# PREDICTORS OF LONGEVITY IN AN ELDERLY INSTITUTIONALIZED POPULATION



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# PREDICTORS OF LONGEVITY IN AN ELDERLY INSTITUTIONALIZED POPULATION

by

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# ABSTRACT

A number of salient predictors of longevity, other than age and gender, have emerged from research on samples of elderly community dwellers. In particular, high levels of cognitive function, high socioeconomic status, high self-health ratings and activity levels, and low incidence of lifestress all predict longevity in this population. In contrast to the abundant research on predictors of longevity in elderly community dwellers, there is a paucity of research on predictors of longevity in the elderly institutionalized. This is problematic, as findings on community- dwelling elderly may not generalize to other samples of elderly, such as elderly institution dwellers. Volunteer samples of elderly from longitudinal studies have been shown to differ even from other community dwellers in cognitive function and socioeconomic status (higher for volunteers).

Therefore, a non-demented institutionalized elderly sample from all major institutions in Newfoundland was retrospectively examined on two measurement occasions, within 12 months of each other. One hundred and fifty-six subjects between the ages of 65 and 95 years were available at first measurement (Wave One), and 122 of the same subjects were alive and agreed to be retested on a second occasion 12 months later (Wave Two). Dimensions of health, personality, quality of life and lifestress were measured, and relevant demographic data were analysed. Time-to-death (i.e. time from initial measurement until subject's death) was used to classify all subjects. Three comparisons of data were made: 1) retestees were compared to non-retestees (i.e., subjects who were alive at retest but were not retested), 2) the full sample was compared on the basis of time-to-death, and 3) the retestees alone were compared on the basis of time-to-death. Analyses of Variance were computed for all comparisons.

Several predictors of longevity emerged from this study: retestee status (i.e. being retested), higher activity levels and higher lifestress were the main predictors of longevity in the institutionalized sample. Fewer years of education were also related to death, for the group surviving between three and six years after initial testing. Findings were compared to previous research findings, and suggestions for future research were made.

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# TABLE OF CONTENTS

Page

ABSTRACT ..... i

ACKNOWLEDGEMENTS ..... ii

TABLE OF CONTENTS ..... iii

LIST OF TABLES ..... vi

LIST OF APPENDIXES ..... vii

INTRODUCTION ..... 1

The Issue of Generalizability ..... 2

Characteristics of the Institutionalized Elderly ..... 2

Theoretical Perspectives ..... 4

Methodological Issues ..... 6

Experimental Findings ..... 8

[i] Cognitive Indices ..... 9

[ii] Demographic Variables ..... 13

[iii] Education and Socioeconomic Status ..... 16

[iv] Personality Variables ..... 16

[v] Health-Related Predictors ..... 18

[vi] Social Activity ..... 22

[vii] Life Stress ..... 23

Summary of Experimental Findings ..... 25

[i] Predictors of Longevity in Community Samples ..... 25

[ii] Predictors of Longevity in Institutional Samples ..... 27

Purpose Of This Research Project ..... 29

METHOD ..... 30

Data Base ..... 30

Subjects ..... 30

Measures ..... 31

[i] SES ..... 31

[ii] HEALTH ..... 31

[iii] WELL-BEING ..... 32

[iv] ACTIVITY ..... 33

[v] LIFESTRESS ..... 33

[vi] CONTROL ..... 34

[vii] VERBAL ABILITY ..... 34

[viii] SATISFACTION ..... 34

[IX] RELIGIOSITY ..... 35

Procedures ..... 35

RESULTS ..... 37

Preliminary Analyses ..... 37

[i] Age, Gender and Survival ..... 37

[ii] Retest Status and Survival ..... 37

Main Analyses ..... 40

[i] Predictors According to Time-to-Death for Wave One Data ..... 40

[ii] Predictors According to Time-to-Death for Retestees ..... 41

DISCUSSION ..... 46

Contribution of This Study ..... 46

[i] Activity ..... 47

[ii] Lifestress ..... 48

[iii] Age ..... 49

[iv] Gender ..... 49

[v] Marital Status, Education and SES ..... 50

[vi] Verbal Ability ..... 51

[vii] Health ..... 51

[ix] Well Being and Locus of Control ..... 52

Conclusions ..... 53

REFERENCES ..... 55

APPENDIXES ..... 62

# LIST OF TABLES

PAGE

TABLE 1: GENDER AND MEAN AGE DISTRIBUTIONS AT W1 IN TIME-TO-DEATH GROUPS FOR ALL WAVE ONE SUBJECTS (N = 156) .....39

TABLE 2: GENDER AND MEAN AGE DISTRIBUTIONS AT W1 IN TIME-TO-DEATH GROUPS FOR RETESTEES (N = 121) .....39

TABLE 3: SAMPLE MEANS AND ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) FOR MEASURES SHOWING SIGNIFICANT DIFFERENCES BETWEEN RETESTEES AND NON-RETESTEES .....42

TABLE 4: SAMPLE MEANS AND ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) FOR SUBSCALES OF THE MUNSHON WHICH SIGNIFICANT DIFFERENCES WERE FOUND BETWEEN RETESTEES AND NON-RETESTEES .....42

TABLE 5: CORRELATIONS AMONG MEASURES SIGNIFICANTLY DIFFERENT FOR RETESTEES AND NON-RETESTEES .....42

TABLE 6: CELL SIZE PER MEASURE FOR ALL WAVE ONE DATA GROUPED BY TIME-TO-DEATH .....43

TABLE 7: SAMPLE MEANS AND ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEAN) FOR MEASURES SHOWING SIGNIFICANT DIFFERENCES ACCORDING TO SUBJECT'S TIME-TO-DEATH .....43

TABLE 8: CELL SIZE FOR RETESTEE TIME-TO-DEATH GROUPS ON ALL MEASURES FOR WAVE ONE .....45

TABLE 9: SAMPLE MEANS AND ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) FOR MEASURES SIGNIFICANTLY DIFFERENT ACCORDING TO TIME-TO-DEATH OF RETESTEES .....45

# LIST OF APPENDIXES

PAGE

APPENDIX A: OCCUPATIONAL CATEGORIES AND WEIGHTINGS .....62

APPENDIX B: DRUG CLASSIFICATION INDEX .....63

APPENDIX C: SEVERITY OF ILLNESS INDEX .....65

APPENDIX D: MUNSH .....70

APPENDIX E: MUNAI .....72

APPENDIX F: JESSOR SCALE .....75

APPENDIX G: CELL SIZE FOR RETESTEE TIME-TO-DEATH GROUPS ON ALL MEASURES FOR WAVE TWO .....76

APPENDIX H: SAMPLE MEANS, ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS), AND F VALUES FROM ANOVAS ON DATA FOR ALL SUBJECTS GROUPED ACCORDING TO TIME-TO-DEATH.....77

APPENDIX I: SAMPLE MEANS, ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) AND F VALUES FOR MEASURES ACCORDING TO SUBJECTS' RETEST STATUS .....78

APPENDIX J: SAMPLE MEANS, ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) AND F VALUES FROM ANOVAS ON GROUP EFFECT FOR RETESTEES ACCORDING TO SUBJECTS' TIME-TO-DEATH .....79

APPENDIX K: SAMPLE MEANS, ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) AND F VALUES FROM ANOVAS ON TIME OF MEASUREMENT EFFECTS FOR RETESTEES ACCORDING TO SUBJECTS' TIME-TO-DEATH .....80

# INTRODUCTION

"Lord, make me know mine end, and the measure of my days, what it is" (Old Testament: Psalms, xxxix, 4).

Since time immemorial, man has attempted to determine signs of approaching death, ostensibly in order to adequately prepare for it. The purpose of modern research in this area is quite different: to define variables susceptible to intervention, leading thereby to prolonged life and improvements in its quality.

The earliest established predictors of death, chronological age, along with sex and race, continue to be used by present day actuaries. However, these variables cannot be manipulated and provide only a crude estimate of time of death, an estimate plagued by much individual variability, especially in the old-old age range (80 years and over). In order to define variables susceptible to intervention as well as to account for some of the extreme variability in aged individuals' longevity, research in the last half of the century has shifted its focus: although originally concerned with describing declines in absolute levels of individual variables thought to indicate approaching death, scientists are now attempting to delineate a constellation of related predictors, in order to describe the complex picture of interrelated biological, psychological and social influences on longevity. However, in the words of a reviewer of recent efforts in this area, "it has just begun" (Botwinick, 1984).

## Purpose of This Study

This research examines predictors of longevity in an elderly non-demented nursing home population. The review of previous literature is organized as

follows. After discussion of issues relating to generalizability and special characteristics of institutional samples, theoretical perspectives on mortality will be described. Then, methodological issues related to longevity prediction will be discussed. Finally, a comprehensive review of research findings will be presented.

## The Issue of Generalizability

Not only is the research in the area of interelated predictors of longevity in its infancy, but, until recently, findings were restricted in their application, due to the highly selective nature of the populations analyzed. With the exception of a few studies primarily completed in the sixties and early seventies, research into longevity prediction used selected samples of community-dwelling elderly volunteers. It has been suggested that findings from these samples may not generalize to the average community-dweller, let alone to a more specialized subgroup of the elderly population, such as the institutionalized elderly. Riegel and Riegel (1972) and Riegel, Riegel and Meyer (1967, 1968), for instance, found that their retest resisters and study drop-outs (i.e., subjects who had undergone testing on the first occasion but refused to do so on a second one either five or ten years later), significantly differed from those who agreed to be retested on measures of intelligence, attitude and activity. The resisters and drop-outs had lower I.Q. scores, more rigid and dogmatic attitudes and lower rates of activity. Other researchers have uncovered similar findings (Baltes, Schaie and Nardi, 1971). Such findings highlight the shaky foundation on which rest the potential generalization of findings from retested community samples.

## Characteristics of the Institutionalized Elderly

Researchers have attempted to document reliable differences between community and institutional dwelling elderly in order to draw attention to the characteristics of specialized populations. For example, Goldfarb (1971) found an

incidence of between 72% and 90% of brain syndrome in his examination of institutionalized elderly in New York, an incidence much higher than one would expect in the community- dwelling population.

Other researchers think the differences between institutionalized and non-institutionalized elderly may be exaggerated. Lieberman (1969) suggested that comparisons between community dwellers and their institutionalized counterparts probably suffered from bias due to subject selection. He noted that ill and lower socioeconomic status community residents were usually excluded from the database of studies on community elderly. He suggested that the exclusion of such subjects exaggerated the extent of unfavourable trends among the institutionalized.

In addition, a recent epidemiological comparison of death rates between community and institutionalized elderly (McConnel and Deljavan, 1982) suggested that although the yearly mortality rate of the institutionalized elderly remains two to three times higher than that of the community dwellers, this rate has been exaggerated in the past, and may reflect characteristics (in particular greater degree of incapacity or severity of illness) of those admitted to institutions. This argument was supported by the findings of Booth (1985), who carried out a longitudinal study of 175 nursing homes in England. He anticipated that excess mortality rates would be related to the deleterious effects of dependency-inducing institutional regimes, but found instead that death was predicted only by the severity of functional impairment in the elderly institutional dwellers.

Despite some controversy concerning the magnitude of excess mortality among institutional residents, particular attention to prediction of longevity in institutional settings is warranted for several reasons: recent statistics (Lefebvre, Zsigmond and Devereaux, 1979; Statistics Canada, 1985) indicate that approximately 8% to 12% of the elderly (over 65) presently reside in an institution (Statistics Canada, 1985); the number of elderly is growing rapidly (8.7% of the population in 1976, 12% projected for 2001, or every eighth

Canadian); middle-old (75-85 years if age) and old-old people (85+) constitute a greater percentage of the over 65 population (37% in 1976, 44% projected for 2001) and costs of nursing home facilities are much lower than those of hospitalization (25 dollars a day compared to 125 dollars a day). Thus, not only is elderly population growing, but it is living longer. It is probable that need for supportive environments other than hospitals also will grow. In light of the above, there is a pressing need to understand the predictors of longevity among the institutionalized elderly.

## THEORETICAL PERSPECTIVES

### The Sociological Mortality Model

Although a number of "microtheories" exist that try to explain why individual psychological variables change during old age, a structured theoretical framework to organize disparate findings has yet to be applied in the area of longevity prediction. Both Riegel and Riegel (1972) and Lieberman and Tobin (1983) have argued against the adoption of a purely biological model, that consistently defines any change in psychological or social functioning prior to death as a result of underlying or manifested physiological deterioration. As findings elucidating the interactive nature of biopsychosocial variables continue to mount, this argument appears well-founded. However, their "sociological mortality model" replaces one simplistic model with another. This model postulates that an individual's chances for survival are changed according to social opportunities such as access to higher education, to medical services, and to a high standard of living.

### The Cascade Model

A more complex model than the preceding was proposed by Birren and Cunningham (1985). An encompassing perspective on the disparate findings in aging research encouraged them to propose the "cascade" model within the

context of discontinuity theory as a conceptual framework to integrate longevity predictors. This model may best be illustrated by reference to some findings on cognition in longevity research.

The cascade hypothesis suggests that the human organism is composed of a complex series of subsystems, "each of which retains the potential for limiting the lifespan of the whole system" (p. 11). Further, these subsystems may be ordered hierarchically, with change at a higher level implying prior change at a lower level.

Specifically, the model proposes that there may be three stages or phases within the aging process. Each stage is comprised of interelated biological, psychological and social effects. Birren and Cunningham (1985) exemplify the model by reference to cognitive change. The first level represents "natural aging", which implicates the "fluid" (i.e., speed and motor-related) aspects of I.Q. The second level may be called "health-related aging", and involves deterioration in processes related to reasoning (e.g. mathematical sub-tests on I.Q. measures). The third level of aging, "death-related aging", involves deterioration in "crystallized" or culture-bound variables, usually verbal-ability related. A "cascading" effect is postulated, such that deterioration of verbal ability at the highest level is preceded by deterioration of motor and speed-related performance at the lower levels. This model attempts to encompass findings indicating that some aspects of cognitive function seem to remain stable until just before death, while others progressively deteriorate with advance of chronological age.

Such a model holds promise for organization of findings in longevity prediction, but needs more elaboration before it is adequate. For instance, while this model provides a framework for a pattern of interrelated biological, psychological and social variables, it neither considers relationships among these variables, nor allows prediction of transition from one stage to another. In addition, the authors suggest the top-down directionality of the relationship between subcomponents is not adequate to predict existing data on cognitive function. On the positive side,

however, it does provide a perspective on the individual variability in aging patterns, which has been a particular concern in this research.

## METHODOLOGICAL ISSUES

### Operational Procedures

Prediction of the final stage of life generally has been obtained using scores measured on one or more occasions on a variety of psychobiosocial variables. Terms such as 'terminal drop', 'terminal decline', and 'distance from death' indicate unique perspectives in viewing death related variables according to the type of variable as well as the number of measurement points obtained.

'Terminal drop' is considered to refer to "a curvilinear or accelerating drop" (Palmore and Cleveland, 1976) in scores on measures of intellectual aptitude such as the Wechsler Adult Intelligence Scale (WAIS) or the Stanford-Binet Intelligence Test. In order to establish that a terminal drop in a score has occurred, three or more measurement points are examined. If scores at point three show a "curvilinear or accelerating drop" (Palmore and Cleveland, 1976) compared to scores at the first two points, then terminal drop is said to have occurred, and death is thought to be imminent.

Another way to predict imminent death from test scores is by means of "steady linear decline in scores" (Palmore and Cleveland, 1976) on variables which are not thought to significantly decline throughout the lifespan. These variables usually are verbal or specific performance tasks on I.Q. tests, but, more recently, personality and activity-related variables also have been considered.

Recently, some investigators have preferred to attempt prediction of longevity based on 'distance from death' (Siegler, McCarty and Logue, 1982). This procedure compares individuals grouped according to their time of death on scores

taken at one measurement time. Differences between the least and the most longevous on scores on variables may then be related to time-to-death.

Some researchers have attempted to apply knowledge about declines or drops in scores on psychobiosocial variables through the calculation of 'longevity differences' or 'longevity indices' (Palmore, 1982) and 'longevity quotients' (Berkman and Syme, 1979), which are mathematical estimates of the number of years added to or subtracted from life depending on the possession of a certain constellation of scores on variables. These calculations require incorporation of actuarial estimates of longevity, based on age, sex and race of individuals.

**Problems in Application of Methodology**

Reviews of the early literature on 'terminal drop' (Siegler, 1975; Jarvik, 1975; Abrahams, 1976) suggested that often, subjects' initial health standing was not controlled. In addition, the small number of subjects used by many researchers led Palmore and Cleveland (1976) to question the interpretation that a 'terminal drop' in scores had occurred.

Others have criticized the narrow focus of the early terminal drop literature, i.e., on cognitive function alone. In her review of the 'terminal drop' literature, Siegler (1975) noted that "it has been useful in that it has forced a sharper evaluation of the effects of health status and the correlates of survival into studies of cognitive functioning as assessed by measures of intellectual development." (p. 183). This focus seems particularly narrow in view of growing research interest in the relationships of a wide variety of interelated variables to longevity. Therefore, it is not surprising that recent studies have adopted one of the remaining methodologies in order to organize their findings.

Studies using 'terminal decline' have been criticized on similar grounds to the preceding. Furthermore, reviewers have described inconsistencies in findings ranging from the lack of statistical significance in rates of decline between the

most and least longevous, to evidence of mortality-related declines in scores for those under 65 but not over 65 (Palmore and Cleveland, 1976).

Lastly, the application of findings based on the calculation of 'longevity differences' or 'quotients' has been criticized. McConnell and Deljaven (1982) and Manton (1986) have cautioned against overeliance on statistics from actuarial tables (on which the 'longevity quotient' calculations are based), especially for institutionalized or old-old individuals.

The remaining perspective, 'distance from death', will be adopted for purposes of analyzing the new data. This perspective avoids aspects of the "conceptual confusion between the terms 'terminal decline' and 'terminal drop' "(Palmore and Cleveland, 1976: p. 76) documented in early studies. It also permits analysis of data taken at one measurement time. However, this perspective is not without weaknesses. Firstly, differences on variable scores between the most and least longevous groups may reflect longstanding individual variability in scores unrelated to time of death. Secondly, scores actually related to death may change prior to measurement and remain undetected (Siegler, 1975; Botwinick, 1984).

## EXPERIMENTAL FINDINGS

The review of research is organized according to chronological order, such that findings on the earliest category of interest (the cognitive predictors of longevity) precede the findings from more recently examined categories of variables (such as social activity and lifestress). This review will report findings in terms of the direction of change in scores (increase or decrease) and on the type(s) of variable measured.

Following the cognitive predictors of longevity, the demographic, socioeconomic and personality categories of variables will be reviewed. Health-related categories of variables then will be examined, followed by the categories of social activity and of lifestress.

## I. Cognitive Indices

In their cross-sectional examination of intellectual change over the lifespan, Jones and Conrad (1933) noted that the structure of intelligence changes over the lifespan: in the sixth decade of life, the factor of the Army Alpha I.Q. test which accounted for 40 % of the variance of I.Q. was that incorporating vocabulary (or Opposites) and General Information; however, this factor accounted for only 25% of the variance in 10 year olds.

Kleemeier (1962) was among the first researchers to stimulate research interest in declines in I.Q. preceding death. His longitudinal findings (13 men were tested four times on the Wechsler-Bellevue over 12 years), led him to hypothesize that an increased rate and a greater degree of intellectual decline were associated with the death of several participants. Kleemeier further examined 70 elderly men who were tested only twice, and again found that decreases in scores from one testing session to another characterized those who died at an earlier time.

Since Kleemeier, a number of studies, principally longitudinal in design, have made important contributions to the understanding of cognitive predictors of approaching death. With the exception of a few studies, which will be indicated, subject populations were drawn from samples of community volunteers. Among the studies in this area, three longitudinal studies are responsible for some of the most important findings.

### [i.] The New York State Psychiatric Institute Study

One of the most frequently cited studies supporting the relation between decline on intellectual functioning and mortality is the New York State Psychiatric Institute Study of senescent twins. Participants in this study, (mean age 69.3 years), consisted of a subsample of monozygotic and dizygotic twins, residents of

New York State at first selection (1947). These individual have been followed up as recently as 1978 (Steuer, LaRue, Blum and Jarvik, 1981).

A triad of variables was initially established by Jarvik and Falek (1963), any two of which reliably predicted mortality of one member of a twin pair 5 to 10 years prior to death. These variables were called "critical loss" variables: any loss of verbal ability, as measured on the Stanford-Binet vocabulary scale, a 10% yearly decline on the Similarities sub-test of Wechsler -Bellevue(W-B) and/or a 2% annual decline on the Digit-Symbol sub-test of the W-B. Since "identical twins were discordant for 'critical loss'" (Jarvik, 1975; p. 580), the importance of environmental effects clearly is indicated.

When the surviving twins, who were then in the old-old age range, were analyzed after 20-year follow-up (Steuer et al. 1981), critical loss no longer predicted death, but the presence of Organic Brain Syndrome (OBS) did. Thus, while cognitive decline on primarily verbal measures predicted death in the young-old (65-75 age range), it did not do so in the old-old (85+).

**[ii.] Duke First Longitudinal Studies of Aging**

Further evidence that cognitive decline predicts death comes from two separate analyses of the Duke First Longitudinal Studies of Aging (Palmore, 1969, 1982; Siegler, McCarty and Logue, 1982). This sample initially comprised male and female community residents, with ages ranging from 60 to 94 years in 1955. These subjects were examined a maximum of 11 times, and final examination of the remaining 44 subjects occurred during 1976.

Palmore (1982) described a composite of 22 predictors of longevity, primarily decreases in scores on variables, including verbal and performance scores on the WAIS (the performance scores appeared to be the more powerful predictors of mortality). However, in total, cognitive drops accounted for only 2% of the variance in mortality, and Palmore suggested that reliance on these scores alone was unwarranted.

Siegler et al. (1982) used the same data, but examined them only from the perspective of the first time of measurement. They attempted to determine distance from death by grouping survivors according to the number of years they lived beyond first measurement. Significant prediction was obtained (i.e., between 1-7 year survivors, 8-13 year survivors and 14-21 year survivors) from the verbal memory scores and visual organization subtests of the Wechsler Memory Scale (WMS), as well as on verbal scores on the WAIS. Although age also was correlated with survival, the preceding variables retained their predictability with age covaried out.

**[iii.] The Bonn Longitudinal Study**

Evidence for a relationship between decrease in scores on cognitive measures and mortality can be found in the Bonn Longitudinal Study. In this study, 222 male and female community and nursing home residents with a mean age at first testing (in 1965) of approximately 70 years, were retested on four occasions over seven years (Lehr and Schmitz-Scherzer, 1976). Scores of individuals who were retested in 1972 were grouped according to subsequent survival status. Nonsurvivors showed nonsignificant decreases from 1965 to 1972 on full scale and performance I.Q., and significant decreases on verbal subtests of the German equivalent of the WAIS when compared to survivors. In addition, survivors were reported to have significantly higher levels on a test of psychomotor performance, using the Mierke apparatus (Mathey, 1975, cited in Lehr and Schmitz-Scherzer, 1976), than nonsurvivors at the 1972 measurement. Although the authors report using ANOVAS to determine differences, significance levels are not indicated. Furthermore, while the death rate for the older subjects was reported to be higher than that of the younger one (28% vs. 13.5%), there is no mention of statistical control for age differences.

**[iv.] Other Evidence**

Decreases in verbal memory and visual organization were found to distinguish survivors from nonsurvivors in the only prospective study as yet available, though not yet completed. Botwinick, West and Storandt (1978) tested two independent apartment-dwelling samples of males and females, ranging in age from 60-89 years, from one to three times over the course of a year. In an initial analysis of the data, they compared the first test scores of five year survivors to those of nonsurvivors. They found that 13 different measures distinguished survivors from nonsurvivors: significantly higher scores at first testing on visual organization and perception (the Bender-Gestalt and the Trailmaking test), on performance measures of the WAIS, and on paired associate learning on the WMS, predicted survival of five or more years post testing.

These findings support the much earlier work of Lieberman (1965). He compared nursing home residents tested at least five times over two and one half years, and found differences between people who died within three months of last testing (Death Imminent) and people who lived at least one year beyond that point (Death Delayed). The DI group had significantly lower performance scores and smaller drawing sizes on the Bender-Gestalt and significantly less complex drawings on the Draw-A-Person task. His results are particularly noteworthy due to his careful control for incidence of illness and hospitalization over the testing period. He found that performances before and after hospitalization were not significantly related to survival.

Reimains and Green (1971) evidenced a relationship between mortality and decrease in verbal intelligence, as indicated by scores on the W-B and on the Wechsler Adult Intelligence Scale (WAIS). Their sample was male veterans living in the veterans' domicilary (mean age 68 years). Subjects were tested twice, and the Comprehension subtest scores showed a significant decrease for those who died within one year of second testing. However, interpretation of their results is confounded by their use of different retest intervals for different subjects. On the

other hand, Berkowitz (1965) failed to find any significant relationship between I.Q. decrease and mortality after administering the W.-B. twice to the same sample. However, both studies have been criticized by Siegler (1975), for the experimenters' lack of control of health status of participants. Need for such controls was cogently demonstrated by Goldfarb (1971), Jarvik, Blum and Varma (1972) and requested by reviewers in this field (Abrahams, 1976; Lieberman, 1969, 1974).

One study may have indicated the relevance of maintaining verbal skills to survival even among organically impaired individuals. In their sample of 257 demented residents of seven institutions, matched for age, sex and length of institutionalization with non-demented residents, Kraus and McGeer (1981) found that demented subjects rated by staff as verbally abusive had a significantly lower mortality rate (28%) at two year follow-up than those without this characteristic (46.1%). Although other interpretations of this finding clearly are possible, Kraus and McGeer (1981) suggest that maintenance of verbal facility is critical for survival.

## II. Demographic Variables

### [i.] Age

Chronological age has long been considered among the strongest predictors of mortality. It has been found to indicate higher probability of death among the institutionalized (Booth, 1985; Goldfarb, 1971; Kraus and McGeer, 1981), particularly among the functionally impaired within this subpopulation (Booth, 1985; Kraus and McGeer, 1981).

Another reason why age must be considered when analysing predictors of lifespan is that age may act as a moderator variable. Goldfarb (1971) found that higher educational level predicted longer life in his subjects under 85 years of age, but not in those over this age. Steuer et al. (1981) found that their cognitive triad

lost predictive power in the twins over 80 years of age. Jarvik, Ruth and Matsuyama (1980) found that Organic Brain Syndrome emerged as the best predictor of imminent death in surviving twins older than 80.

LaRue, Bank, Jarvik and Hetland (1979) found that self-health ratings may not be as powerful a predictor of survival for subjects in the old-old age range. They found that although their rating significantly distinguished survivors from nonsurvivors over a 5-year period, it was a powerful predictor only for subjects aged 77 to 84 years. For subjects older than 84, self-health rating had no predictive power.

Other researchers commented on the moderating effects of age on prediction. Helsing and Szklo (1981) found that loss of a spouse was a predictor of early mortality among men younger than 75 years of age, but not at older ages. Breslow and Enstrom (1980) found that endorsement of health practices had a greater impact on the life expectancy of their younger subjects.

**[ii.] Sex**

Waldron (1976) in her comprehensive review of sex differences in mortality, noted that there continues to be a gap between male and female mortality rates: men have a 60% higher rate than women. She attributes the differences in longevity to higher rates of particular diseases among men (arteriosclerotic heart diseases, cirrhosis of the liver, respiratory cancer and emphysema), as well to a greater incidence of destructive behaviours, such as cigarette smoking, coronary prone behaviour, higher suicide rates, and accidents among males. Others have reported similar findings (Verbrugge, 1983; Osgood, 1985).

Besides the sex difference in life expectancy, there have been a number of studies indicating moderating effects of sex. As already noted, Palmore (1982) found that a high self-health rating predicted longevity for males while higher health satisfaction predicted longevity for females. He noted several other sex-

linked differences in longevity predictors: for men, higher frequency of intercourse, while for women, more enjoyment of intercourse predicted longevity; greater locomotor activity predicted longevity in women but not in men. Breslow and Enstrom (1980) found that following seven health habits was more advantageous for men than for women in terms of numbers of years added on to life.

**[iii.] Marital Status**

Marriage has been endorsed almost unanimously as a predictor of longevity (Singer, Garfinkle, Cohen and Srole, 1976; Osgood, 1985; Palmore, 1982). However, Palmore (1982) suggests that it is not marriage per se that adds years to life, but sexual satisfaction provided within marriage: he found that frequency of intercourse for men, and enjoyment of intercourse for women predicted longevity.

Furthermore, for males, marriage to a younger female appears to prolong life. Foster, Klinger-Vartabedian and Wispe (1984) compared expected death rates (as reported in the 1970 U.S. Census) to the observed death rates in the National Mortality Follow-Back Survey (1980) in a weighted random sample of 1/260 of all deaths in the 35 to 84 year age group. They found that the overall mortality for husbands with younger wives was 87% of the adjusted mortality rate for all married caucasian men, and that mortality of men married to the same aged or older wife, was 120% of this rate. Findings by Fox, Bulushu and Kinlan (1979) are similar.

Only Goldfarb (1971) presented data inconsistent with the preceding findings. He found that married institutionalized males died earlier than those who were unmarried. He suggested that married males may have avoided institutionalization until their functional health had deteriorated to a higher degree than the unmarried males'. The latter probably had entered the institution prior to significant functional incapacity.

### III. Education and Socioeconomic Status [SES]

Performance on cognitive indices (described previously) has been found to be related to academic experience. Since higher performance on these indices has been shown to predict longevity, it is not surprising that greater years of education, higher job status and higher income level have been associated with longevity (Jarvik, 1975; Goldfarb, 1971; Palmore, 1982). This finding was demonstrated clearly by Jarvik (1975), who noted that the more longevous member of any twin pair always had the higher education.

### IV. Personality Variables

In contrast to the abundant evidence for decreases in cognitive performance prior to death, studies using personality measures are sparse.

The earliest study that looked specifically at personality measures was carried out by Lieberman (1965). As previously indicated, he found greater decreases in the Draw-A-Person test scores and in Bender- Gestalt scores in individuals nearer to death. He hypothesized that such individuals were experiencing gradual disorganisation of personality, and that the increasing simplification of designs produced by these subjects reflected an individual's attempt to deal with growing internal chaos. Other studies have examined rigidity, control, aggression, narcissism and psychological well-being.

#### [i.] Rigidity and Control

Riegel, Riegel and Meyer (1967) measured rigidity three times on 380 community residents. They found nonsurvivors to have more rigid, less adaptive "cognitive style". However, to date, very few studies have examined this variable.

Botwinick et al. (1978) found that lower scores on a self-rating scale of "control over things" significantly differentiated survivors from non-survivors in a

prospective study. They suggested that people "who feel well, who are able and who can look forward to the future" (p.761) may have been those who also felt "in control". The rating of "feeling of control" probably best relates to self-efficacy rather than the internal/external control dimension.

### [ii.] Aggression and Narcissism

Personality factors were shown to be related to survival after relocation, a stressful incident for most elderly. In order to determine the effects of relocation on a sample of elderly individuals, Turner, Tobin and Lieberman (1972) compared a relocation group with two control samples. Thirty-seven established residents of institutions (for between one and three years) and 35 community residents were treated as controls for a study sample of 85 elderly community residents, who were admitted to a home for the aged four months after initial testing. The relocated elderly were again assessed two months after relocation. Survival after relocation was determined one year after relocation. Subjects for whom the second test scores showed deterioration and those who had died by the end of the first year ($N = 41$) were compared to the 'stable' survivors. Significantly higher scores on ratings of aggression and narcissism were found to characterize stable survivors, who also had significantly higher cognitive, physical health and energy scores. High ratings on aggression and narcissism also characterized the control institution group, who were judged to be physically and mentally comparable to the study sample. The authors interpreted these findings as demonstrating congruence between the individual and the institutional environment; in other words, subjects possessing these characteristics were thought to have adapted to the environment. Sex-role rigidity, dominance/submission and locus of control did not predict adaptation or survival.

### [iii.] Well Being

Lehr and Schmitz-Scherzer (1976) found that subjects reporting happier mood at first testing survived significantly longer than those who reported being unhappy in the Bonn Longitudinal sample. This finding was supported by Palmore (1971,

1982) who found that happiness, as rated by agreement/disagreement with six statements, was a strong predictor of the longevity of both men and women up to 25 years prior to death (Duke First Longitudinal Study).

Rodin and Langer (1977) proposed that higher happiness ratings were one of several differences between experimental and control ambulatory nursing home subjects that predisposed the former to survive significantly longer than the latter (when compared at 18 month follow-up). The experimenters attributed increases in the happiness ratings by experimental subjects to "increased environmental control" resulting from an intervention (Langer and Rodin, 1976). However, this interpretation is seriously challenged by the observation that nurses' ratings on scales of happiness, alertness, dependence and social activity, administered pre-intervention, reliably predicted who would survive.

In contrast to the preceding findings, Lieberman (1965) noted that an increase in "happy, magical" responses to questions about death was commonly found in a Death Imminent group when they were compared to the Death Delayed group, in an institutionalized sample.

Satisfaction with work (work being defined as any useful activity) was found by Palmore (1969, 1982) to be among the top three out of 22 predictors of longevity for males in the Duke First Longitudinal Study.

In summary, these findings suggest that psychological well-being is a predictor of longevity.

## V. Health-Related Predictors

### [i.] Functional Status

In one of the few studies of institutionalized individuals, Goldfarb (1971) obtained measures on 1279 subjects from 25 institutions over a seven year period. Fifty percent of these were in the 75 to 84 year age range, while the rest were

fairly evenly partitioned between the 65-74 and 85+ ranges. He excluded from the study subjects who had been residents in any institution for less than three months. He found that impairment of function, as denoted by incontinence, inability to complete self-care (washing, dressing) or 9-10 errors on the Mental Status Questionnaire were significantly correlated with early mortality: more than half the subjects with such characteristics died within the first year compared to an overall mortality of 23%. These indicators were much more reliable predictors than either the combined ratings of likelihood of survival by an internist and a psychiatrist, or by their individual ratings. Other findings on the institutionalized elderly are similar, even when more comprehensive measures of functioning, such as verbal and motor functioning levels, are included in the assessment (Booth, 1985) or when relocatees are examined (Watson, 1980).

Gutman, Stark, Witney and McCashin (1981) obtained evidence relevant to functional status in a 12 month follow-up of admissions to a long-term care program (i.e., at home or in an institution). Of 3518 patients admitted to the program, 86% were over 65 years of age. Predictors of death within one year of admission included age (over 75 years of age), sex (male) and greater level of care (of five levels).

In a somewhat different vein, Borkan and Norris (1980) compared functional age scores on 24 measures between survivors and nonsurvivors in the Baltimore Longitudinal Study of Aging. Nine of these variables (forced expiratory volume, vital capacity, systolic blood pressure, serum albumin, globulins, two tapping measures and simple and choice reaction times) were significantly less favorable at initial measurement for the nonsurvivors.

**[ii.] Self-Health Rating**

Self-rated health has received substantial support as a predictor of mortality in persons aged over 65 years, and may be the most powerful health predictor after Organic Brain Syndrome.

Mossey and Shapiro (1982) controlled for objective health status (as rated by health care claims files and either medical record ratings or hospital visits), age, sex and place of residence (rural-urban) in their sample from a representative community population in Manitoba. They found that self-rated health significantly predicted survivors at two follow-up times (i.e., two and five years).

Complementing these results, Singer, Garfinkel, Cohen and Srole (1976) completed a 20-year follow-up on participants in the Midtown Manhattan Study, originally begun in 1954 with subjects between 20 and 59 years of age. Only the respondents' rating of poorer health on a four point scale predicted death in the subsequent years, even when variables of smoking, alcohol consumption, obesity, mental health status (rated by a psychiatrist) and self-reported hypertension were included in the multivariate analysis.

Palmore (1982) also found that higher self-health ratings on a scale from 1 (poor) to 5 (excellent) predicted longevity, even 25 years later. In fact, he found that this rating was one of three of the strongest predictors (among 22) for men, while, for women, health satisfaction was a more salient predictor.

Botwinick et al. (1978) found a self-health rating scale to predict survival in their sample, while physicians' rating failed to predict significantly.

### [iii.] Health Habits

#### [a.] Physical Activity

Rose and Cohen (1977) interviewed the surviving wife or child of 500 men deceased during 1965, whose age at death ranged from 50 to over 80 years. They measured the deceased individual's lifelong activity levels on a five point rating scale (0 = sedentary, 4 = very active) administered to a surviving family member. The scale was completed twice, for both "on-job" activity and "off-job" activity, for 4 different decades of the deceased's life. They found that higher "off-job" activity predicted persons who had lived longer, even when education level was controlled for.

This finding was supported by Lehr (1983). He commented in his overview of findings from the Bonn Longitudinal Studies "...'longevity' in terms of survivorship was more closely related to subjective health than to objective health. This may be explained by the higher activity of the subjectively more healthy subjects: activity showed the highest correlation with longevity." (p. 58). He noted a significant difference in activity patterns between survivors and nonsurvivors of the Bonn study: for the most longevous survivors, activity levels remained stable or increased over the 12-15 year study period, while for nonsurvivors it did not. Changes in activity level were found to vary with sex and marital status: men showed declines in activity levels significantly more often than women; women who had been widowed or divorced at an early age, or who were single, were more active than women for whom marital status changed in the 7th to 9th decade.

Palmore (1982) also found higher activity levels to predict longevity, but only for women: greater frequency of locomotor activity at the first measurement time was a significant predictor of longevity for women over a 25 year follow-up, but it was not a significant predictor of longevity for men.

In addition, when demented subjects were rated as unable to "participate in activity programs for non-demented residents" (Kraus and McGeer, 1981), they were found to die significantly earlier than those who remained active. This deficiency was found to be the "most predictive of death within two years". Subjects unable to participate in activity programs were reported to have a death rate of 63.5% as compared to a death rate of 28.7% for persons able to participate.

**[b.] Other Health Habits**

Belloc (1973) found that endorsement of at least six of seven health habits (i.e., not smoking, fasting between meals, getting eight hours of sleep, eating breakfast, getting exercise, drinking moderately and controlling weight) predicted survivors

at 6-year follow-up in a community sample, for which ages ranged from 30 to 69 years at first measurement. However, with increasing age, the number of years added to life by following the health habits decreased.

Breslow and Enstrom (1980) determined that men who endorsed the same seven health practices had 28% the mortality rate of men following fewer practices, while women had 43% the mortality rate of women not following them. These results seem particularly reliable as the researchers controlled for initial health status and disability level of subjects in the 9.5 year follow-up of 6928 Alameda County residents.

## VI. Social Activity

Berkman and Syme (1979) predicted survival over over a nine-year interval on the basis of the number and type of social ties reported. The data were obtained from the Alameda County study. Their results were obtained after controlling for the seven health habits reported by Belloc (1973), as well as self-reported health, SES, use of health services, age and sex.

Watson (1980) studied the 126 black residents of two nursing homes prior to relocation, and four and eight months after relocation. He found that "higher disposition to interaction", as measured by church attendance in groups, and visitation pattern was significantly greater for the survivors of relocation.

In contrast, Botwinick et al. (1978) did not find that the number of club memberships or offices held predicted survival in a community sample of elderly, after statistically controlling for psychomotor activity. However, as Berkman and Syme (1979) point out, the degree of intimacy in a relationship (i.e., marriage vs. club membership) may be a more important predictor of longevity than the number of relationships and the frequency of contact.

## VII. Lifestress

### [i.] Bereavement

Bereavement, particularly the loss of a spouse, is agreed to be one of the most negative life events. In one study, Helsing and Szklo (1981) followed-up prospectively for 13 years 4032 widowers and widows (1204 males, 2828 females from the 1963 Maryland census) whom they matched with married individuals of the same race, sex, year of birth and geographic region. They found a much higher rate of mortality in widowers in the 55 to 74 year age range than in their married counterparts; this trend was not present in widowers 75 years and over. They also found that widows suffered a higher mortality rate during the second year after bereavement.

Reviewers of this area (Klerman and Clayton, 1984; Rowland, 1977) deplore the design problems of many studies in this area and suggest that trends concerning mortality and widowhood are tentative. However they agree that men seem especially vulnerable to loss of a spouse, particularly early after the event (i.e., within six months).

### [ii.] Relocation

In her review of events which influence mortality rates in the elderly, Rowland (1977) suggested that relocation (move to an institution from a home or another institution) is a predictor of mortality in those already in poor health or cognitively impaired. Others have agreed (Watson, 1980; Lieberman, 1974; Turner et al. 1972). Lieberman (1974) also concluded that a primary factor in the relocation literature is the functional adequacy of the elderly individual.

In contrast to the majority of studies on relocation, Watson (1980) found that the mortality rate of his black elderly subjects actually decreased after relocation. He did find that the mortality rate had increased one month prior to relocation, although the overall mortality rate for the year prior to relocation was not different from expected level. He suggested that sociocultural factors may have accounted for this unexpected finding.

**[iii.] Suicide**

Suicide is another cause of death, being particularly frequent in elderly caucasian males. Although people over 65 comprise less than 10% of the population, they commit between 12% and 18% of the yearly suicides (McIntosh and Santos, 1981). In her review of suicide in the elderly, Osgood (1985) noted that the unmarried of all ages and those living alone are much more at risk for suicide than their married peers. She pinpointed the elderly widower as particularly at risk for suicide. In women, however, Helsing and Szklo (1981) note that being divorced or separated is much more often related to suicide.

Among the proposed reasons for the high rates of suicide in the elderly are loss of self-esteem and feelings of uselessness. In his analysis of the principal factors contributing to depression in the aged, Zung (1967) found that loss of self esteem was the most important factor in the elderly. This finding is in contrast to findings with younger subjects, for whom biological symptomatology is the main factor in depression.

## Summary of Experimental Findings

### [1.] Predictors of Longevity in Community Samples

As the review of the literature has demonstrated, a variety of salient predictors of longevity has emerged from research over the past several decades.

Cognitive declines, as indicated by scores on verbal ability measures (Jarvik and Falek, 1963; Steuer et al. 1981; Siegler et al. 1982; Lehr and Schmitz-Scherzer, 1976), verbal memory measures (Siegler et al. 1982; Botwinick et al. 1978), as well as on measures of performance (Palmore, 1982; Jarvik and Falek, 1963; Lehr and Schmitz-Scherzer, 1976; Botwinick et al. 1978) and of visuo-spatial organization (Botwinick et al. 1978; Siegler et al. 1982), have emerged as important predictors of imminent death. The cognitive indices appear particularly reliable predictors, as evidenced both by the wide variety of measures used by researchers to assess cognitive function and the long-term nature of many of the studies.

Other salient predictors of longevity for community dwellers include all major demographic variables: being younger, female (Waldron, 1976; Verbrugge, 1983), having a higher education and occupational status (Jarvik, 1975; Palmore, 1982), and being married (particularly to a younger female if one is male) all predispose one to a longer life (Palmore, 1982; Breslow and Enstrom, 1980; Osgood, 1985; Klerman and Clayton, 1984; Rowland, 1977; Singer et al. 1976; Foster et al. 1984; Fox et al. 1979).

Recent studies have revealed that, among health-related predictors of longevity, high self-health ratings are the best (Mossey and Shapiro, 1982; Singer et al. 1976; Palmore, 1982; Botwinick et al. 1978; Lehr, 1983). Practicing health habits has been shown to predispose to long life (Belloc, 1973; Breslow and Enstrom, 1980). Noteworthy among recent studies are controls for socioecomic status and initial

health status, variables which were neglected in the earlier research (Abrahams, 1976; Siegler, 1975).

Lastly, higher activity levels (Rose and Cohen, 1977; Lehr, 1983) and fewer negative life events, such as widowhood or widowerhood (Helsing and Szklo, 1981; Osgood, 1985) and relocation (Rowland, 1977), contribute to longevity.

Although it has been suggested that personality variables may differentiate between survivors and nonsurvivors, there is as yet little reliable evidence. Studies appear to converge in finding that happier individuals live longer (Palmore, 1982; Rodin and Langer, 1977; Lehr and Schmitz-Scherzer, 1976). Palmore (1982) also found that occupational satisfaction predicted longevity for men. There is some suggestion that less rigid individuals live longer (Riegel et al. 1963). However, both the lack of attention to psychometric properties of the measures used to assess personality variables, and the paucity of research on the relation between personality and longevity indicate the preliminary status of these findings.

Some researchers have suggested that many predictors of longevity are more salient for the young-old (65-75) (Steuer et al. 1981; Helsing and Szklo, 1981; LaRue et al. 1979; Riegel, 1971) than for the old-old (85+). In other words, each age may have its own predictors of longevity.

The bulk of the research has focused on community-dwelling, elderly volunteer populations who have usually been tested more than once. Since such populations have been demonstrated to differ significantly not only from institutional populations, but also from non-retested community dwellers on cognitive style and interests (Riegel et al. 1967, 1971), overall intelligence, cognitive flexibility and visuo-motor flexibility (Baltes et al. 1971), it is questionable whether findings from these studies will generalize to nursing home populations of elderly.

**[ii.] Predictors of Longevity in Institutional Samples**

In contrast to the abundant research findings on community samples, research on the predictors of longevity in institutional samples has just begun. This can be clearly demonstrated by examining the findings regarding the cognitive predictors of longevity for institutional samples. Only two studies, one on visual organization of an elderly non-demented institutionalized sample (Lieberman, 1965) and one on differences among demented institutionalized elderly on verbal skills (Kraus and McGeer, 1981) have analyzed cognitive indices of longevity in the institutionalized elderly, compared to the multitude of studies on such indices in community samples. The few findings that are available on the institutionalized elderly concur with those on community samples (i.e., better cognitive function predicts longevity), but these must be regarded as preliminary.

Several studies on institutional samples have found that functionally impaired institutionalized elderly die sooner than their more able confreres (Goldfarb, 1971; Booth, 1985). Lieberman (1974) has suggested that functional impairment appears to be a first-order predictor of mortality, while personality factors may be second-order predictors. However, very little research has been completed on the relation of variables such as personality and activity to longevity in institutionalized elderly.

With respect to personality, there has been some suggestion that happier institutionalized elderly survive longer (Rodin and Langer, 1977). However, as with the community sample research on personality predictors of longevity, unequivocal findings are lacking. Although there is some suggestion that higher ratings of aggression and narcissism (Turner et al. 1972) predict survival, only one study has examined these. At least one study (Rodin and Langer, 1977) attempted to demonstrate that increased environmental control and the related increases in well-being resulting from an intervention predicted longevity in such a population; however, methodological concerns mar that study.

Several changes in predictor salience with age have been noted in this

population (Goldfarb, 1971; Booth, 1985) as in the community population, suggesting that attention to different age groups in all elderly individuals is essential.

However, the studies using institutional residents demonstrate a number of design limitations. Earlier studies focused exclusively on functional indices of longevity (Goldfarb, 1971) or only on objective measures (Booth, 1985), or used a few narrowly focused measures, such as visual organization and projective personality measures (Lieberman, 1965; Turner et al. 1972). Others used a particular sub-population, such as black elderly nursing home relocatees (Watson, 1980), or to the demented elderly (Kraus and McGeer, 1981), who may not resemble their caucasian non-demented counterparts.

To date, little attention has been paid to non-demented nursing home dwellers, for whom a particular pattern of psychological variables may predict death. While at least one recent study examined such a population (Booth, 1985), no subjective measures were collected; questionnaires were completed by administrators of homes or staff. Kahana and Kahana (1985) have suggested that "the recent quantitative studies are typically less in-depth and may miss the subjective experiences of dehumanization and depersonalization that have been attributed to institutional living" (p. 235), which may, in the long run, contribute to early mortality.

Both the methodological problems of previous studies, and the paucity of research on this population, seriously limit understanding of the complex nature of survival in non-demented nursing home dwellers. Further research in this direction is clearly warranted.

# THE PRESENT INVESTIGATION

The focus of the present investigation is on predictors of longevity in a non-demented nursing home population. This study attempted to refine previous efforts by choosing a hitherto relatively unstudied population, and by administering a wide range of inter-related psycho-social measures with well-established psychometric properties. In contrast to much previous work, health status was measured by a subjective health rating, as well as two objective health measures: a severity of illness index and a rating of number of ingested drugs. Furthermore, the comparison of scores of retest refusers to those of retestees was expected to increase understanding of possible sub-populations within the institutionalized aged.

# METHOD

## DATA BASE

Originally collected in 1979 and 1980, data used for this study represent the institutional portion of a larger data base, which consists of random samples of urban, rural and institutional dwellers from across the island of Newfoundland. To date, a number of analyses of this data base have been completed (Stones and Kozma, 1986a, 1986b; Kozma and Stones, 1983; McKim, Stones and Kozma, 1986). These have examined measurement and theoretical issues relevant to several studies of psychosocial variables. McKim et al. (1986) examined illness issues, as well as demographic and personality factors relevant to medication use by the elderly.

This study determined survival status (as of May 1986) of all residents of institutions who had participated in the original study, and attempted to determine predictors of longevity on this subpopulation. Community dwellers were not followed up at this time due to difficulties in determining survival status.

## SUBJECTS

An institution was defined as a residential facility for 25 or more senior citizens. All major institutions on the island of Newfoundland were asked to participate in the study. Administrators of each facility were requested to provide lists of all residents judged to be physically and mentally capable of answering questions from the test battery. Subjects then were selected randomly from the lists provided.

In total, one hundred and fifty-six seniors (60 males and 96 females) between the ages of 65 and 95 years of age were tested in Wave One (W1) of testing. Approximately twelve months later, 121 of the same individuals (52 males and 69 females) were alive and agreed to be retested. Subject attrition was attributed to one or more of the following: cognitive impairment, illness, relocation, refusal or death. Budgetary constraints made return visits for ill and relocated subjects impossible.

## MEASURES

Dimensions of health, well-being, personality, quality of life and lifestress were measured, and relevant demographic variables were collected.

### Demographic Variables

Subjects' age, sex; and years of schooling (EDYEAR) were recorded, along with type of employment (OCCUP), which was assigned a numerical value according to level of income (adapted from Pineo and Porter, 1967; see Appendix A). Marital status (MSTAT) was recorded, and was later coded according to whether the individual was married (coded 1) or not (coded 2).

### Health Status

The need for health assessment in aging studies has been frequently stressed (Abrahams, 1976; Lieberman, 1969; Lieberman and Tobin, 1983; Siegler, 1975). One subjective and two objective ratings of health were used to assess health status.

**1. Subjective Health Rating (S-HEALTH)**

A rating scale which consisted of a seven-step ladder drawing was administered. "Worst possible health" was represented by the bottom rung, and assigned the value 1, while "Best possible health" was assigned the value 7, on the top rung. Subjects were asked to indicate how they rated their health "at the present time". A subject's score was the number which corresponded to the rung on the ladder that she/he chose.

**2. Drug Use (DRUG)**

Subjects were asked to give the names of both prescribed and non-prescribed drugs used, and to indicate the frequency (daily/ weekly/monthly/as needed) and duration of use. Weighted values for drug use were established, according to the categorization of the drug, the duration, the frequency and number of drugs used (McKim et al., 1986; see Appendix B), so that subjects using stronger drugs more frequently had higher scores than those using weaker drugs less frequently.

**3. Severity of Illness Index (SEVERE)**

A severity of illness index was completed for each subject. This index consisted of the sum of weighted ratings on answers to questions concerning use of aids (hearing, visual, ambulatory), nature of disease (heart disease, high blood pressure, diabetes, etc.), onset and duration, the time since last episode and the total number of illnesses (McKim et al. 1986; see Appendix C for the weighting formula). Higher scores indicated presence of more severe illness(es).

**Psychological Well-Being**

Two measures were administered to assess a subject's well-being.

**1. The Memorial University of Newfoundland Scale of Happiness (MUNSH)**

The MUNSH is a scale of 24 items, from four subcategories: positive and negative affect, and positive and negative experience. All four subscales demonstrate high internal consistency (Kozma and Stones, 1980; 1983), and are

thought to represent both dispositional (experience) and affect-related aspects of the "happiness-misery" dimension (Kozma and Stones, 1980). This scale (see Appendix D) has been shown to have high internal consistency and high test-retest reliability, with older subjects over an 18 month interval (Kozma and Stones, 1980; 1983). Total scores are calculated by summing scores from all sub-scales.

**2. Avowed Happiness (AVHT)**

Subjects were asked to describe their happiness both "at this moment" and "over the past month" using a seven point rating scale: one represented "the unhappiest I have ever felt" while seven represented "the happiest I have ever felt". These ratings were found to be highly intercorrelated (Kozma and Stones, 1980) and were summed to give a single index of total avowed happiness (AVHT).

**Activity: The Memorial University of Newfoundland Activity Inventory (MUNAI)**

The MUNAI is an inventory of 37 activity items (Appendix E) which cluster reliably on five factors, namely household independence, family involvement, community activity, homemaker activity and solitary activity. This scale has demonstrated structural stability over an 18-month period with elderly individuals (Stones and Kozma, 1986b). A 13-item subscale of the MUNAI, that maximized internal consistency (alpha $>0.8$) and correlated at greater than 0.9 with the full scale (Stones and Stones, 1987), was used to assess overall activity level.

**Lifestress and Control**

**1. The Social Readjustment Rating Questionnaire (SRRQ)**

The 40 item SRRQ was administered in order to measure life events (Appendix F). It is important to consider life events in an analysis of predictors as these have been shown to be significantly related to health (Palmore and Luikart, 1972; Holmes and Rahe, 1967).

## 2. The Internal-External Control of Reinforcement Scale (CONTROL)

A sense of perceived control in elderly institutionalized individuals has been related to lower stress (Rodin, 1986) and to higher happiness and longevity (Rodin and Langer, 1977). Other research has suggested that extremes in internality or externality are associated to vulnerability to stress in elderly individuals (Krause, 1986). An adapted version of Jessor's scale (Palmore and Luikart, 1972) was administered (Appendix G). This consisted of four pairs of items from which the respondent chose the item which corresponded to his/her belief. Internal item choices were scored as zero while external item choices were scored as one. Higher scores indicate an individual's belief that control is external.

## Verbal Ability: The Word Fluency Task (WORDFL)

A word fluency task, the modified Set Test (Cyr and Stones, 1977) was administered as a measure of verbal ability. [redacted] task predicts the diagnosis of dementia (Isaacs and Akhtar, 1972) and rated functional status among institutional residents. It requires a subject to name items from semantic categories for 40 second periods. Five categories of words were used: countries, parts of the human body, four-footed animals, fruit and parts of the house. One point was given per item, except repeated items, which scored no points. Higher scores indicate better orientation, functioning and verbal ability.

## Housing (HOUSAT), Financial (FINSAT) and Job (OCCSAT) Satisfaction

Some studies indicate that greater satisfaction with housing, finances and job predict longevity (Palmore, 1971; Palmore, 1982). Therefore, rating scales with a horizontal bar divided into seven sections were used to assess housing, financial and job satisfaction. At the far left of the scale "completely dissatisfied" was indicated by the value one, while "completely satisfied" was indicated by the value seven.

### Religiosity (RELIGN)

There has been some suggestion that perceived religiosity may predict longevity (Watson, 1980). Perceived religiosity was measured using a rating scale, with one on this scale referred to "very non-religious" while seven referred to "extremely religious".

## PROCEDURES

### Wave One (W1)

All measures were administered in a structured interview format by two research assistants. The assistants visited each facility a week prior to testing in order to acquaint themselves with residents and to ensure cooperation. Oral administration was utilized as reading difficulties were detected among a significant minority of subjects.

Information from subjects was collected in the following order: age, happiness, activities, life satisfaction, marital status, locus of control, life events, socioeconomic status and health.

Data collection usually lasted approximately two hours. Occasionally, a subject would tire during the course of questioning, or refuse to continue with the session. Missing data were coded as 9, 99 or 999 at the time of data collection. Numbers of subjects per variable at W1 can be found in Tables 6 and 8, and subjects per variable for W2 can be found in Appendix G. Raw data was entered into the VAX-VMS Computer System at Memorial University of Newfoundland and appropriate transformations using the Statistical Package for the Social Sciences, version X (SPSSX) were made.

**Wave Two (W2)**

Data collection occurred in the same manner as described above. In addition, subjects' dates of death (day, month and year) were collected at each institution where death had occurred within the 12 month test interval.

Subsequent dates of death were collected by phone with institutional administrators. These were randomly cross-checked against provincial archive records of death and found to be accurate. Table 1 reports subject mortality from less than one to five years after W1.

# RESULTS

## PRELIMINARY ANALYSES

Time-to-death from initial testing was used to classify all subjects. Three time-to-death groups were formed. "Early Death" subjects lived between one and 24 months beyond first testing. "Delayed Death" subjects lived between 25 and 59 months. "Survivors" lived five years (60 months) or more beyond first testing. Table 1 shows the mean age and the sex distribution of each group.

As previously indicated, chronological age has been found to predict mortality in the institutionalized elderly (Booth, 1985; Goldfarb, 1971; Kraus and McGeer, 1985). Age has also been shown to have moderating effects on other longevity predictors (Goldfarb, 1971; Steuer et al. 1978; Jarvik et al. 1980; LaRue et al. 1979). Gender, too, has been shown to be a predictor of longevity (Waldron, 1976; Verbrugge, 1983), and also to have moderating effects on other predictors of longevity (Palmore, 1982; Breslow and Enstrom, 1980; Helsing and Szklo, 1981). Therefore, a three (group) by two (gender) ANOVA was computed on age in order to determine its relationship with survival. A significant groups effect ($F[2,150] = 6.711$, $p<.002$), a gender effect, with females living longer ($F[1,150] = 5.068$, $p<.026$), but a nonsignificant interaction ($F<1$) were found. Post hoc analysis (Scheffe) revealed a significant difference in age between the Delayed Death and the Survivor subjects ($p<.01$), with the Delayed Death subjects being the oldest. In a second analysis, the relationship between gender and mortality was examined in a three (group) by two (gender) categorical design. The chi square statistic ($=1.020$) was nonsignificant, which suggests that gender was not related to time of death.

Subjects who were retested ($N = 121$) also were analysed for the contributions of age and gender to survival. Although the mean number of months to retest

was 12, time-to-death for the retestees was adjusted by adding 11 months to each time interval. This was done in order to retain sufficient subjects in each time-to-death group for meaningful comparisons to be made. Three time-to-death groups were considered. The Early Death Retestees survived between one and 35 months from initial testing. The Delayed Death Retestees survived between 36 and 71 months from first testing. The Survivor Retestees lived 72 or more months from initial testing. Table 2 shows the mean age and sex distribution of the Retestees. A three (group) by two (gender) ANOVA was computed on age. As in the previous ANOVA, both an age effect ($F[2,115] = 5.126$, $p<.007$) and a gender effect, with females living longer ($F[1,115] = 5.012$, $p<.027$), were found. Post hoc analysis (Scheffe) revealed that the Delayed Death subjects were older than the combined Survivor and Early Death subjects ($p<.05$). Again, the Chi Square statistic, computed on the categorical data to test for the relationship of gender to time of death, did not achieve significance (chi square = 2.077).

A further examination of subject differences consisted of a comparison of scores from those subjects who were alive at retest but were not restested ($N = 25$) with those from retested subjects ($N = 121$). Ten subjects died during the retest interval, and were not considered in these analyses. One-way ANOVAS were computed on the dependent variables at W1 with age and gender being treated as covariates. There were several reasons for covarying out age and gender. Age was shown to be related to time-to-death in the first ANOVA on this data. Furthermore, researchers have unanimously underlined the importance of controlling for age in this type of research (Helsing and Szklo, 1981; Lieberman and Tobin, 1983; Botwinick, 1984). Gender, though not related to time-to-death in this study, correlated with a number of measures. In addition, other studies found sex effects (Palmore, 1982; Breslow and Enstrom, 1980). As Kirk (1968) explained, the covariance procedure adjusts the dependent variate means "so as to remove the effects of the uncontrolled source of variation represented by the concomitant variates" (p. 455).

TABLE 1: GENDER AND MEAN AGE DISTRIBUTIONS AT W1 IN TIME-TO-DEATH GROUPS FOR ALL WAVE ONE SUBJECTS (N = 156)

| VARIABLE | GROUP | | | |
|---|---|---|---|---|
| | EARLY DEATH | DELAYED DEATH | SURVIVOR | TOTAL |
| CELL SIZE - MALE | 10 | 18 | 32 | 60 |
| MEAN AGE (S.D.*) | 76.60(8.84) | 81.44(5.67) | 76.34(8.36) | |
| FEMALE | 19 | 22 | 55 | 96 |
| MEAN AGE (S.D.) | 80.84(7.69) | 83.77(6.40) | 78.727(6.90) | |
| TOTAL | 29 | 40 | 87 | 156 |
| GR.MEAN AGE (S.D.) | 79.37(8.21) | 82.73(6.12) | 77.85(7.51) | 79.38 |

*S.D.: STANDARD DEVIATION

TABLE 2: GENDER AND MEAN AGE DISTRIBUTIONS AT W1 IN TIME-TO-DEATH GROUPS FOR RETESTEES (N = 121)

| VARIABLE | GROUP | | | |
|---|---|---|---|---|
| | EARLY DEATH | DELAYED DEATH | SURVIVOR | TOTAL |
| CELL SIZE - MALE | 9 | 18 | 25 | 52 |
| MEAN AGE (S.D.*) | 76.22(10.12) | 80.05(7.45) | 76.32(8.17) | |
| FEMALE | 12 | 16 | 41 | 69 |
| MEAN AGE (S.D.) | 81.33(8.88) | 84.56(5.32) | 78.12(7.18) | |
| TOTAL | 21 | 34 | 66 | 121 |
| GR. MEAN AGE (S.D.) | 79.14(9.55) | 82.19(6.84) | 77.44 (7.57) | 79.07 |

*S.D.: STANDARD DEVIATION

Retested subjects were found to have significantly higher self-health ratings ($F[1,142] = 4.261$, $p<.041$), higher word fluency scores ($F[1,139] = 4.702$, $p<.032$), higher MUNSH scores ($F[1,142] = 15.043$, $p<.000$) and higher occupational satisfaction ($F[1,141] = 4.334$, $p<.032$) than subjects alive but not retested. Retested subjects also survived significantly longer than non-retestees ($F[1,142] = 5.465$, $p<.021$). Table 3 indicates sample means and adjusted group means (i.e., deviation from the grand mean after adjusting for covariates) for measures showing statistical significance according to retest status. Table 4 gives the subscales of the MUNSH in the same fashion. Appendix I gives the sample means, the adjusted group means (the deviation from sample means) and the F values from all ANOVAS computed for all measures according to the subjects' retest status.

An analysis of correlation among the previously mentioned measures also was undertaken. Results of correlation analysis (two-tailed) are presented in Table 5. None of the measures that significantly differed between groups correlated to months survived. The only significant correlation was between the self-health rating and the MUNSH. However, neither health nor happiness was related to survival, which significantly differed between the groups.

## MAIN ANALYSES

### Wave One Data

One-way ANOVAS were performed on all the initial data (subjects = 156), with age and gender being included as covariates. The ANOVA procedure was used in order to maximize cell size, since MANOVA requires list-wise deletion of subjects with missing data. Table 6 presents the cell size for each variable. The group factor, time-to-death, was retained as originally described: subjects who survived up to two years after first testing were categorized in the Early Death group, those who survived up to five years, in the Delayed Death group and those who lived beyond five years were considered the Survivors.

Significant effects were revealed on two of the measures. Firstly, a main effect was seen on the activity measure ($F[2,148] = 3.089$, $p<.048$). Post hoc analysis (Scheffe) indicated that subjects in the Survivor group had higher levels of activity than the Delayed Death and Early Death subjects combined ($p<.05$). The finding regarding activity is consistent with previous findings (Berkman and Syme, 1979; Watson, 1980).

Secondly, there was a main effect of years of education ($F[2,132] = 3.694$, $p<.027$). Post hoc analysis (Scheffe) revealed that the subjects in the in the Delayed Death group had less education than those in the Survivor group ($p<.05$). No other differences attained significance. The sample means and adjusted means (deviations from the sample means) for both measures are reported in Table 7. Sample means, adjusted group means (deviation from sample means) and F values from all ANOVAS computed for all measures on W1 data can be found in Appendix H.

**Retestee Data**

The data from the 121 retested subjects were analysed for group and time of measurement effects in a series of two-way ANOVAS, with age and sex being covariates. Time-to-death groups were adjusted to reflect the retest interval. As previously reported, this involved adding 11 months to each time-to-death interval. The Early Death group survived between one and 35 months from initial testing, the Delayed Death group, between 36 and 71 months from first testing and the Survivor group lived 72 months or more. The cell sizes for Retestee data taken at Wave One are presented in Table 8, and for Wave Two, in Appendix G.

TABLE 3: SAMPLE MEANS AND ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) FOR MEASURES SHOWING SIGNIFICANT DIFFERENCES BETWEEN RETESTEES AND NON-RETESTEES

| MEASURE | SAMPLE MEAN | GROUP | |
|---|---|---|---|
| | | RETESTEES (121) | NON-RETESTEES (25) |
| S-HEALTH | 5.23 | 0.11 | -0.53 |
| MUNSH | 12.67 | 1.39 | -6.73 |
| OCCSAT | 6.64 | 0.06 | -0.31 |
| WORDFL | 28.91 | 1.07 | -5.03 |
| MONTHS LIVED | 61.09 | 2.08 | -10.07 |

TABLE 4: SAMPLE MEANS AND ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) FOR SUBSCALES OF THE MUNSH ON WHICH SIGNIFICANT DIFFERENCES WERE FOUND BETWEEN RETESTEES AND NON-RETESTEES

| MEASURE | SAMPLE MEAN | GROUP | |
|---|---|---|---|
| | | RETESTEES | NON-RETESTEES |
| POSITIVE EXPERIENCE | 10.84 | 0.45 | -2.19 |
| NEGATIVE AFFECT | 2.49 | -0.29 | 1.41 |
| NEGATIVE EXPERIENCE | 3.32 | -0.47 | 2.28 |

TABLE 5: CORRELATIONS AMONG MEASURES SIGNIFICANTLY DIFFERENT FOR RETESTEES AND NON-RETESTEES

| | MUNSH | S-HEALTH | OCCSAT. | WORDFL. | MONTHS LIVED |
|---|---|---|---|---|---|
| MUNSH | - | 0.2999* | 0.1425 | 0.1198 | -0.0673 |
| S-HEALTH | - | - | 0.1863 | 0.0054 | 0.0941 |
| OCCSAT | - | - | - | -0.0852 | 0.0937 |
| WORDFL. | - | - | - | - | -0.0004 |

*P<.01

TABLE 6: CELL SIZE PER MEASURE FOR ALL WAVE ONE DATA GROUPED BY TIME-TO-DEATH (RANGE OF N: 137 - 156)

| MEASURE | GROUP | | | |
|---|---|---|---|---|
| | EARLY DEATH | DELAYED DEATH | SURVIVOR | TOTAL |
| OCCUP | 28 | 39 | 87 | 154 |
| EDYEAR | 26 | 36 | 75 | 137 |
| HOUSAT | 29 | 40 | 87 | 156 |
| FINSAT | 29 | 40 | 87 | 156 |
| OCCSAT | 28 | 39 | 87 | 154 |
| RELIGN | 29 | 40 | 87 | 156 |
| CONTROL | 29 | 38 | 87 | 154 |
| S-HEALTH | 29 | 40 | 87 | 156 |
| SEVERE | 28 | 37 | 86 | 151 |
| DRUG | 27 | 33 | 83 | 143 |
| WORDFL | 28 | 40 | 85 | 153 |
| MUNSH | 29 | 40 | 87 | 156 |
| AVHT | 29 | 40 | 87 | 156 |
| SRRQ | 29 | 40 | 87 | 156 |
| MUNAI | 27 | 40 | 86 | 153 |

TABLE 7: SAMPLE MEANS AND ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEAN) FOR MEASURES SHOWING SIGNIFICANT DIFFERENCES ACCORDING TO SUBJECT'S TIME-TO-DEATH

| MEASURE | SAMPLE MEAN | GROUP | | |
|---|---|---|---|---|
| | | EARLY DEATH | DELAYED DEATH | SURVIVOR |
| EDYEAR | 6.04 | 0.26 | -1.39 | 0.57 |
| MUNAI | 8.51 | -0.85 | -0.87 | 0.67 |

The results indicated a significant main effect of groups on the lifestress measure ($F[2,116] = 3.318$, $p < .040$) and on the activity measure ($F[2,114] = 4.090$, $p < .019$). Sample means and the adjusted group means (deviation from the sample means) for these measures are reported in Table 9. The sample means, the adjusted group means (deviation from sample means) and the F values from ANOVAS computed on all measures (for the retestee data) are reported in Appendixes J (for W1) and K (for W2).

A first post hoc analysis (Scheffe) indicated that the subjects in the Survivor group had higher levels of activity than the subjects in the Early Death group ($p < .05$). A second post hoc analysis, computed on lifestress scores, revealed that subjects in the Survivor group had higher lifestress than those in the Early Death group ($p < .05$). To investigate the relationship between lifestress and activity, the correlations between the two variables were computed for each time-to-death group. None of the correlations reached significance ($p > .18$). One interpretation of this finding would be that subjects who are more active are likely to experience more lifestress, whether of the positive (celebrating Christmas) or negative (having arguments) type.

No significant group by time-of-measurement interactions were obtained. Also, the time-of-measurement effects are neither reported nor interpreted, for two reasons: 1) a 12 month retest interval is too short a time to yield indications of a meaningful trend in scores; 2) the scores may have been unduly affected by time of measurement effects and practice effects.

TABLE 8: CELL SIZE FOR RETESTEE TIME-TO-DEATH GROUPS ON ALL MEASURES FOR WAVE ONE (RANGE OF N: 103 - 121)

| MEASURE | GROUP | | | |
|---|---|---|---|---|
| | EARLY DEATH | DELAYED DEATH | SURVIVOR | TOTAL |
| OCCUP | 21 | 33 | 66 | 120 |
| EDYEAR | 19 | 27 | 57 | 103 |
| HOUSAT | 21 | 34 | 66 | 121 |
| FINSAT | 21 | 34 | 66 | 121 |
| OCCSAT | 21 | 33 | 66 | 120 |
| RELIGN | 21 | 34 | 66 | 121 |
| CONTROL | 21 | 34 | 66 | 121 |
| S-HEALTH | 21 | 34 | 66 | 121 |
| SEVERE | 21 | 33 | 65 | 119 |
| DRUG | 20 | 28 | 63 | 111 |
| WORDFR | 20 | 34 | 64 | 118 |
| MUNSH | 21 | 34 | 66 | 121 |
| AVHT | 21 | 34 | 66 | 121 |
| SRRQ | 21 | 34 | 66 | 121 |
| MUNAI | 21 | 34 | 66 | 121 |

TABLE 9: SAMPLE MEANS AND ADJUSTED GROUP MEANS FOR MEASURES SIGNIFICANTLY DIFFERENT ACCORDING TO TIME-TO-DEATH OF RETESTEES

| MEASURE | SAMPLE MEAN | GROUP | | |
|---|---|---|---|---|
| | | EARLY DEATH | DELAYED DEATH | SURVIVOR |
| SRRQ | 128.55 | -31.765 | -7.925 | ~~14.195~~ |
| MUNAI | 8.46 | -1.80 | 0.295 | 0.43 |

# DISCUSSION

The data from this study were analyzed in three ways: 1) retestees were compared to non-retestees, 2) the full sample was evaluated on the basis of time-to-death, and 3) the retestees alone were evaluated on the basis of time-to-death. Predictors of longevity which had received the bulk of experimental support in community samples (e.g. better cognitive functioning and self-health) were not found to predict longevity in this sample. However, higher cognitive function and self-health rating did characterize a subgroup of the population (the retestees) that lived the longest. The subjects alive at the time of retest but not retested (N = 25), died sooner than those who were retested. The retestees also had higher occupational satisfaction and happiness than the non-retestees. Riegel, Riegel and Meyer (1967, 1968) and Baltes et al. (1971) had previously demonstrated significant differences between retestees and non-retestees in community samples of elderly.

Two main predictors of longevity emerged from the present study. Firstly, home residents who lived longer had the higher activity levels. Previous research on physical and social activity in community dwellers (Lehr, 1983; Rose and Cohen, 1977; Palmore, 1982; Berkman and Syme, 1979), demented nursing home dwellers (Kraus and McGeer, 1981), and a relocated nursing home population (Watson, 1980) has found that more active individuals live longer. Secondly, retested individuals found to experience more lifestress lived longer. Although previous studies have concluded generally that deleterious life events, such as bereavement and relocation, may limit life (Rowland, 1977; Turner et al. 1972; Lieberman, 1974) usually only one "negative" life event has been considered. This study both examined 40 life events, some of which were "positive" (i.e. celebrating Christmas), and used a psychometrically sound measure to detect their relationship to longevity.

Among personality variables, none emerged as reliable predictors of longevity. Sparse findings regarding the effects of personality variables on longevity have led other researchers to be equivocal regarding the contribution of personality to longevity prediction (Rodin and Langer, 1977; Turner et al. 1972).

Few previous studies examined non-demented institutionalized nursing home populations. Of those that did, limitations inherent in the type of measures utilized (Booth, 1985; Watson, 1980; Lieberman, 1965; Turner et al. 1972) and in design (Turner et al. 1972; Watson, 1980) have led to uncertain expectations regarding predictors of longevity in non-demented nursing home residents. Although retrospective in design, this study benefitted from a wide selection of psychometrically sound measures representing the majority of variables (demographic, socioeconomic, health, psychological and social) thought to influence longevity.

**Activity**

Significant relationships between activity and longevity were found both in the total sample (N = 156) and in the retestee subgroup (N = 121). As indicated in Table 7 (i.e., for the total sample), subjects who survived first testing by 60 months or more had significantly higher activity levels, as measured by the MUNAI, than those who survived less long. Post hoc analysis of the scores of the two least longevous groups indicated that these two groups did not differ in activity levels. A breakdown of the MUNAI into subscales yielded no significant relationships between MUNAI subscales and mortality. Consequently, the activity/longevity relationship pertains to overall activity level.

A further finding was that higher activity levels predicted longevity among the retestees. Post hoc analysis revealed that the retestees who lived longer than 35 months after first testing had significantly higher activity levels than those who did not survive as long. The MUNAI factor which principally accounted for the effect was Household Independence ($p < .052$). Items included in this factor are housework, household repairs, gardening and grocery shopping.

While not directly comparable to any of the previous studies because of major differences in the population assessed, and/or because of the measure(s) used, these findings are consistent with a growing literature on the beneficial effects of maintaining activities throughout the lifespan (Berkman and Syme, 1979; Lehr, 1983; Rose and Cohen, 1977; Watson, 1980; Palmore, 1982).

**Lifestress**

A finding less consistent with the existing literature was that, among the retestees, subjects measured as having more lifestress (SRRQ) in the previous year were found to live longer than those who reported less lifestress (see Table 9). Indeed, a post hoc analysis of the SRRQ scores indicated that those subjects surviving six years or more after initial testing reported significantly more life stress than those who died earliest. This finding was not significant when the sample was evaluated on the basis of time-to-death (see Appendixes H, I and J).

Although none of the previous literature indicates that greater lifestress should predict longevity, interpretation of this finding may be directly tied to the previously discussed finding, that is, higher levels of activity predict longevity because more active people may experience more lifestress. In support of this point, Kasl (1983), in a recent "reappraisal" of the link between life experience and disease, noted that life events "are not random happenings which follow Gaussian or Poisson distributions; they are ultimately embedded in life cycle and lifestyle dynamics; and they are not part of some causal matrix with its own dynamics" (p. 86). He advocates the careful analysis of life events within the context of the life cycle, and suggests the interpretation of the event could determine its influence.

That higher numbers of life events were found for the subgroup of retestees again highlights their special characteristics. These subjects may reflect a more "engaged" or active lifestyle, as opposed to a more withdrawn but life-event-free lifestyle. More research into life events in the nursing home elderly, with due

consideration given to this special subgroup, is needed before further interpretation of this finding can be proposed.

## Age

As stated in the "Preliminary Findings" section, age was related to survival in elderly nursing home dwellers, and was treated as a covariate in the main analysis. The relationship between age and survival was curvilinear, with the oldest mean age being recorded for the Delayed Death group, and not for the Early Death group as actuarial estimates and a number of previous studies would have predicted (Booth, 1985; Goldfarb, 1971; Kraus and McGeer, 1981).

Reviewers of research on the prediction of longevity have requested that the effects of age be controlled for in such studies (Siegler, 1975; Abrahams, 1976), as chronological age has long been considered among the strongest predictors of mortality, for community and institutional samples alike (Booth, 1985; Goldfarb, 1971; Kraus and McGeer, 1981; Jarvik, 1975).

## Gender

Sixty-two percent of subjects in the study were female. While higher mortality rate among males probably contributes to the imbalance in gender among institutional residents available to study (Waldron, 1976; Verbrugge, 1983), it was not related to mortality in the present study. Other studies have also questioned the importance of gender in predicting longevity in the institutionalized elderly: the Booth (1985) study found that functional impairment and length of institutionalization, irrespective of gender, were the most salient predictors of longevity in such a population.

Gender was treated as a covariate in this study because, as in many previous studies, (Palmore, 1982; Breslow and Enstrom, 1980; Osgood, 1985; Klerman and Clayton, 1984; Rowland, 1977), it was related to several of the dependent variables.

**Marital Status, Education and Socioeconomic Status**

In this study, neither marital status nor occupational status significantly differentiated among subgroups in any of the analyses nor was either related to longevity (see Appendixes H, I and J). This finding contradicts previous findings on community samples, that reported being married (Singer et al. 1976; Osgood, 1985; Palmore, 1982) and having higher job status and income level (Palmore, 1982) predicted longevity. In his research on an institutionalized population, Goldfarb (1971) had reported that married institutionalized males died sooner than the unmarried ones. One reason this study found no relation between marital status and longevity may have been that most individuals in this study were widowed (63%), with married individuals representing such a small percentage of the total population (15%) that substantial findings related to marital status were unlikely.

As previous studies on institutional populations have suggested, it appears that institutional life is a "great leveler" when it comes to SES (Lieberman, 1969; Booth, 1985). In only one comparison, that of all subjects (N = 156) according to distance-to-death, did years of education emerge as a a significant predictor of longevity: post hoc analysis revealed that subjects in the Delayed Death group had fewer years of education than subjects who lived longest (i.e., the Survivor group). However, education failed to distinguish between the most and least longevous among the subjects. Indeed, in two out of three comparisons, the subjects who died earliest had the highest educational status (see Appendixes H, I and J). Goldfarb (1971) reported that years of education predicted longevity in subjects until the age of 85 years; after this, educational status failed to predict longevity. A similar effect may have been operating on this institutional sample. Further research will be necessary to define reasons for the lack of predictor salience of SES in the institutionalized elderly.

**Verbal Ability**

The only significant effect of verbal ability was a higher mean score for the retestees than non-retestees. Verbal ability was not significantly related to mortality (see Appendixes H, I and J).

The non-significance of the findings with respect to mortality is in contrast to a vast literature describing death related changes on a wide variety of cognitive measures in community samples (Jarvik, 1975; Palmore, 1982; Botwinick et al. 1978; Lieberman, 1965; Kleemeier, 1962 and others) and in one sample of demented elderly (Kraus and McGeer, 1981). One difference between this study and previous ones was the relatively short length of the retest interval. The other studies ranged from 3 to 25 years in their analyses of cognitive changes related to death.

Another difference between this study and those completed previously was in the type of measure used to test for cognitive ability: most studies have relied on lengthy standardized measures of intelligence (WAIS, Stanford-Binet), visual and motor organization (Hooper, Bender-Gestalt), or memory (Wechsler Memory Scale) to indicate changing cognitive functioning. The measure used in this study, the Set Test, has been used to discriminate between demented and non-demented elderly, but may not be appropriate for sensitive discriminations in the short term, especially of the type needed to ascertain levels of deterioration in specific aspects of cognitive functioning.

**Health**

The story of the health variables parallels that of the cognitive measure: although the survivors have the highest mean self-health ratings (see Appendixes H, I and J), and in two out of three comparisons, the lowest severity of illness and drug ingestion scores, significance was not achieved in these analyses. In this study, self-health ratings were found to be correlated to the severity of illness and drug ingestion scores for all distance-to-death subgroups.

These results are tantalizing albeit inconclusive. Previous research, entirely on community samples, have unanimously endorsed self-health ratings as a significant predictor of longevity (Mossey and Shapiro, 1982; Palmore, 1982; Singer et al. 1976) while reporting weaker findings regarding objective health ratings (Mossey and Shapiro, 1982; Botwinick et al., 1978). One study (LaRue et al. 1979) suggested that self-health ratings lose predictability past 84 years of age. Subjects in this study were on the threshold of the old-old age range. The age distribution in this study could have contributed to the lack of predictability of health measures. Also, the selection in this study of only those individuals who were judged to be physically and mentally capable of completing two hours of testing probably affected this study by decreasing the amount of variance found in measures of health.

Once again, the anticipated results were not found, perhaps because of differences between the community samples and the carefully selected nursing home dwellers. However, the importance of including both subjective and objective health measures in any study of longevity has been repeatedly discussed (Abrahams, 1976; Lieberman, 1969; Botwinick, 1984).

**Well-Being and Locus of Control**

Subjects in this study appeared to differ with respect to their ratings of well-being. For instance, the 25 subjects who were not retested had significantly lower happiness ratings, as measured on the MUNSH, than those who were retested (see Table 3). Analysis of MUNSH subscales (see Table 4) indicated significantly higher rates of positive experience and lower negative affect and experience for retestees when compared to non-retestees. In two out of three comparisons, the earliest death group had both the lowest MUNSH scores and the lowest avowed happiness ratings (see Appendixes H, I and J). However, happiness did not significantly contribute to longevity.

Happiness, as measured by the MUNSH, has been demonstrated to conform to the specifications of a trait (Stones and Kozma, 1986a; Kozma and Stones, 1983),

and therefore is more likely to indicate long-standing differences in subjects than changes relating to subsequent death. Support for this interpretation was obtained: the MUNSH scores were found not to be correlated to months survived, and the MUNSH scores of the retestees did not change over the 12-month retest interval.

Again, comparison of these findings to previous ones is difficult because of a lack of studies using standard scales of happiness. Previous studies have looked at happiness ratings, which may better measure the mood of the subject than his/her enduring disposition. For instance, Rodin and Langer (1977) found that happiness as measured on a rating scale increased for subjects in a responsibility-inducing condition. The experimental subjects also lived longer than those who had not undergone treatment. However, because of the uncertainty of what (mood/trait) was measured and the small number of subjects in follow-up, this finding appears tentative. In contrast, Lieberman (1965) found an increase in "happy, magical responses" prior to death in subjects questioned on approaching death in an institutional sample. Because Lieberman used a projective instrument, no firm comparisons can be made across studies.

With respect to locus of control, the most longevous in all three comparisons had the lowest (i.e., more "internal") mean scores (see Appendixes H, I and J). Few studies concerned with predicting longevity have analyzed "locus of control". Botwinick et al. (1978) suggested that community dwellers who felt "control over things" were more likely to survive than those who did not. It is uncertain whether this measure and his rating scale are comparable. This finding suggests that further investigation of this personality measure with institutionalized elderly samples is warranted.

## Conclusions

The most reliable predictor of longevity for the institutionalized elderly in this sample was activity level: the most active individuals survived the longest. A

second, though less reliable, predictor of longevity that emerged from this study was lifestress: higher levels of lifestress predicted longer life for those subjects who were retested.

A number of significant differences emerged between retested and non-retested subgroups of elderly within this sample. This study found that retestees (N = 121) lived significantly longer than non-retestees (N = 25). Other significant differences between these subgroups included cognitive functioning, health, occupational satisfaction and happiness, all of which were more favourable for the retestees (see Table 3). Previous studies found significantly higher scores on measures of general intelligence, cognitive flexibility and visuo-motor flexibility (Baltes et al. 1971) and higher general intelligence and lower personal rigidity (Riegel and Riegel, 1972; Riegel, Riegel and Meyer, 1967, 1968) for retestees compared to non-retestees in community samples. The present findings suggest that the institutionalized retestees, like the community retestees, represent a special subgroup of the elderly population. Findings from such a subgroup may not apply to the universe of elderly institutionalized, and therefore should be treated with caution.

Prospective research into the longevity of elderly institutional dwellers is long overdue. A comparison of findings from both elderly community and nursing home dwellers indicates that, while both subpopulations of elderly appear to benefit from staying active, in other respects (SES, health, cognitive abilities) they may differ. This study makes the preliminary observation that nursing home dwellers appear to be a unique subgroup of elderly individuals, who may not be homogeneous with respect to survival. Future studies would be well-advised to attend to retest/non-retest status as an important individual difference variable.

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# APPENDIX A

## OCCUPATIONAL CATEGORIES AND WEIGHTINGS

| OCCUPATIONAL CATEGORY | WEIGHTING |
|---|---|
| 1) HOUSECARE | 0 |
| 2) FARM OR FISH | 23 |
| 3) SECRETARIAL/TECHNICAL | 36 |
| 4) OWN BUSINESS | 39 |
| 5) PROFESSIONAL | 49 |

# APPENDIX B

## DRUG CLASSIFICATION INDEX

Drug data were weighted according to:

[i] the purpose of the drug:

1. heart
2. lungs
3. high blood pressure
4. arthritis and rheumatism
5. kidneys and bladder
6. diabetes
7. circulatory
8. stroke
9. pneumonia or bronchitis
10. ulcers
11. influenza
12. nerves
13. bowels and laxatives
14. antibiotics
15. antacids
16. sleeping pills
17. vitamins and dietary supplements
18. headaches (and other aspirin uses)
19. unknown
20. other

[ii] the frequency of use:

1. number per day
2. every other day
3. 4-6 per week
4. 1-3 per week
4. monthly
5. as needed or occasionally

[iii] the duration of use:

1. 1-60 months
2. over 60 months

[iv] whether the drug was prescribed or not:

1. no 2. yes
3. unknown but drug only available by prescription
4. unknown

Drugs were then assigned to one of the following eight categories:

[1] psychotropic drugs
[2] analgesics, anti-inflamatory and anti-gout
[3] digestive system
[4] respiratory system
[5] vitamin and mineral supplements
[6] diabetics (injections and pills)
[7] heart and circulatory
[8] miscellaneous (eye drops, hormones, antibiotics, Dodd's kidney pills, corticosteroids, oral and topical sulfonamides and unknown prescribed drugs)

# APPENDIX C

## SEVERITY OF ILLNESS INDEX

Select the number that describes the subject's severity of illness.

1. Heart disease: ..... none mild moderate severe

   (i) Length of time since last problem:
   - -no, never
   - -last month
   - -2 to 6 months ago
   - -7 to 12 months ago
   - -13 to 24 months ago
   - -over 24 months ago
   - -chronic

   (ii) Onset of disease:
   - -1 to 24 months
   - -2 to 5 years
   - -6 to 10 years
   - -or, if answer was many years, over 10 years

2. Lung disease: ..... none mild moderate severe

   (i) Length of time since last trouble:
   - -no, never
   - -last month
   - -2 to 6 months ago
   - -7 to 12 months ago
   - -13 to 24 months ago
   - -over 24 months ago
   - -chronic

   (ii) Onset of disease:
   - -1 to 24 months
   - -2 to 5 years
   - -6 to 10 years
   - -or, if answer was many years, over 10 years

3. High blood pressure: ..... none mild moderate severe

   (i) Length of time since last trouble:
   - -no, never
   - -last month
   - -2 to 6 months ago
   - -7 to 12 months ago
   - -13 to 24 months ago
   - -over 24 months ago
   - -chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

4. Arthritis or rheumatism: ..... none mild moderate severe

(i) Length of time since last trouble:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

5. Kidney or bladder
problems: ..... none mild moderate severe

(i) Length of time since last trouble:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

6. Diabetes: ..... none mild moderate severe

(i) Length of time since last trouble:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

7. Circulatory problems:..... none mild moderate severe

(i) Length of time since last trouble:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

8. Stroke: ..... none mild moderate severe

(i) Length of time since last trouble:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

9. Pneumonia or bronchitis: ..... none mild moderate severe

(i) Length of time since last trouble:
-no, never -last month
-2 to 6 months -7 to 12 months
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Length of disease:
-1 to 30 days -1 to 2 months
-2 to 6 months -7 to 12 months
-1 to 5 years -6 to 10 years
-over 10 years
(7 months to over 10 years apply only if illness is chronic)

10. Ulcers: ..... none mild moderate severe

(i) Length of time since last trouble:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

11. Influenza: ..... none mild moderate severe

(i) Length of time since last problem:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Length of disease:
-1 to 30 days -1 to 2 months
-2 to 6 months -7 to 12 months
-1 to 5 years -6 to 10 years
-over 10 years
(7 months to over 10 years apply only if illness is chronic)

12. Nerves: ..... none mild moderate severe

(i) Length of time since last problem:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

13. Bowels: ..... none mild moderate severe

(i) Length of time since last problem:
-no, never -last month

-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

14. Infections: ..... none mild moderate severe

(i) Length of time since last problem:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

15. Other: ..... none mild moderate severe

(i) Length of time since last trouble:
-no, never -last month
-2 to 6 months ago -7 to 12 months ago
-13 to 24 months ago -over 24 months ago
-chronic

(ii) Onset of disease:
-1 to 24 months -2 to 5 years
-6 to 10 years
-or, if answer was many years, over 10 years

Weightings were assigned according to frequency of illness (higher weighting for greater frequency) and duration of illness (higher weighting for longer duration).

# APPENDIX D

## MEMORIAL UNIVERSITY OF NEWFOUNDLAND

## SCALE OF HAPPINESS

I would like to ask you some questions about how things have been going. Please answer "yes" if a statement is true for you and "no" if it does not apply to you.

In the past few months have you ever felt:

1. On top of the world? ____
2. In high spirits? ____
3. Particularly content with your life? ____
4. Lucky? ____
5. Bored? ____
6. Very lonely or remote from other people? ____
7. Depressed or very unhappy? ____
8. Flustered because you didn't know what was expected of you? ____
9. Bitter about the way your life has turned out? ____
10. Generally satisfied with the way your life has turned out? ____

The next 14 questions have to do with more general life experiences.

11. This is the drearist time of my life. ____

12. I am just as happy as when I was younger. ____

13. Most of the things I do are boring or monotonous. ____

14. The things I do are as interesting to me as they ever were. ____

15. As I look back on my life, I am fairly well satisfied. ____

16. Things are getting worse as I get older. ____

17. I often feel lonely. ____

18. Little things bother me more this year. ____

19. I am quite satisfied with living in this town (city, village). ____

20. I sometimes feel that life isn't worth living. ____

21. I am as happy now as I was when I was younger. ____

22. Life is hard for me most of the time. ____

23. I am satisfied with my life today. ____

24. My health is the same or better than most people my age. ____

# APPENDIX E

## MEMORIAL UNIVERSITY OF NEWFOUNDLAND

## ACTIVITIES INVENTORY

1. Do you manage to do things for yourself, such as eat, dress, and wash? ____

2. Do you do general housework?:

| | some | /most | /all |
|---|---|---|---|
| for yourself | ____ | ____ | ____ |
| for yourself and your spouse | ____ | ____ | ____ |
| for others | ____ | ____ | ____ |

3. Do you take care of your own hair?:
   self ____
   barber/beautician ____
   friend ____

4. Do you generally do your own work around the house and garden? ____

5. Do you get your own groceries and pay bills yourself? ____

6. Do you still work, either full(2) or part-time(1)? ____

7. Do you go for a walk regularly, either daily(2) or weekly(1)? ____

8. Do you have a nap or rest during the day? ____

9. How often do you see your family or relatives? ____

10. Do you get many phonecalls from your family? ____

11. Does your family or relatives drop by to see you very much? ____

12. Do you have regular visits with your family

(such as Sunday dinners, car rides)? ____

13. Do you go on regular trips to visit your family or do they regularly come to see you? ____

14. Do you and your family get together for special occasions (birthdays, weddings, Christmas, etc.)? ____

15. How often do you attend church services? 0. Never ____
1. Special occasions only ____ 2. Occasionally ____
3. Monthly ____ 4. Weekly ____ 5. Daily ____

16. How often does your parish priest or minister visit you? 0. Never ____ 2. Occasionally ____
3. Monthly ____ 4. Weekly ____ 5. Daily ____

17. Are you involved in any church or community groups (e.g. UCWA, the Vestry, K of C, Vetrans, etc.)? ____

18. Do you go to any church events (e.g. garden parties, flower services, bake sales, etc.)? ____

19. Do you attend organized events (e.g. bingo, card parties, etc.)? ____

20. Would you entertain friends in you own room (e.g. make a cup of tea, have a game of cards, etc.)? ____

21. How often do you get together with your friends? ____

22. Do you have any hobbies that involve you and your friends? ____

23. Do you read the Bible, say prayers, or listen to religious programs on TV and radio regularly? ____

24. Do you watch TV, listen to the radio, play records or tapes? ____

25. Do you read newspapers or magazines? ____

26. Do you read books? ____

27. Do you write letters and read your mail? ____

28. Do you sew, crochet, knit or quilt? ____

29. Do you go shopping? ____

30. Do you watch Another World or any soap opera either occasionally(1) or frequently(2)? ____

31. Do you have any hobbies that you do? ____

32. Do you go to the doctor very often? 0. Never ____
1. Yearly ____ 2. Every 6 months ____
3. Every 3 months ____

33. Do you see the nurse? ____

34. Are you able to get up and around all the time or just occasionally? ____

35. Do you do any baking? ____

# APPENDIX F

## JESSOR SCALE

I'm going to read some questions now, each of which has two parts, a and b. I'd like you to tell me for each question which part you believe is more true. In some cases you may believe both parts are true or neither part is true. But for every question I'd like you to choose the part, a or b, which you believe is MORE true (for you).

1. a) Some of the good and some of the bad things in my life have happened by chance.

   b) What's happened to me has been my own doing.

2. a) When I make plans, I am almost certain that I can make them work.

   b) I have usually found that what is going to happen will happen regardless of my plans.

3. a) I like to do things on the spur of the moment.

   b) I prefer to have things all planned out in advance.

4. a) Often I seem to have little influence over what other people believe.

   b) When I'm right, I can usually convince others.

# APPENDIX G

CELL SIZE FOR RETESTEE TIME-TO-DEATH GROUPS ON ALL MEASURES* FOR WAVE TWO (RANGE OF N: 103 - 121)

| MEASURE | GROUP | | | |
|---|---|---|---|---|
| | EARLY DEATH | DELAYED DEATH | SURVIVOR | TOTAL |
| HOUSAT | 21 | 34 | 66 | 121 |
| FINSAT | 21 | 33 | 66 | 120 |
| RELIGN | 21 | 34 | 66 | 121 |
| CONTROL | 21 | 32 | 64 | 117 |
| S-HEALTH | 21 | 34 | 66 | 121 |
| SEVERE | 21 | 33 | 66 | 120 |
| DRUG | 16 | 25 | 62 | 103 |
| WORDFL | 21 | 34 | 65 | 120 |
| MUNSH | 21 | 34 | 66 | 121 |
| AVHT | 21 | 34 | 66 | 121 |
| SRRQ | 21 | 34 | 66 | 121 |
| MUNAI | 21 | 32 | 66 | 119 |

*OCCUP, OCCSAT AND EDYEAR WERE NOT COLLECTED DURING WAVE TWO

# APPENDIX H

SAMPLE MEANS, ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) AND F VALUES FROM ANOVAS ON DATA FROM ALL SUBJECTS GROUPED ACCORDING TO SUBJECTS' TIME-TO-DEATH

| MEASURE | SAMPLE MEAN | GROUP | | | |
|---|---|---|---|---|---|
| | | EARLY DEATH | DELAYED DEATH | SURVIVORS | F VALUE |
| MSTAT | 1.85 | 0.01 | 0.08 | -0.04 | 0.223 |
| OCCUP | 18.34 | 3.07 | -0.83 | -0.62 | 0.446 |
| EDYEAR | 6.04 | 0.26 | -1.39 | 0.57 | 3.694* |
| OCCSAT | 6.65 | -0.01 | -0.06 | 0.03 | 0.851 |
| HOUSAT | 6.38 | 0.36 | -0.05 | -0.09 | 1.559 |
| FINSAT | 1.53 | 0.15 | -0.03 | -0.04 | 0.746 |
| RELIGN | 6.12 | 0.08 | 0.05 | -0.05 | 0.532 |
| CONTROL | 1.68 | 0.03 | 0.08 | -0.05 | 0.176 |
| S-HEALTH | 5.19 | -0.17 | -0.31 | 0.20 | 1.902 |
| SEVERE | 3.45 | -0.31 | 0.16 | 0.03 | 0.733 |
| NDRUG | 2.17 | 0.04 | -0.01 | -0.01 | 0.989 |
| WORDFR | 28.69 | -0.62 | 0.26 | 0.08 | 0.044 |
| MUNSH | 12.85 | 2.92 | -1.73 | -0.18 | 1.952 |
| AVH | 17.69 | 0.82 | -0.14 | -0.21 | 1.658 |
| SRRQ | 124.61 | -13.88 | -4.09 | 6.51 | 0.643 |
| MUNAI | 8.51 | -0.85 | -0.87 | 0.67 | 3.089 * |

*P<.05

# APPENDIX I

SAMPLE MEANS, ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) AND F VALUES FOR MEASURES ACCORDING TO SUBJECTS' RETEST STATUS

| MEASURE | SAMPLE MEAN | GROUP | | |
|---|---|---|---|---|
| | | RETESTEES | NON-RETESTEES | F VALUE |
| MSTAT | 1.83 | 0.00 | -0.01 | 0.922 |
| OCCUP | 18.79 | 0.24 | -1.17 | 0.209 |
| EDYEAR | 5.98 | -0.09 | 0.38 | 0.332 |
| OCCSAT | 6.64 | 0.06 | -0.31 | 4.334* |
| HOUSAT | 6.36 | 0.04 | -0.20 | 0.762 |
| FINSAT | 1.52 | 0.05 | -0.23 | 2.883 |
| RELIGN | 6.12 | 0.02 | -0.10 | 0.655 |
| CONTROL | 1.71 | -0.06 | 0.29 | 1.960 |
| S-HEALTH | 5.23 | 0.11 | -0.53 | 4.261* |
| SEVERE | 3.46 | -0.05 | 0.26 | 0.279 |
| DRUG | 2.16 | 0.02 | -0.10 | 0.122 |
| MUNSH | 12.67 | 1.39 | -6.73 | 15.043*** |
| AVHT | 11.62 | 0.06 | -0.28 | 0.302 |
| WORDFL | 28.91 | 1.07 | -5.03 | 4.702* |
| SRRQ | 123.92 | -1.70 | 8.23 | 0.282 |
| MUNAI | 8.49 | 0.19 | -1.02 | 2.076 |

*P<.05; ***P<.001

# APPENDIX J

SAMPLE MEANS, ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) AND F VALUES FROM ANOVAS ON GROUP EFFECT FOR RETESTEES ACCORDING TO SUBJECTS' TIME-TO-DEATH

| MEASURE | SAMPLE MEAN | GROUP | | | |
|---|---|---|---|---|---|
| | | EARLY DEATH | DELAYED DEATH | SURVIVORS | F VALUE |
| MSTAT | 1.83 | 0.07 | 0.01 | -0.03 | 0.562 |
| HOUSAT | 6.37 | 0.06 | 0.015 | -0.030 | 0.065 |
| FINSAT | 1.54 | 0.225 | -0.075 | -0.035 | 1.934 |
| RELIGN | 6.125 | 0.04 | 0.01 | -0.02 | 0.095 |
| CONTROL | 1.85 | 0.26 | 0.015 | -0.095 | 1.535 |
| S-HEALTH | 5.435 | -0.29 | -0.10 | 0.145 | 1.326 |
| SEVERE | 3.23 | 0.18 | 0.25 | -0.175 | 0.592 |
| DRUG | 2.155 | 0.15 | 0.08 | -0.065 | 0.190 |
| WORDFL | 28.66 | -1.455 | 2.235 | -0.745 | 0.724 |
| MUNSH | 13.78 | -0.67 | 0.625 | -0.112 | 0.487 |
| AVHT | 11.56 | -0.27 | 0.13 | 0.035 | 0.157 |
| SRRQ | 128.55 | -31.765 | -7.925 | 14.195 | 3.318* |
| MUNAI | 8.46 | -1.80 | 0.295 | 0.43 | 4.090* |
| OCCUP, OCCSAT AND EDYEAR WERE NOT COLLECTED DURING WAVE TWO. | | | | | |
| OCCUP | 19.77 | 4.55 | -2.46 | -0.22 | 1.646 |
| EDYEAR | 5.81 | -0.76 | -0.13 | 0.31 | 0.623 |
| OCCSAT | 6.70 | -0.18 | -0.03 | 0.07 | 1.039 |

*P<.05

# APPENDIX K

SAMPLE MEANS, ADJUSTED GROUP MEANS (DEVIATION FROM SAMPLE MEANS) AND F VALUES FROM ANOVAS ON GROUPS BY TIME OF MEASUREMENT INTERACTION* (I.E., W1-W2) ACCORDING TO SUBJECTS' TIME-TO-DEATH

| MEASURE | SAMPLE MEAN | GROUP | | | |
|---|---|---|---|---|---|
| | | EARLY DEATH | DELAYED DEATH | SURVIVORS | F VALUE |
| MSTAT | 0.02 | -0.02 | -0.01 | 0.01 | 0.170 |
| HOUSAT | 0.07 | 0.07 | 0.16 | -0.11 | 0.449 |
| FINSAT | 0.06 | -0.15 | 0.10 | 0.00 | 0.667 |
| RELIGN | 0.03 | 0.08 | -0.18 | 0.07 | 1.402 |
| CONTROL | -0.39 | 0.07 | 0.21 | -0.13 | 0.735 |
| S-HEALTH | -0.17 | 0.34 | 0.00 | -0.11 | 0.641 |
| SEVERE | 0.26 | -0.91 | 0.87 | -0.15 | 2.454 |
| DRUG | -0.17 | -0.10 | -0.03 | 0.04 | 0.067 |
| WORDFL | 2.46 | -0.85 | 2.26 | -0.95 | 0.892 |
| MUNSH | 0.64 | 1.09 | 0.93 | -0.84 | 0.996 |
| AVHT | 0.22 | 0.17 | -0.05 | -0.03 | 0.037 |
| SRRQ | -13.17 | 7.24 | 2.16 | -3.42 | 0.114 |
| MUNAI | 0.22 | 0.26 | -0.35 | 0.09 | 0.363 |

*OCCUP, OCCSAT AND EDYEAR WERE NOT COLLECTED DURING WAVE TWO