effects are variables that have not been combined into interaction terms. Second, two-factor interaction terms were examined. The only two-factor interaction terms examined were those using either poisoning, drowning, or other violence in conjunction with survey data and social causation data. Interaction terms between the remaining predictor variables were not computed because of the excessive number of combinations (372), a number too large to be adequately examined by available statistical procedures. Interaction between predictor variables occurs when the effect of one predictor on the outcome variables changes as a second predictor variable changes. This effect has the potential of creating spurious regression coefficients. Finally, variable selection was completed using all age- and category-specific main-effects and two-factor interaction terms combined. From this three stage selection process, the best variables chosen at each stage were combined and examined using multiple regression analysis. It was at this stage

that estimates of multicollinearity and diagnoses (discussed in Chapter Three) were computed and examined.

Results of Multiple Regression Analysis

For females aged 65-74 and the poisoning sub-category five variables composed the parsimonious regression model after examination of the main-effects, two-factor interaction terms, and both together. These variables include gross national product per capita, the rate of deaths due to accidental poisoning, per 100,000, and three interaction terms (between the rate of death due to poisoning and density, gross national product per capita, and the ratio of male to female life-expectancy at birth). Multiple regression yielded an R^2 of 0.58, however, a problem with multicollinearity between the interaction terms of poisoning with the live-expectancy variable and poisoning with gross national product per capita was identified. This was indicated by variance inflation factors of 3.8 and 150.0, respectively. Because two interaction terms appeared to produce redundancy, the poisoning-gross national product per capita term was deleted and regression analysis was repeated. Because of the high intercorrelation between these two terms, they both appeared to be redundant. The term exhibiting the greatest variance inflation factor estimate was then deleted. This second analysis indicated no problem with multicollinearity. However, one case (Denmark) exhibited diagnostics greatly above the cutoffs used in this study. The Danish studentized deleted residual was estimated at 3.8 while the degree of fit, standardized equaled 1.3. Because of these estimates, Denmark was considered an outlier and filtered from further analysis. The United States also reported diagnostics above the observed cutoff, however, only slightly. The U.S. consequently was not deleted.

After Denmark was identified as an outlier, the entire variable selection process was repeated producing a model with an R^2 of 0.78. Variables included in this model were the examiner dummy variable, gross national product per capita, and three interaction terms of poisoning with density, the life-expectancy variable, and gross national product per capita. Once again, a problem with multicollinearity was identified and the interaction term of poisoning with gross national product was again deleted for the same reasons as mentioned above. After culling the data for multicollinearity and outliers, two variables remained within the model: gross national product per capita and the interaction term of the ratio of male to female life-expectancy at birth and rate of poisoning. Only gross national product per capita was statistically significant at the .05 level. But, the interaction term of poisoning and life-expectancy variable approached significance (p=.07).

For females age 75 years and older, a different approach was taken toward analysis because of a lack of problems within the data. The data set for this age group appeared to be cleaner as exhibited by no problems with multicollinearity or outliers. The initial variable selection for appropriate main-effects, two-factor interactions, and both, yielded the following variables with an R^2 of 0.75: the percentage of females making up the labor force, the ratio of the number of females less than 15 years of age to those between 15 and 64, the ratio of the number of females over the age of 64 to those between 15 and 64 , Catholicism, and Protestantism. Regression diagnostics did not indicate any problems with the data. From this analysis, only three variables appear statistically significant. The ratio of the number of females aged less than 15 to those 15-64,

Protestantism, and Catholicism were statistically significant at the .05 level while female labor force participation approached significance (p=.09).

Interpretations of Multiple Regression Analysis

From the analysis of these data, it would appear acceptable to reject the second hypothesis in favor of the first. Hypothesis one states that differences in reported annual average rates of suicide among elderly females are a product of social causation. By accepting this hypothesis, we are saying that social construction issues, such as suicide misclassification and differing ascertainment procedures, have little impact upon the dependent variables. The data presented in the previous section offers support for this assertion.

First, for females 65-74, gross national product per capita was the only significant predictor of reported rates of suicide, at the .05 level. However, one social construction variable, the rate of death due to accidental poisoning, was found to approach significance (p=.90) and only in the form of an interaction term with the ratio of male to female life-expectancy at birth. Equation 4.1 represents the associations between suicide among females aged 65-74 and the predictor variables found to be significant within the poisoning sub-category. From this equation, we see that, holding the interaction term constant, as gross national product increases by $1,000, suicide increases by 0.86 persons per 100,000. However, the interaction term may be interpreted in three different ways. First, while adjusting for gross national product per capita and holding the life-expectancy ratio constant, for every unit (or death) increase per 100,000 in the rate of poisoning, the rate of suicide will decrease by 0.11 persons per 100,000. Secondly, if the rate of poisoning is held constant, for every increase of .10 in

Equation 4.1

$$\check{S}_p = -0.57 + 0.86\,(GNPPC) - 0.11\,(POISONING*LIFE\text{-}EXPECTANCY)$$

$$R^2_{pred} = 0.27$$

where $\check{S}_p$ represents the predicted rate of suicide among females aged 65-74 with the rate of poisoning included in the analysis, GNPPC is the gross national product per capita, and POISONING/LIFE-EXPECTANCY is the interaction term of the annual average rate of poisoning, per 100,000 with the ratio of male to female life-expectancy at birth.

the live-expectancy variable, the rate of suicide will, again, decrease by 0.11 persons per 100,000. However, if either the life-expectancy variable increases (or decreases) and the poisoning rate decreases (or increases), the interpretation of this equation becomes country specific. Countries reporting low estimates on both the life-expectancy and poisoning variables will experience less suicide adjustment than nations with higher estimates of these two variables.

This equation must, however, be tempered by examining its predictability. The R-squared predict (R^2_{pred}) statistic was calculated to offer a measure of the utility of the models constructed in predicting annual average rates of suicide. R^2_{pred} is calculated by omitting a particular variable from the sample and predicting this variable from the remaining n-1 predictors. This is completed n times as an effective measure of predictability when examining small sample sizes. This statistic is used here because it is a better estimate of model predictability than the traditional R^2, as the latter statistic is not a prediction oriented criterion (William Seaver, Department of Statistics, the University of

Tennessee, personal communication). When examining the data in light of the poisoning rate, a calculated R^2_{pred} of 0.27 was found, thus this model only explains 27 percent of the variance between the observed and predicted values of the dependent variable. What this tells us is that, even though we are able to construct an equation which represents the relationship between suicide and the variables in the equation, this tells us very little about this relationship. One reason for a deficiency in predictability may be that, for this particular age division, the variables examined have been misspecified. Variable mispecification occurs when unimportant data points have been collected and used in the analysis, while ignoring important variables. Further research should be completed to evaluate this assertion.

Among older females, the regression model was composed solely of social causation variables. Three predictors, the ratio of the number of females aged less than 15 to those between the ages of 15 and 64 (RCS1), Catholicism (CAT), and Protestantism (PRO) were statistically significant at the .05 level. The percentage of the total labor force composed of women (FLFP) is included in the model even though it approached significance (p=.09). Equation 4.2 depicts the relationship between these variables and the annual average rate of suicide among females aged 75 and over:

From this equation we may say that, with the ratio of females aged 14 years of age or less to those between 15 and 64 years (RCS1), Catholicism (CAT), and Protestantism (PRO) held constant, as the percentage of females making up the labor force increases by one percent, the rate of suicide among older females will increase by 0.61 persons per 100,000. However, with each predictor

Equation 4.2

$$\check{S} = -.29.8 + 0.61\ (FLFP) - 84.6\ (RCS1) - 32.2\ (CAT) - 41.6\ (PRO)$$

$$R^2_{pred} = 0.71$$

where Š represents the predicted rate of suicide among females aged 75 and over, FLFP is the percentage of females making up the labor force, RCS1 is the ratio of the number of females aged less than 15 to those between 15 and 64 years, CAT represents the dummy variable for Catholicism, and PRO is the dummy variable for Protestantism.

constant except the second term in the equation, (RCS1), we may say that as this ratio increases by .01 units (ie., more young people relative to older individuals), suicide will decrease by 85 persons per 100,000. The same may be said for both the religious variables. Countries with predominantly Catholic and Protestant religions experience 32 and 42 fewer, respectively, fewer suicides per 100,000 than countries reporting other forms of religion. These regression coefficients suggest that Protestantism has more of an influence on decreased suicide rates than does Catholicism. Unlike the equations for younger females, the R^2_{pred} among older females is much greater, estimated at 0.71. This model appears to offer a truer representation of correlates of suicide among older females than the previous model discussed, as 71 percent of the variance was explained.

V. Conclusion

From this analysis, it becomes more feasible to state that social construction variables offer little to the predictability of suicides among elderly females in the nations examined in this study. For females aged 65-74, gross national product

was the only variable statistically significant at the .05 level. The only social construction variable indicated in this age group was found in an interaction term composed of the rate of death due to accidental poisoning and the life-expectancy variable. This term was significant only at the .10 level.

However, given these findings, the model constructed for females 65-74 explains less than half of the variance, indicating, perhaps a problem with model specification. A great deal more variance was explained by the equation constructed for older females (71 percent). Four variables are found in this equation: female labor force participation, the ratio of the number of females aged less than 15 to those between 15 and 64, and the religious dummy variables of Catholicism and Protestantism. It is because of these findings that the second hypothesis of this study is rejected in favor of the first.

CHAPTER FIVE: FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

I. Introduction

The purpose of this study was to examine social causation and social construction variables in relation to annual average rates of suicide reported by 20 nations. Two age-specific populations were examined; females between the ages of 65 and 74 and females over the age of 74. This was done to assess the best correlates, either social construction or social causation, of self-destruction within these sub-populations. Social construction variables were variables that might produce artifactual suicide rate variation due to differences between nations in the manner in which causes of death are determined. On the other hand, social causation variables pertained to those aspects of social existence, such as divorce and religion, that might exert a direct environmental influence upon reported rates. Both these issues have been discussed within the literature, yet, according to Pescosolido and Mendelsohn (1986) no definitive answers have been developed concerning the quality of suicide statistics.

To examine the purpose of the study two research hypotheses and one research question were considered:

- ***Hypothesis One:*** Suicide rate differentials reported for the elderly female population of the countries examined are a product of social construction.
- ***Hypothesis Two:*** Suicide rate differentials reported for the elderly female population of the countries examined reflect differences in social causation factors.

- ***Research Question:*** For the countries examined, do social construction or social causation variables serve as the best predictors of suicide rates among females 65 years of age or greater?

In order to examine these hypotheses and question, descriptive statistics were used to describe the data. Secondly, correlation coefficients were generated as a first step in assessing the relationships between the predictor variables and the dependent variables. However, the primary tool utilized was that of multiple regression analysis. This statistical technique was helpful in determining the variables which served as the best predictors of the annual average rates of suicide among elderly females in the nations examined.

II. Findings

The major finding of this study involved the importance of social causation variables as predictors of annual average rates of suicide among females aged 65-74 and 75 and above. Each of the equations constructed within this study included variables relating to environmental conditions as opposed to issues associated with the quality of suicide data. The one exception to this was the emergence of an interaction term containing the poisoning rate and the ratio of male to female life-expectancy at birth. This term approached significance, but only for females aged 65-74. Based upon the analysis, the following findings are discussed.

1. Among females aged 65-74, gross national product per capita was the only variable statistically significant at the .05 level.

2. For younger females, the only social construction variable with any importance was the rate of deaths due to accidental poisoning which approached significance (p=.07) . This variable was only exhibited as part of an

interaction term along with the ratio of male to female life-expectancy at birth. This interaction term was included in the model along with gross national product per capita. As indicated by its negative regression coefficient (-.39) accidental poisoning represents a mortality category that might contain misclassified suicides.

3. Among older females, those over the age of 74, three variables were found to be significant at the .05 level; the ratio of the number of females less than 15 years of age to those between the ages of 15 and 64, Catholicism, and Protestantism. One variable, the percentage of the total labor force composed of females was also included in this model, but was found to be significant only at .10.

4a. Given these models, it was found for females aged 65-74, that as gross national product per capita increased by $1,000, the rate of suicide among this age group also increases by from 0.73 to 0.86 persons per 100,000. However, if the economic variable is adjusted for, and the poisoning rate is held constant, as the gap between male and female life-expectancy at birth decreases, suicide rates decrease by 0.11 persons per 100,000. The same holds true if the live-expectancy variable is held constant; an increase in suicide of 0.11 persons per 100,000 is evident given one unit increase (one death per 100,000) in the rate of deaths due to accidental poisoning.

4b. Among older females, it was found that as the number of females less than 15 years of age decreases relative to the number of females between the ages of 15 and 64, the rate of suicide increases by 85 persons per 100,000. Likewise as the number of females composing the labor force increases by one percent, the rate of suicide among this age group also increases, but only by 0.61

persons per 100,000. Finally, nations with predominantly Catholic and Protestant religious doctrines experience 320 and 42 fewer suicides per 100,000, respectively, than nations with other primary forms of religion.

5. Even though models were produced offering significant predictors of suicide among the populations examined, the predictive power of these models varied greatly between the two age groups. The first equation exhibited an R^2_{pred} of only 0.27, meaning that the variables comprising the model only explained 27 percent of the variance between observed and predicted values of the dependent variable. On the other hand, the R^2_{pred} statistic was much greater for the equation used to explain suicide among older women. A statistic of 0.71 indicated that the model used among this age group explained 71 percent of the variance, offering more confidence in this model as a predictive tool than the model pertinent to the younger female group.

III. Conclusions

The following conclusions have been reached. Each conclusion is based upon the findings of this study discussed in the previous section.

1. Social construction apparently has very little influence upon reported rates of suicide among females aged 65-74 and 75 and over, given the countries and data points included here. This conclusion is offered because for each age group the only social construction variable emerging was one component of an interaction term comprised of the rate of deaths due to accidental poisoning and the ratio of male to female life-expectancy at birth. Moreover, this term was found to be significant only at the .10 level.

2. Given the data and countries selected for this study, annual average rates of suicide among elderly females are products of social causation. This was found

to be the case for both age groups examined. Among younger females, gross national product per capita emerged as a significant predictor. Yet, for older females three different variables, the ratio of the number of females 15 years of age or less to those between the ages of 15 and 64, Catholicism, and Protestantism were found to be significant at .05. A fourth variable, the percentage of the total labor force comprised of females was also included in the model, but was only significant at the .10 level of probability.

3. Annual average rates of suicide reported by the nations examined in this study appear to be valid based upon the finding that only social causation variables served as significant predictors of self destruction among elderly females at the .05 level of probability. The only emergence of a social construction variable was found among younger females and only in terms of an interaction variable.

4. The variables used to explain suicide rate differentials among younger females do not appear to be appropriate given the low R^2_{pred} estimates found among this age group. This may be due to model misspecification. Perhaps traditional correlates of suicidal behavior do not apply to women within this age range. However, for females over the age of 74, the model, based upon an R^2_{pred} of 0.71, appears to be more accurate in explaining the relationship between model variables and self-destruction.

5. Finally, it may be concluded that the two populations examined in this study are distinctly different groups given, first, the low predictive power of the model constructed for females aged 65-74, and second, the inclusion of different predictor variables between the two ages examined.

IV. Recommendations

Based upon the completion of this study, the following recommendations are offered for future research.

1. Regardless of the findings in the present study, future investigations into suicide rate differentials should examine the possibility of suicide data being invalidated by issues of social construction. This has been an issue of concern to many researchers. However, further research is needed. If reported data are not questioned in this manner, the possibility exists for data analysis to lead to incorrect conclusions.

2. The social construction variables used in this study should be expanded to include a wider range of such variables. Additional variables may include the number of years that death registration has been in place in a particular region, personal characteristics of those responsible for determining cause of death, and other potentially problematic classifications of death such as deaths due to drugs and medicaments causing adverse effects in therapeutic use.

3. With regard to social causation variables, traditional correlates of suicide should be abandoned in favor of age-specific predictors. In the present study, variables, such as the rate of divorce (a traditional variable), did not emerge as significant. Also, it was found that different variables served as significant predictors of self-destructive behavior between the two age groups examined. For these reasons, future research should examine age-specific data in order to develop variables suitable for investigations. Also, because of a lack of support for appropriate lag periods between the predictor and response variables, further study is needed to determine the amount of time (between environmental exposure and self-destruction) needed to produce a significant relationship.

4. To substantiate or refute the findings of this study, another investigation should be completed using more than 20 nations or a different combination of countries. The addition of more countries, especially less developed ones, and the acquisition of similar results, would offer greater support to statements concerning the validity of reported suicide rates.

5. Even though ecological investigations of suicide are useful in determining geographical correlates, they lack the ability to relate study findings to individuals within a particular region. It is important to realize this limitation and construct research designs capable to examine the findings of this study using individual-level data.

6. A thorough examination of data quality should be included in future examinations of reported rates of suicide. In the present study, Denmark was a habitual outlier when the data for females aged 65-74 were examined. If this problem had not been identified, it is quite possible that the regression coefficients would have been different and erroneous.

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APPENDICES

Appendix A1

Addresses from Foreign Consular Offices Located in the United States, 1994

Country	Address
Australia	1601 Massachusetts Avenue, North West Washington, D.C. 20036
Austria	3524 International Court, North West Washington, D.C. 20008
Canada	501 Pennsylvania Avenue, North West Washington, D.C. 20001
Denmark	3200 Whitehave Street, North West Washington, D.C. 20008
Finland	3216 New Mexico Avenue, North West Washington, D.C. 30016
France	4101 Reservoir Road, North West Washington, D.C. 20007
Germany	4645 Reservoir Road, North West Washington, D.C. 20007
Greece	2221 Massachusetts Avenue, North West Washington, D.C. 20008
Ireland	2234 Massachusetts Avenue, North West Washington, D.C. 20008
Israel	3514 International Drive, North West Washington, D.C. 20008
Italy	1601 Fuller Street, North West Washington, D.C. 20009
Japan	2520 Massachusetts Avenue, North West Washington, D.C. 20008

Appendix A1, Continued

Country	Address
Netherlands	4200 Linnean Avenue, North West Washington, D.C. 20008
New Zealand	37 Observatory Circle, North West Washington, D.C. 20008
Norway	2720 37th Street, North West Washington, D.C. 20008
Spain	2700 15th Street, North West Washington, D.C. 20009
Sweden	600 New Hampshire Avenue, North West Suites 1200 and 715 Washington, D.C. 20037
Switzerland	2900 Cathedral Avenue, North West Washington, D.C. 20008
United Kingdom	3100 Massachusetts Avenue, North West Washington, D.C. 20008

Appendix A2

Data Variables and Their Sources

Variable	*Source*
Dependent Variables	
Rate of Suicide Among Females 65-74	World Health Statistics Annual, 1989 and 1991-1994[1]
Rate of Suicide Among Females 75 and Over	World Health Statistics Annual, 1989 and 1991-1994[1]
Independent Variables	
Social Construction	
Rates of Accidental Poisoning, Drowning and Other Violence	World Health Statistics Annual, 1989 and 1991-1994[1]
Survey Data	Gilles E. Bujold, tax lawyer (personal communication) [2] Peter Dervan, University College Dublin, (personal communication)[3] Foreign Consular Offices Within the United States New Zealand Ministry of Health (personal communication) Peter Faris, Queens Council,(personal communication)[4] Statistics Norway, Division of Health, National Insurance and Social Conditions (personal communication) Statistics Sweden

Appendix A2, Continued

Variable	*Source*
Social Causation	
Population Structure	
Percentage Population Urban	World tables, 1992[1]
Population Density	United Nations Demographic Yearbook, 1992[1]
Ratio of Females <15 Years of age to those Between 15-64	World Health Statistics Annual, 1989 and 1991-1994[1]
Population Structure	
Ratio of Males <15 Years of age to those Between 15-64	World Health Statistics Annual, 1989 and 1991-1994[1]
Ratio of Females >64 Years of age to those Between 15-64	World Health Statistics Annual, 1989 and 1991-1994[1]
Ratio of Males >64 Years of age to those Between 15-64	World Health Statistics Annual, 1989 and 1991-1994[1]
Economic and Social Indicators	
Gross National Product Per Capita	World Tables, 1992[1]
Divorce Rate	European Marketing and Data Statistics, 1992[5] International Marketing and Data Statistics, 1992[6] Rodrick Beaujot, University of Western Ontario (personal communication)[2]

Appendix A2, Continued

Variable	*Source*
Divorce Rate, Continued	United Nations Demographic Yearbook, 1992 and 1993 United Nations Statistical Yearbook, 1993
Percentage of Economically Active Population Composed of Females	World Tables, 1992[1]
Primary Religion	World Factbook, 1986-1988[1]
Rate of Death Due to Cirrhosis of the Liver	World Health Statistics Annual, 1986-1989, 1991, and 1992[1]
Economic and Social Indicators	
Ratio of Female to Male Year of Suffrage	The New Standard Jewish Encyclopedia, Seventh Edition Revised, 1992[7] Political Data Handbook: OECD Countries, 1991
Ratio of Male to Female Life Expectancy	Austrian Demographic Yearbook 1993 Julie Greenblatt, Israel Information Service (personal communication)[11] World Almanac and Book of Facts, 1992[10] World Development Report, 1990: Poverty, 1990[9] World Factbook, 1990[8]

Appendix A2, Continued

[1] For all years
[2] Canadian data
[3] Irish data
[4] Australian data
[5] Norwegian data
[6] Greek data for 1986 and 1987
[7] Israeli data
[8] New Zealand and United Kingdom Data for 1989 and 1990
[9] United Kingdom data for 1988
[10] Israeli data for 1989
[11] Israeli data for 1988 and 1990

Appendix A3

Survey Requesting Information Regarding Type of System Responsible for Determining Cause of Death in Suspecious and/or Unnatural Deaths

TO: Foreign Consular Offices in the United States
Public Relations Officer

FROM: B. McKinley Thomas
The University of Tennessee, Knoxville

DATE: June 10, 1994

RE: Death certification

Please allow me to ask you a question. I am currently conducting an international study of mortality and would like to gain information from Australia.

QUESTION: For **Australia**, in cases of premature *and/or* suspicious death, which system has the primary responsibility for assigning manner of death; that is, assigning death as natural, accident, suicide, or homicide?
Please check one of the following.

Coroner System _____
Medical Examiner System _____
Judiciary _____
Police _____
Other _____

Any information you could send me would be greatly appreciated. *Please* return your answer by one of the following methods:

B. McKinley Thomas
The University of Tennessee
Fax: Area Code (615) 974-8981
E-Mail: bthomas@utkvx.utk.edu
Mailing Address: The University of Tennessee
Department of Health, Leisure, and Safety
Andy Holt Avenue
Room 381
Knoxville, TN 37920 U.S.A.

Thank You!

VITAÉ

Billy McKinley Thomas was born on July 29th, 1964. Billy attended grades one through eleven at a private institution in Gordon, Georgia. Upon the schools closing due to financial insolubility in 1981, Billy attended Georgia Military Academy in Milledgeville, Georgia where, during the summer of this year, he completed his 12^{th} grade English and Physical Education requirements.

From 1981 to 1988, Billy was enrolled in Georgia College at Milledgeville, studying, first Business Information Systems, followed by Physical Education, and finally deciding upon the major of Community Health Education. After graduation with a Bachelors of Science Degree in June of 1988, Billy re-enrolled at Georgia College to work toward a Masters of Education. While working toward this degree, Billy served as a Graduate Teaching Assistant, offering instruction in Personal Health, assisting on various research projects, and planned and implemented a number of community workshops dealing with topics ranging from human sexuality, child abuse, and drug abuse, to stress management, successful goal setting, and AIDS prevention.

Upon receiving his M.Ed. from Georgia College in August of 1989, Billy was recruited by the institution to teach in the Department of Health and Physical Education. Here, he taught Human Sexuality, Tobacco Alcohol, and Drugs, Stress Management, Introduction to Human Diseases, Wellness, and Health Methods, as well as assisted in the collection and analysis of research data concerning AIDS education in the State of Georgia. Billy taught at Georgia College for two years.

In the Fall of 1991, permission was granted by the University of Tennessee at Knoxville for Billy to enroll in the Doctoral Program in order to work toward a Doctorate of Education in Health Education. From August of 1992 until December of 1994, Billy worked as a Graduate Teaching Associate in the Department of Health, Leisure, and Safety. His duties included teaching Personal Health and Emergency First Aid and Safety. His course work was completed in the Summer of 1993, followed by his dissertation requirement in 1995. The title of his dissertation was Correlates of Elderly Female Suicide: A Cross-National Ecological Study. Billy graduated from the University of Tennessee, Knoxville on August 11th, 1995.