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**LA THÈSE A ÉTÉ
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**Psychological Predictors of Survival
in Elderly Individuals**

Michèle Gagnon

**A Thesis
in
The Department
of
Psychology**

**Presented in Partial Fulfillment of the Requirements
for the Degree of Master of Arts at
Concordia University
Montréal, Québec, Canada**

May 1986

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ABSTRACT

Psychological Predictors of Survival
in Elderly Individuals

Michèle Gagnon

The purpose of the present study was to investigate the relationship between psychological functioning and survival in elderly individuals. This study consisted of a follow-up evaluation of 346 elderly subjects who had been assessed for psychological functioning in the period from 1981 to 1983. At that time, the subjects had a mean age of 72 and were residing independently in the Montreal area. The sample included males and females, francophones and anglophones from middle and working class background. Of the 346 subjects originally tested, 86.7% were still alive, 8.09% had died and 5.21% could not be contacted. Analysis of the contacted subjects' test scores, revealed that survivors were significantly younger, less depressed, more satisfied with their health and financial situation and more involved in socially and intellectually demanding activities. Survivors were also found to have younger subjective ages, higher cognitive scores and more support available from family members. Discriminant function analysis provided good classification results for survivors and poor classification results for nonsurvivors. The major discriminating variables for survivors were younger subjective age, higher levels of happiness, intellectually demanding activities and social support. These results provide evidence for the importance of psychological variables in predicting survival in elderly individuals.

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Background

One of the most profound changes of the past century has been a marked increase in human life expectancy. This increase has been the result of improvements in the standard of living brought about by industrialization and modernisation. This change has been accelerated in many countries over the past forty years by the introduction of modern public health techniques.

Recently, life expectancy (the statistically determined number of years that an individual is expected to live) (Yin & Shine, 1985) research has focussed on a portion of the elderly population which lives longer than the elderly of the past century. Results from such investigations suggest that life expectancy could be increased even further if the factors that lead to this higher life expectancy could be isolated (Myers & Manton, 1984).

Research on longevity has revealed many factors that lead to long duration of life. Such factors encompass physical (e.g., heredity), psychological and social characteristics of long lived people (Jewett, 1973). Dunbar (1957) has coined the term "longevity syndrome" to describe unusually healthy characteristics found in a special group of elderly individuals. She found that if these elderly people do not develop dementia, they remain active, creative and in good physical health. Moreover, Jewett (1973) investigated longevity in 79 individuals ranging between the ages of 87 and 103. The individuals interviewed seem to fit the longevity syndrome because they were all in a good state of health, had high levels of well-being, were physically and mentally active, creative and enjoying life. Jewett (1973) concluded that these findings probably reflected

the basic personality characteristics of the subjects, that is, it is possible that these characteristics were present in adolescence, suggesting that healthy adolescence is a forerunner of a healthy old age.

This review of the literature is divided into three major sections. The first section deals with the evaluation of research on demographic variables such as sex, cultural factors, race, and religious affiliation which are thought to play an important role in longevity.

The second section reviews findings derived from two elderly populations: the institutionalized and noninstitutionalized elderly. The review of the literature on the relationship between institutionalization and longevity suggest that institutionalized elderly have higher mortality rates than noninstitutionalized elderly. Of particular interest is the possibility that institutionalization creates an additional stressor in the lives of elderly individuals which could lead to a decrease in longevity.

The third section presents a critical evaluation of research examining the contribution of life satisfaction, personality, social support systems, stress and cognitive functioning to longevity. This section is intended to provide the basis for specific hypotheses regarding the relationship between psychological functioning and longevity.

Demographic variables: Effects of sex, race, and religious affiliation on longevity. Several factors that are thought to relate to longevity have been reviewed and studied extensively by researchers. Such factors are sex, cultural variables, race and religious affiliation.

Longevity has been shown to vary considerably with the sex of the person. In 1900, males outnumbered females in all but one of the age groups (15 to 24). However, by 1960 females outnumbered males in all age categories over the age of 24, with the male-female discrepancy increasing with increased age. Although war deaths have contributed to the proportionally low number of surviving men in the older age groups, the sharp decline in the sex ratio has been largely due to the increase in male deaths caused by degenerative diseases (Aiken, 1982). That is, the widening sex difference in longevity is caused primarily by the fact that, at every period of life, males are more susceptible than females to diseases. The discrepancy is especially great for heart disease, cancer and respiratory disorders, which are all common diseases in later life. These gender differences also appear to be related to certain lifestyle patterns (e.g., smoking, drinking) commonly found in men (Aiken, 1982).

With respect to race and cultural factors researchers have found that mortality varies with geographical regions. Several of these studies were however distorted by the fact that in certain cases birth records were not available, this leading to inflated ages for most of the subjects. The studies discussed below are methodologically more reliable because birth records were used to confirm the subjects' reported ages.

Several studies indicated that elderly individuals residing in the Palauans islands, Turkey and Russia have been shown to have greater longevity than their American counterparts (Beller & Palmore, 1974; Jensen & Pollot, 1984; Kyucharyants, 1974; Medvedev, 1974, 1975; Wing, Manton, Stallard & Tryoler, 1985).

Jensen & Polloi (1984) investigated thirty-eight Palauans citizens whose ages ranged from 86 to 111. The participants were all found to be in good physical health, to consume less medications than United States citizens and to have an incidence of dementia that was relatively low compared with other countries. Jensen and Polloi (1984) argued that possibly the most significant aspect in the lives of these Palauans was their meaningful role in the family and/or the respect they received from the family and society in general. Therefore, respect and role integrity could be basic issues or developmental task achievements critical for good mental health and survival at the oldest ages in this society (Jensen & Polloi, 1984).

Similar results were found in a study of long-living Turks. In a group of fifty Turks with a stated age of 90 or more, physical factors associated with longevity were relatively good health, being male, and having normal height and weight. Moreover, behavioral factors associated with longevity consisted of simple diets, no cigarette smoking, physical activity, marriage and sexual activity, social activity and a positive view of life (Beller & Palmore, 1974). Again, what seemed important was the honor and respect that the elderly received from the community. Another important finding was that only one-third of the long-living Turks were women. This might indicate that women have higher mortality rates in under-developed regions, or that women in these regions do not receive as much honor and respect as the men, which may lead to lower life satisfaction or poorer treatment, and possibly greater mortality. In general, findings from these studies of long-living Turks support the theory that good health, social activity, satisfaction and a positive view of life contribute to longevity (Beller & Palmore, 1974; Palmore, 1970, 1974,

1982). Kyucharyants (1974) and Medvedev (1974, 1975) found a similar profile for elderly people in the USSR. To summarize, heredity, work satisfaction, diets low in fats and calories, and a stable mode and rhythm of life seem to play important roles in longevity.

Religious affiliation has also been shown to be an important factor in longevity (Palmore, 1982). Jarvis (1976) found superior health and greater longevity for members of the Mormon church in Canada. Moreover, Locke and King (1980) found that, compared to the general population and the total American white clergy, Baptist ministers had a much lower ratio for total mortality and for practically all specific causes of mortality (e.g., hypertension, diabetes, malignant neoplasms). Similar low mortality rates were found for Presbyterian, Lutheran and Anglican clergymen compared to the general male population in the United States (King, 1971; King, Zafros & Haas, 1975). These researchers interpret the greater longevity as being caused by the life style of these clergymen which includes: moderation in the eating of meat, moderation in tobacco and alcohol use, strong emphasis on regular family life, prohibition of multiple sex partners, regular and frequent social programs with emphasis on music, dancing, drama and athletics. The clergy and other learned professions generally share certain common characteristics such as higher social origin, assured relatively high income, educational attainment and occupational stability. These factors, in turn, lead to greater life satisfaction and longevity (Jarvis, 1976; King, 1971; King, Zafros & Haas, 1975; Locke & King, 1980).

For most industrialized society, men have higher mortality rates than women. This discrepancy in mortality rates is caused mainly by

the greater incidence of heart disease, degenerative diseases and respiratory disorders among older men, which appear related to certain lifestyle patterns more commonly found in men. Moreover, cultural factors also seem important in determining longevity. The variable that appeared to be most important in differentiating the lifestyles maintained by individuals residing in certain geographical regions compared to the United States was the respect and honor the elderly received from both the family and the community. The meaningful roles assumed by the elderly are believed to be important positive contributors to longevity through greater life satisfaction.

Finally, religious affiliation has also been shown to be related to longevity. This latter finding has been interpreted as being caused by the life style, financial adequacy, educational attainment and occupational stability of clergymen, factors which are all related to greater life satisfaction and increased longevity. Thus, there is good evidence that a great proportion of variance in longevity attributable to demographic factors is due to life style behaviors associated with such factors.

Longevity differences as related to living environment

Several researchers have focussed on the differences in mortality rates between institutionalized elderly and community dwellers. The findings are consistent in indicating that elderly people living in institutionalized settings (e.g., nursing homes, general hospitals, psychiatric institutions) have higher mortality rates than elderly people residing in the community. Consequently, it is important to distinguish between these two populations when trying to discover factors that relate to longevity.

Findings from the institutionalized elderly. Several studies

have been conducted in order to determine the factors that relate to longevity in an institutionalized elderly population. Epstein and Simon (1969) for example, reported that certain factors were important in predicting whether older psychiatric patients at follow-up were still living in the community, in a psychiatric institution, or had become deceased. Subjects consisted of 534 patients aged 60 and older, who at the time of initial admission into a psychiatric ward of a general hospital, received medical and psychiatric examinations, psychological ratings (consisting of measures of activity levels, and four subtests of the Wechsler Adult Intelligence Scale (WAIS) (Wechsler, 1955)), and open-ended interviews. Results showed that at a two-year follow-up, 56 percent of all patients, except those that were admitted with the initial diagnosis of psychogenic disorders, were dead. Moreover, demographic, social and economic factors (e.g., age, education and socioeconomic status (SES)) did not appear to be of consequence for the prediction of survival up to two years after admission. However, the orientation subscale on the WAIS and physical and self-maintenance ratings were significantly related to outcome, with subjects who scored high on the WAIS, self-maintenance scales and good orientation having higher chances of survival. Low scores on these scales were associated with death. These findings were interpreted as indicating that the presence or absence of organic brain syndromes and the functional level of the patient were the most significant factors related to outcome (Epstein & Simon, 1969).

Another follow-up study was done on these patients eleven years after the initial admission (Epstein, Robinson & Simon, 1971). Of the original sample six percent were survivors, 12 percent of the subjects

could not be contacted, and all the other subjects were dead.

Demographic variables like age, sex, social living arrangements, and economic factors which had not been related to prognosis within two years after admission remained unrelated to survival eleven years after admission. Variables that were found to be associated with the probability of survival were social and physical self-maintenance, orientation as tested by the WAIS, change on ward (i.e., changes in physical or psychiatric condition), physical functional impairment (increased survival for mildly impaired patients compared to severely impaired) and psychiatric diagnosis (increased survival for patients with psychogenic illnesses compared to patients with chronic brain syndromes).

Similar findings were obtained in a longitudinal study of institutionalized elderly carried out by Goldfarb, Fisch and Gerben (1966). The original sample consisted of 1,280 persons over 64 years of age. Most of the subjects were living in old age homes or in small nursing homes, where females outnumbered males two to one in each setting. The rest of the sample were patients residing in chronic care state hospitals. Each subject was given medical (with overall physical level and functional capacity ratings), psychiatric (open-ended interviews) and psychological examinations (mental status questionnaire and tests evaluating cognitive functioning).

All subjects were reexamined one year later. Within one year of the first examination, 24 percent of the sample had died. The results indicated that the relationship between institutionalized setting and mortality is important, with the risk gradually increasing from old age homes to nursing homes to state hospitals. Also notable was the fact that family structure (measured by marital status and the

presence of living children) was not significantly related to mortality.

Of the physical causes of death, diseases of the circulatory system outnumbered all other causes of death combined. Moreover, duration of residence in the institution was negatively related to mortality; that is, persons most recently admitted had the highest mortality rates. Psychiatric ratings proved to be one of the best predictors of mortality. Specifically, presence of extensive brain syndrome, as measured by psychiatric examinations (open-ended interviews), was consistently related to higher mortality rates than the presence of localized brain syndrome. Also, the degree of behavior disorder, or more specifically, the degree to which an individual's disturbed behavior appeared to pose a management problem on the ward, was related to mortality. Physical factors, such as incontinence of urine and feces were also related to mortality. Goldfarb et al (1966) indicated that the identification of psychological and psychiatric estimates appeared to predict mortality more accurately than a physician's estimate of life expectancy.

Grauer, Mueller and Zelnicker (1981) performed a fifteen-year follow-up study on 291 elderly patients referred to a psychogeriatric clinic. At the time of referral, the subjects had an average age of 69 years. At follow-up, of the 291 patients who could be traced, 167 had died, and 104 remained alive. Of the patients who were still alive, 73 were institutionalized. Grauer and his associates (1981) found that medical and psychiatric criteria were of little help in predicting longevity or eventual institutionalization. Only the diagnosis of organic brain syndrome had a negative predictive

significance in terms of longevity.

Factors that were positively related to longevity were being female, self-referral to an institution, higher education, skilled work, independent income and absence of dementia. In addition, orphans, concentration camp survivors and other individuals who spent the war years in Europe both exceeded their sex and age specific mortality ratings (based on mortality tables calculated life expectancies of each patient). Grauer et al (1981) interpreted their findings as being attributable to a form of selection process, with an individual's survival being based on either a "better hereditary endowment or a will to live" (p.13).

In a follow-up evaluation of over 180 psychogeriatric patients, Muller, Grad and Engelsman (1975) demonstrated the importance of generalized electro-encephalogram (EEG) slowing and of impaired EEG reactivity in decreased survival probability. Psychological test results were also excellent predictors of longevity, with clinical ratings, degree of organization and complexity of a patient's daily behavior being positively related to survival. Maintenance of meaningful goals throughout old age and education were also found to be important factors that increased life satisfaction and longevity in institutionalized elderly patients (Muller et al., 1975).

In general, findings from the studies of institutionalized elderly patients indicate that institutionalization may have a deleterious effect on the elderly's chances of survival. The institutionalized elderly person usually has little power over his/her own condition. This situation may be especially stressful, since all the important decisions are made by powerful others (e.g., family, medical staff), leaving the elderly with no meaningful goals to

achieve. Therefore, institutionalization may contribute negatively to survival by increasing the stressful events surrounding the elderly individual. However, an important factor related to the higher incidence of mortality in this population by the great proportion of organic brain disorders among institutionalized patients, which, in itself, is related to a greater risk of mortality. So, it is possible that the association between institutionalization and mortality is not causal. It may not be institutionalization per se that leads to mortality but the physical condition of the patient that leads both to institutionalization and death.

Findings from community dwellers. A number of longitudinal studies have investigated longevity in terms of survivor-nonsurvivor differences. Studies such as the Bonn Longitudinal Study of Aging (BLSA) (Lehr & Schmitz-Scherzer, 1976; Thomae, 1976) and the Duke Longitudinal Study (Palmore, 1969 a, b, 1980, 1982; Palmore & Jeffers, 1971; Pfeiffer, 1970) have investigated the determination of factors that, in addition to age, sex and race, lead to longevity.

The BLSA focussed on the relationships and interdependency of the factors involved in survival. Of the 222 men and women in the original sample (in 1965), 45 were no longer alive in 1972. Deaths constituted 18.2 percent of the women and 22 percent of the men of the original sample. Analyses of the biological correlates of survival indicated that at the first measurement point, nonsurvivors had more sclerotic symptoms and lower auditory capacity than survivors. There was no difference with respect to physician's general rating of health, but survivors had expressed more concern about their health and had consulted their physicians significantly more often than

nonsurvivors had (Lehr & Schmitz-Scherzer, 1976).

With respect to psychological factors, there were significant differences between survivors and nonsurvivors in terms of intelligence quotient (IQ) and certain personality variables. Survivors had higher IQs than nonsurvivors, however, survivors did not differ from nonsurvivors on social activity and satisfaction with degree of activity. In addition, more survivors felt needed than nonsurvivors. No major differences were found between the two groups with regards to family, job and economic situation. Socioeconomic status and IQ correlated very highly with survival for men, but this was not true for women. This discrepancy may be explained by the fact that the women's socioeconomic status was often defined in these studies by their husband's SES level (Lehr & Schmitz-Scherzer, 1976). Since highly paid work was less available to women in this age cohort, the emphasis was more on family than on formal education.

Lehr and Schmitz-Scherzer (1976) postulated a model that focussed on the relationships among the different factors involved in survival. They postulated that aged persons who are more active, show more initiative in various areas of life because they have a tendency to be more involved and more interested in their physical and social surroundings. Cognitive functioning, in turn, benefits from this stimulation. However, activity had the strongest correlation with successful coping in crisis situations, such as illness, physical and emotional stressors.

According to this model, the effects of personality and intelligence appear to have direct and indirect influences (at least for men) on higher education and high socioeconomic status, two correlates of longevity. Thus, higher intelligence not only leads to

more stable personality traits, higher education and better environmental conditions but also serves as a prerequisite for more qualified occupations, which in turn lead to greater longevity via improved SES. Social status coupled with stable personality and other environmental conditions also ensures proper nutrition which is another correlate of longevity. Similarly, personality, ecological conditions, SES and nutrition are related to preventive medical care and attention to hygiene which in turn leads to increased longevity (Lehr & Schmitz-Scherzer, 1976). This model proves helpful in demonstrating the complex interactions between external and internal, social, psychological and physiological conditions of longevity.

A similar investigation was undertaken by Palmore (1969 a, b, 1970, 1980, 1982) and Pfeiffer (1972) in the Duke Longitudinal Study of Aging. In their earlier work on longevity, these authors had shown that various physical, social and psychological characteristics were good predictors of longevity. The strongest predictors of longevity were physical functioning, non-smoking, work satisfaction and happiness (Palmore, 1969 a, b; Palmore & Jeffers, 1971).

Using the subjects of the original sample, Palmore conducted a 25-year longitudinal follow-up study of 270 community volunteers whose ages ranged from 60 to 94 at the beginning of the study. Since most of the subjects of the original sample had died, their longevity was not estimated with actuarial tables. However, for the 26 subjects who were still alive at the time of the analysis (spring 1981), estimates of the number of years they would have lived after initial testing were made by adding the present number of years since initial testing to the actuarially estimated number of years remaining based on their

present age. This rating was labeled the Longevity Difference (LD). Thus, a positive LD meant that the person lived longer than expected, and a negative LD meant that the person lived a shorter period than expected.

The strongest predictors for men were the father's age at death, intelligence (with performance IQ being somewhat stronger than verbal IQ), socioeconomic status, activity (participation in clubs), sexual relations (i.e., high frequency of intercourse), non-smoking and non-consumption of alcohol, work satisfaction, usefulness, happiness, and health self-rating (more so than physician's health rating). The strongest predictors of longevity for women were high intelligence (with performance IQ being stronger than verbal IQ), physical and social activity, past enjoyment of intercourse, non-smoking and non-consumption of alcohol, happiness, usefulness and satisfaction with present health status.

Palmore's results (1982) suggest that higher intelligence contributes to longevity through greater problem-solving ability and better coping mechanisms. In addition, higher SES may contribute to longer life because of better nutrition, housing and medical care. In addition, participation in formal groups outside the family and neighborhood contribute to longevity through the physical and mental stimulation they provide as well as through psychological improvement of mental health. For both men and women, happiness was a strong predictor indicating that a positive view of life may contribute to longevity through its effects on mental health. Finally, health self-ratings and health satisfaction seemed to be more important than objective health itself. Palmore (1982) also suggested that how persons react to their health status is more important than their

objective health.

Therefore, findings from both the institutionalized elderly and community dwellers studies indicate that several factors contribute to longevity. The fact that survival could be determined in a fairly reliable fashion on the basis of psychological test results was consistently found in these studies. In general, then, factors which are believed to be important in predicting longevity for the institutionalized elderly were being female, orientation, social and physical self-maintenance, and little or no physical or functional impairment. Similar findings were found in community dwellers: factors related to survival were physical and social activity, better education, socioeconomic status, personality, work satisfaction, feelings of usefulness, happiness and health satisfaction. These factors appear to have both direct and indirect effects on longevity, that is, they are thought to influence survival by both their independent contribution and by their interdependency with other factors.

The literature in this area clearly indicates the relationship between several psychological factors and longevity in elderly individuals. The present study examined five factors believed to be important in predicting longevity; Life satisfaction, personality, social support, stress and cognitive functioning.

Life Satisfaction

Life satisfaction can be defined as an assessment of the overall evaluation of conditions of existence as derived from a comparison of one's aspirations to one's actual achievements. Life satisfaction is then essentially a cognitive assessment of one's progress towards

desired goals (Campbell, Converse & Rodgers, 1976). Thus, the main objective of life satisfaction research is to discover under which conditions is the older person most likely to make a successful adjustment to aging. The life satisfaction approach seeks to explain why people with differing lifestyles and values can all successfully adapt to aging (Palmore & Jeffers, 1974).

Several studies have investigated the relationship between well-being and advancing age. Negative relationships were often noted in the studies where advancing age, poor health and physical disability were related to low life satisfaction (Jeffers & Nichols, 1961; Lowenthal & Boler, 1965).

Several studies have found significant correlations between life satisfaction and socioeconomic status, marital status, size of community and work status (Hansen & Yoshioka, 1962; Marshall & Eteng, 1970). For example, Daniel and Riddick (1982) investigated life satisfaction differences among older female retirees and homemakers. Their findings showed that participation in leisure activity was the strongest predictor of life satisfaction among older women. Income also had a sizeable indirect effect on life satisfaction via its influence on leisure activity participation. Older homemakers had higher life satisfaction than female retirees. From these findings, Daniel and Riddick (1982) speculated that retirement itself created a disequilibrium for older women which had a negative effect on the role transition of these older women.

Hutchison (1975) investigated the effect of income, sex and marital status on life satisfaction in an elderly population. In general, the results indicated that poverty-level elderly people scored more negatively than did those of low income levels (somewhat

higher than the poverty level). In addition, the widowed rated themselves more negatively than the divorced, and in turn, these two groups rated themselves more negatively than the married. Therefore, either very low income or widowhood seem to be associated with lower morale and lower life satisfaction among the elderly. Harvey and Bahr (1974) suggested that the impact of widowhood on morale and affiliation was more related to economic factors than to widowhood per se. However, in Hutchison's study (1975) the reverse was observed; widowhood was a more important factor among the low income than among the poverty level elderly.

Other studies have investigated relationships between socioeconomic status (SES) and life satisfaction among the elderly. These studies showed that lower SES elderly people tend to exhibit less satisfaction or happiness than higher SES elderly (Gurin, Veroff & Feld, 1960). Larson (1978) examined several studies covering a thirty-year period and found that, after health, socioeconomic status emerged as the strongest predictor of well-being. He concluded that lower income elderly are more vulnerable to the impact of negative conditions. Moreover, Larson (1978) found that poor health had a greater impact on the psychological well-being of older persons of lower SES levels than among those with higher SES.

This last study points out an important distinction between actual and self-perceived financial resources. Several studies have shown that the perception of having adequate financial resources, having enough money for needs and extras, and no need for financial assistance appeared to be more important determinants of life satisfaction than objective economic resources (monthly income) and

actual SES (Harel, Sollod & Bognar, 1982; Palmore & Luikart, 1972; Spreitzer & Snyder, 1974). Thus, it appears that the higher the adequacy of perceived family income, the greater the satisfaction with the standard of living.

Similar results have been found for health and well-being. Studies have shown that health satisfaction is a more important determinant of life satisfaction than actual state of health, as determined by physician's ratings (Edwards & Klemmack, 1973; Palmore & Luikart, 1972; Spreitzer & Snyder, 1974). Larson (1978) indicated the importance of health and functional state in determining morale and life satisfaction among the aged. He reported that people who rated their health to be better or reported fewer functional limitations and physical disabilities had consistently higher morale and were more satisfied with their lives. Therefore, the subjective perception of income and the subjective perception of health seem to be important situational factors affecting life satisfaction among older persons.

A similar correlate of life satisfaction in elderly individuals is subjective age. The literature focussing on subjective age has consistently shown that elderly individuals who report feeling younger than their stated age, also report higher levels of morale and life satisfaction (Bultena & Powers, 1978; Peters, 1971). For example, Bultena and Powers (1978) have shown SES to be linked to subjective age, with persons of higher socioeconomic status generally having more youthful subjective ages than elderly individuals of lower socioeconomic status. Moreover, Busse, Jeffers and Orbis (1970) found older age identities in widowed persons than in married persons.

In a four-year longitudinal study on subjective age, Markides and Boldt (1983) found that the less educated subjects were more likely to

have older subjective ages at time one and retain this older subjective age over the four-year study interval. In addition, Markides and Boldt (1983) suggested that subjective age was closely related to a person's health. That is, even after chronological age was controlled for, change in health over the follow-up period was significantly related to change in subjective age.

In order to allow for consideration of the variables' direct and indirect influences on life satisfaction, Markides and Martin (1979) proposed and tested a causal model of life satisfaction in the elderly. Their model used self-perceived health status, education and monthly income as exogenous variables, activity as an intervening variable, and life satisfaction as the predicted variable. These authors believed that "health, income and education are the critical factors which enable individuals to engage in high levels of activity which in turn, influence positively one's level of life satisfaction" (p.88). Markides and Martin (1979) ran separate analyses for men and women, and the results indicated that the proposed model accounted for approximately 50 percent of the variance in life satisfaction of older males and approximately 40 percent of older females. For both sexes, activity and self-rated health were found to be highly predictive of life satisfaction. In addition, all three exogenous variables were found to have an indirect effect on life satisfaction through activity. For males, income had the largest indirect effect, although the indirect effects of health and education were also substantial; however this effect was not as strong for females. Health also had a small indirect effect for females, but the indirect effect of education was minimal. While Markides and Martin's (1979) results

point out the viability of path analysis in life satisfaction research, the limitations of their sample (small size, subjects all Caucasians and of lower SES levels), precludes generalization of their findings.

Other researchers have attempted to show a continuity in life satisfaction. From this perspective, individuals who were happy, emotionally stable, and of high ego strength as young adults, should be more likely to be content and well adjusted during their later years. Mussen, Honzik and Eichorn (1982) for example, have shown that women's satisfaction in later life was influenced more strongly by qualities of the early marital relationship, adequacy of income and leisure time than by their own or their husband's personality traits. For men, however, the best predictors of life satisfaction at 70 were their own and their wife's traits which reflected an emotionally stable personality.

Palmore and Kivett (1977) found no significant changes in mean life satisfaction scores for any age-sex cohort when examined longitudinally over a four-year period for a sample ranging in age from 46 to 70 years at initial testing. They concluded that the best predictor of future life satisfaction appeared to be the person's life satisfaction in the past. Significant predictors also included were self-rated health, and to a lesser extent, sexual enjoyment and social activity.

Baur and Okun (1983) in a three-year longitudinal study, also found stability in life satisfaction scores. Their conclusion was that life satisfaction is a relatively enduring cognitive assessment of one's desired goals or overall condition of life. These results are consistent with continuity theory which suggests that people

maintain their level of life satisfaction over time (Neugarten, 1969).

Life satisfaction has also been found to be closely related to longevity. Rose (1964) and Pfeiffer (1970) for example, demonstrated that among noninstitutionalized elderly people, factors such as higher levels of education, intelligence and life satisfaction, and high status occupations were all associated with increased survival.

Moreover, Harel, Sollod and Bogner (1982) found that successful aging included good physical health, sufficient resources and adequate mental health, and that these factors were all related to life satisfaction. Conversely, factors contributing to a less successful pattern of aging as well as lower life satisfaction included poor health and poor functioning in society, limited financial resources, limited social resources and poor mental health. However, since lower status occupations and lower educational levels are associated with poor housing, poor nutrition and a lack of several other factors important to longevity (Palmore, 1971), the negative impact of low status occupations and low educational levels on life satisfaction and longevity is not clear.

In addition, Palmore (1982) showed that work satisfaction and retaining a useful role in society were strong predictors of life satisfaction for men and that happiness was a moderate positive predictor of longevity for both sexes. These results may indicate that maintaining a positive view of life contributes to longevity through its beneficial effects on mental health (Palmore, 1982).

In general, then, findings from the life satisfaction literature indicate the importance of high life satisfaction in longevity. Factors such as, financial situation (actual and perceived), health

satisfaction (with perceived health satisfaction being somewhat more important than physician's ratings), younger subjective age, high status occupations, high educational levels, and high intelligence were all related to higher life satisfaction and increased survival.

In addition, the relationship between life satisfaction and longevity is particularly relevant for noninstitutionalized elderly; because institutionalization provides a less stimulating and stressful environment, there is a tendency for institutionalized elderly to experience lower levels of life satisfaction. This may be an important factor for the high mortality rates in this elderly population.

The first hypothesis of the present study is based on the results of the life satisfaction research. It is predicted that elderly people who report being satisfied with their lives (as measured by life satisfaction ratings, subjective age and self-perceived health and financial satisfaction) would have greater longevity than people who report lower levels of satisfaction with their lives.

Social Support

Conceptualization and operationalization of social support.

Several researchers have emphasized the importance of social support in longevity. Social support can be defined as support accessible to an individual through social ties to other individuals, groups and the larger community. These social ties represent a support system that may provide not only emotional (expressive) support, but also instrumental support including objects, services and monetary aids (Dean & Lin, 1977). Thoits (1982) defines social support as the "degree to which a person's basic social needs are gratified through interaction with others" (p.147), these needs include affection,

esteem or approval, belonging, identity and security. Similarly, Cobb (1976) defined social support as "communicative sharing", that is, information which leads the individual to believe that he/she is cared for and loved, respected and esteemed, and a member of a network of individuals with mutual obligations to one another.

Caplan (1974) has stated that the most important factor affecting the outcome of a crisis is the "quality of the emotional support and task-oriented assistance provided by the social network within which the individual grapples with the crisis event" (p.4). Therefore, not all sources or types of social support are likely to be equally effective, nor are all social ties necessarily supportive (Thoits, 1982). Gore (1978) found that persons with higher support perceived less financial stress associated with job loss than did those with lower support.

It is then the interactional, dynamic and interpersonal characteristics of social support which provide the information necessary to determine the quality of social support. In a review of the literature on social support and well-being in later life, Ward (1985) concluded that social support systems were multidimensional, that is, social support systems were dependent on both structural properties (e.g., size, accessibility, frequency and stability) and functional properties (e.g., perceived amount and adequacy of aid). In addition, Ward (1984) found that perceived sufficiency of support had a significant relationship with subjective well-being. Thus, the perception of having enough support relations (number) and having enough accessibility and contact increases well-being for elderly individuals.

Much of the interest in research on social support of the elderly has been concerned with both, support provided by family members and support provided by friends and neighbors.

Comparison of social support received by family and friends.

Attention has focussed on the relationships of the elderly with their children and other kin. Typically, the elderly feel closer to siblings than to other relatives, except their own children. This is especially true for elderly who are married with no children, widowed or divorced or never married (Lavery, 1962). Family ties are often preferred over friendships because of their long-term and reciprocal nature. However, findings from studies on support received by family members are somewhat inconsistent. For example, Matthews (1979) suggested that aged women may face an unbalanced exchange within families, having lost their significant place after the children leave and widowhood occur whereas Berghorn, Schafer, Steere, and Wiseman (1978) suggest that family interactions may decline as a rewarding activity because of dependence, role reversal, conflict and generational distance.

Kivett (1985) tested the relative importance of consanguinity and kin level for the support network of older adults. She examined and compared the help received by older rural adults from seven levels of kinship. Results indicate that help received from children and children-in-law was considerably greater than that received from other kin. Siblings were found to be of little functional importance in terms of help provided.

On the other hand, researchers such as Blau (1973) and Wood and Robertson (1978) have argued that interaction with friends is valued more highly because these interactions are voluntary and based on

affectivity and choice rather than obligation. That is, friends are contemporaries and equals, yielding greater openness of communication and intimacy. Moreover, Pihlblad and Adams (1972) suggested that interaction with friends make greater contributions to morale than do family ties.

Research findings indicate that friends provide important psychological and social support for the older adult in the form of companionship, mutual aid, and shared activities. Unlike family ties, in which obligations to older members of the family remain strong, friendship ties may be subject to variations due to personal and environmental conditions (Arling, 1976; Blau, 1981; Lopata, 1979). Moreover, Blau (1981) suggests that being involved in a friendship helps the elderly sustain a sense of usefulness and self-esteem more effectively than filial relationships. A possible reason for this may be that friendships rest on mutual choice and mutual needs and involve a voluntary exchange of sociability between equals (Roberto & Scott, 1984).

Arling (1976) examined the different contributions of family and friends to the morale of elderly widows. Findings showed that contact with family members, especially children, did little to elevate morale, while friendships were related to less loneliness and worry, more feelings of usefulness and a sense of respect in the community.

Family or friends social support networks seem to benefit the well-being of the elderly person. However, controversies arise from the literature as to which support system is the most important and which functions each system serves for the elderly individual.

Complementary roles of each support network. Several authors,

such as Cantor (1979) have argued that networks are "hierarchical-compensatory". According to this perspective, children and other kin play a central role irrespective of task, as children are preferred sources of social support even when they are nonfunctional, that is, living far away or seen infrequently. The network is also compensatory, as other relatives, friends, and neighbors are chosen as the presence of children is increasingly removed. There is then some evidence that ties with children dominate the support networks of older people (Cantor, 1975, 1979; Lopata, 1979; Lowenthal & Haven, 1968; Shanas, 1969).

Similarly, Depner and Ingersol (1980) hold an integrative view of social support. They state that each source of social support (i.e., family and friends) may offer a different, yet equally important form of support for the older person. For example, the permanence and adaptive nature of kinship provides a source of increasingly needed instrumental support for the aged person, whereas selectivity and mutuality of friendship may offer the opportunity for exchange and promote self-esteem (Depner & Ingersol, 1980).

Coe, Wolinsky, Miller and Prendergast (1984) examined the effects of health status and health services utilization of elderly persons in family and neighbor network systems. They described three kinds of relationships: complementary, compensatory, and noncompensatory. Complementary relationships are those in which the frequency of participation was at a desired level in each network (i.e., family and neighbors) and this was reinforced by continued participation at that level in each network. On the other hand, compensatory relationships are those in which the frequency of participation was at a desired level in each network but participation in one network substituted for

lack of participation in the other network. Finally, the noncompensatory relationships are characterized by abandonment by either the family network or neighbor network, or by both networks. These persons had a common perception of too little contact with one or the other or both of their networks and expressed a desire for more contacts.

Results of Coe et al's study (1984) indicated that individuals who were abandoned by either the family or neighbors or both networks had consistently more negative characteristics regarding health status. In addition, differences between elderly respondents with complementary or compensatory relationships were not significant. Moreover, since no evidence was found to support the hypothesis that interaction with the family network was more important for health outcomes than interaction with the neighbor network, these findings suggest that either type of relationship can function to provide support for elderly individuals (Coe et al., 1984).

Relations among social support, psychological well-being and longevity. Several authors view the contribution of social support to longevity as primarily helping to mediate the effects of stressful events (Dean & Lin, 1977; Pearlin, Lieberman, Menaghan & Mullan, 1981). Social support may indirectly affect functioning by influencing the occurrence of life events experienced by the individual or by reducing the individual's appraisal of the stressfulness of a negative life event or strain. For instance, Billings and Moos (1982) found that persons with high levels of support subsequently experienced fewer negative life events than persons with low levels of support. Therefore, supportive social

resources may help resolve minor problems (such as marital conflict) before they become major events (e.g., a separation or a divorce).

Kobrin and Hendershot (1977) tested the importance of social support to longevity in a national sample of people who had died between the ages of 35 and 74. These authors found a complex interaction in the relationships of sex, marital status, and living arrangements to mortality rates. Among the men, those who were heads of the family lived the longest, followed by those who were living in families but not as heads. The men who lived alone had the lowest average longevity. Among the women, those who were heads of the family lived longest, but in contrast with the men, those who lived alone had the second highest longevity. Pfeiffer (1970) also found that only for women was the "never married" status associated positively with longevity. In addition, several authors indicated that widows have more complaints about their health and have increased mortality rates particularly in the first year after bereavement (Kobrin & Hendershot, 1977; Maddisson & Viola, 1968; Parkes, 1964; Rees & Luthins, 1967). Kobrin and Hendershot's (1977) findings (higher health complaints and mortality in widows in the first year of bereavement) indicate that close social ties, which are more likely to be found in marriage than outside it, favor greater longevity. Rose (1964) concludes similarly, stating that the maintenance of a "with spouse" status seems to provide both physical and emotional support which may be crucial to survival.

Contrary to the notion of Kobrin and Hendershot (1977) of the importance of family ties in survival, Palmore (1982) did not find any relationship between marriage and longevity. He concluded that it may not be the marriage per se but the sexual activity and satisfaction

associated with marriage that contributes to longevity. Furthermore, none of the measures of contacts with family and friends were significant predictors of longevity. This, combined with the findings that several measures of secondary or organizational activities were significant predictors, suggests that interactions outside the neighborhood are more important for longevity than are interactions with family and friends. More likely, as Palmore (1982) suggests, people who had substantial involvements outside the neighborhood were an above-average group who benefited from the extra stimulations and gratifications of organizational activities.

Finally, Berkman and Syme (1979) examined in a nine-year longitudinal follow-up study, the impact of various social ties and networks in relation to mortality. Their sample consisted of 2,229 men and 2,496 women between the ages of 30 and 69 years. The results indicated that social and community ties were associated with lower mortality rates. Social support was examined in different kinds of relationships: marriage, contacts with close friends and relatives, church membership and formal and informal group associations. In each instance, people with the highest levels of social ties and relationships had lower mortality rates than people without such ties. The strongest predictors of longevity were the intimate ties of marriage and contact with friends and relatives.

Therefore, findings from the social support literature are generally consistent in indicating that social isolation has negative health consequences and that extended social support networks, either from family or friends, relate positively to longevity. This conclusion gave rise to the second hypothesis of the present study;

that is, elderly people who have an extended and supportive family network, and/or who are socially active with friends or neighbors should have greater longevity than elderly people who are isolated from their families and/or have low levels of contact with friends and neighbors.

Personality

The literature focussing on successful adjustment to aging has centered around two theoretical approaches: disengagement theory and activity theory. Disengagement theory (Cumming & Henry, 1961) argues that old age is a time of declining involvement of the individual with society and society with the individual. According to this theory, aging brings about a change in self-perception such that the individual is less interested in being actively involved in things than in reflecting upon his/her past life and accomplishments.

Contrary to the notion that disengagement is voluntary, activity theory argues that continued productivity and social interaction are essential to satisfaction and a sense of well-being (Maddox, 1968 a, 1970). Activity theory suggests that the roles and relationships one is forced to relinquish in old age must be replaced by new ones of equal status and value in order to maintain morale.

These two theories have been frequently criticized for their failure to take into account personality variables in their attempt to explain what factors lead to successful aging. A third theory, continuity theory, attempts to resolve this conflict (Neugarten, 1969). This theory views personality as an important component in adjustment and proposes that as one progresses through adulthood, personality develops through the formation of certain dispositions such as habits, commitments and preferences. Increasing age evokes

the predisposition towards maintaining constancy of identity.

Adjustments will occur as the elderly person accepts her/his limitations, primarily those that are physical in nature, but retain values and habits as long as possible, thereby enabling the aged to maintain the constancy of their identity (Thomae, 1980).

When the occurrence or non-occurrence of changes in personality dimensions is considered in conjunction with the aging factor, there are indications that certain dimensions appear to remain stable throughout the lifetime (Costa & McCrae, 1977-78; Costa, McCrae & Norris, 1981; McCrae, Costa & Arrenberg, 1980; Neugarten, 1977; Thomae, 1980). Neugarten (1971, 1973) found, in a series of investigations that personality in middle age and adjustment to events in earlier life predicted how an individual will react to old age. Neugarten recognizes that personality does change, but the changes are quantitative rather than qualitative. That is, the pattern of one's personality traits, established early in life becomes more pronounced in response to the stresses of later life.

An important factor for elderly people is their own perception of personality change. That is, elderly people do perceive changes in their own personality functioning even though objective measures tend to indicate that continuity of personality traits predominates (Thomae, 1980). Researchers have attempted to relate self-perceived personality change to psychological functioning. For instance, Gold (1981) and Gold, Andres and Schwartzman (1985) have shown that self-perceived personality change in later life is experienced as a negative phenomenon and is not compatible with continued psychological growth and development. Moreover, Gold (1981) indicated that the

perception by older adults of personality changes was associated with less socially desirable characteristics and poorer psychological functioning. It appears that elderly people who depart from continuity are more likely to be functioning at a poorer psychological level than those who show a greater stability in personality. Therefore, these results tend to support the contention that the maintenance of continuity and the perception of continuity by elderly people are associated with better psychological functioning.

Personality dimensions which are of particular interest in the issue of continuity of personality include neuroticism and extraversion-introversion. This latter concept represents the two directions of basic attitude towards the world. Introverts are more attentive to the subjective world of experience and are more socially withdrawn. Extraverts, on the other hand, are more sociable and more attentive to the objective outer world. Neuroticism represents maladaptive behavior which is accompanied by strong, irrelevant and persistent emotions occurring in full awareness of the maladaptive and irrational nature of the behavior in question (Eysenck, 1979).

These traits are usually measured by the Eysenck Personality Inventory (EPI) (Eysenck & Eysenck, 1968, 1969). Since introversion and extraversion are on a continuum, high scores indicate extraversion and low scores indicate introversion. This inventory also gives a measure of maladjustment. That is, the higher the score on neuroticism the greater the maladjustment.

Using the Bradburn Affect Balance Scale as the criterion, Costa and McCrae (1980) showed that extraverts were happier than introverts and that neuroticism was associated with more unhappiness and greater maladjustment. Moreover, these traits appear to be relatively stable.

Follow-up research by Costa, McCrae and Norris (1981) has shown that an individual's standing on extraversion and neuroticism allowed significant predictions of how happy the person would be ten years later. These findings provide support for the viewpoint that there is a continuity in personality characteristics throughout lifetime.

Another personality characteristic which is thought to play an important role in successful aging is the elderly person's locus of control. People with an internal locus of control tend to feel and act as though they are influential in the face of life difficulties (Averill, 1973; Phares, 1976; Seligman, 1975), whereas people described as having an external locus of control, feel at the mercy of outside circumstances, that is, that their life is governed by fate, luck or others. Several studies have indicated that internal locus of control was correlated with better psychological adjustment (Kuypers, 1971; Palmore & Luikart, 1972; Reid & Zeigler, 1977; Zeigler & Reid, 1979). Moreover, longitudinal studies using samples of various age groups have found no decrease in internality among elderly subjects (Ryckman & Malikiosi, 1975).

Locus of control has been researched extensively by Reid and Zeigler (1977). These authors have modified Rotter's (1966) original locus of control measure in order to adapt it to elderly populations. Zeigler and Reid (1979) found that internal locus of control was negatively correlated with depression and positively correlated with health. Hale, Hedgepeth and Taylor (1985) further suggested that individuals with an internal locus of control are likely to be better adjusted than those with an external locus of control only when the major events they perceive themselves as controlling are highly

valued. Hale et al (1985) found that external locus of control was generally related to higher levels of psychological distress for older women but that such an association did not exist for older men. It is possible that locus of control scores are not predictive of adjustment for many older males because the potential reinforcements available are not valued highly by them. This situation may be especially true if a large proportion of the reinforcements highly valued by males prior to retirement were related to employment outside the home. However, the reinforcements available and valued by older females may be quite similar to those available prior to retirement.

Palmore and Luikart (1972) investigated the correlates of life satisfaction in the noninstitutionalized elderly and found that belief in personal control (internal locus of control) was associated with greater life satisfaction. Moreover, Reid, Haas and Hawkings (1977) found that in noninstitutionalized subjects, there was a relationship between low sense of control (external locus of control) and a negative self-concept. Furthermore, in a second study conducted by Reid et al (1977), carried out this time with residents in homes for the elderly, the same conclusions were drawn. That is, people with a low sense of control had a more negative self-concept and reported themselves as being less content and less happy. This latter finding was especially true for men, suggesting that males who live in homes for the elderly perceive themselves as having less control over their lives and are less adjusted and less happy than noninstitutionalized males (Kivett, Watson & Busch, 1977; Reid, Haas & Hawkings, 1977).

The personality variables which previous research has indicated to be important predictors of elderly people's adjustment to old age are extraversion, internal locus of control and adaptive, rational.

behavior (that is, low neuroticism). Extraversion is seen as being positively related to adjustment and to longevity. Extraverts are more sociable and attentive to the outer world than are introverts, suggesting that extraverts establish an extended support network with sufficient accessibility and contact. Furthermore, since greater life satisfaction is positively related to longevity, the extravert should have greater life satisfaction than the introvert, thereby promoting longevity.

Similarly, individuals with an internal locus of control, should be better adjusted than people who have an external locus of control. This finding is consistent with the results obtained from studies on the institutionalized elderly, in which elderly people living in institutions have been found to perceive themselves as being controlled by powerful others, resulting in a subsequent loss of control. Moreover, loss of control by the institutionalized elderly patients may partly result in higher mortality rates than in the noninstitutionalized elderly population.

Finally, since neuroticism is associated with greater maladjustment, elderly individuals who score high on this trait, should have lower life satisfaction than elderly individuals who score low on neuroticism. Because maladjustment is related to lower life satisfaction, elderly individuals who score high on a measure of neuroticism should have higher mortality rates than elderly people who score low on such a measure.

These conclusions gave rise to the third hypothesis of the present study; that is, elderly individuals who are more extraverted, have an internal locus of control and have low scores of maladjustment

on the neuroticism measure should have greater longevity than elderly individuals who are more introverted, have an external locus of control and score high on the neuroticism measure.

Stress

An increasing body of research has focussed on the deleterious effects of stress on physical and mental functioning. Selye (1956) articulated his concept of stress as the "general adaptation syndrome", a set of unspecific physiological reactions to various noxious environmental agents. Thus, it is generally recognized that stress can be one of the components of any disease, and not just of those designated as psychosomatic.

Illness onset is generally associated with a number of potential factors, including the presence of stressful environmental conditions, perception by the individual that such conditions are stressful, the relative inability to cope with or adapt to these conditions and the presence of a disease agent (Lazarus, 1966). In sum, stress is a broad and general concept describing the organism's reactions to environmental demands. For example, Arthur (1970) and Wolf (1971) have observed repeatedly a linear correspondence between the magnitude of the stressor and the extent of both physical and psychiatric disability.

The purpose of life events research is to demonstrate a temporal association between the onset of illness and a recent increase in the number of potentially stressful events that require socially adaptive responses on the part of the individual. The impact of such events is presumed to be additive in that the greater the number of events, the greater the effects expected (Perkins, 1982; Rahe, 1972, 1974). The Social Readjustment Rating Scale (Holmes & Rahe, 1967) has been

designed essentially to quantify the magnitude of recent life changes as a measure of stress. This scale has provided suggestive evidence for the contribution of stress to the development of different illnesses in a variety of populations (Perkins, 1982; Rahe, 1974).

Ruberman, Weinblatt, Goldberg and Chaudhary (1984) found that two psychological variables, relatively high levels of life stress and relatively high levels of social isolation, made significant independent contributions to the risk of death over a period of three years. These findings support the hypothesis that stress produces deleterious effects, thereby increasing an individual's susceptibility to disease or death. Consequently, these findings support Rahe's (1974) hypothesis, that it is the magnitude of major stressful events rather than everyday events that lead to increased mortality rates in various populations.

Buffer variables. Although there is a large body of evidence that supports the fact that stress influences health and well-being, the correlation coefficients are typically below .3, indicating that stressful life experiences may account for less than ten percent of the variance (Martin & Lefcourt, 1982). In other words, some people who are under stress do not necessarily become ill. Some people may develop diseases after exposure to stressful conditions while others may not. Other factors must, therefore, also be influencing this relationship. Mediating or buffer variables have been hypothesized to reduce the negative consequences of stress and help the individual to cope more adequately with stressful events (Martin & Lefcourt, 1982). A number of attempts have been made to define the coping resources, either of the individual or the environment that serve to

buffer the disruptive effects of life events. Effective coping styles, then, can be expected to mediate the stress-illness relationship (McFarlane, Norman, Steiner, Ray & Scott, 1980). Such coping styles include personality factors, social network and/or social support and material resources (Cobb, 1976; McFarlane et al., 1980).

One category of mediating variable is personality. Personality researchers have sought to measure those aspects of the self-concept that provide personal resources in handling adverse environmental events. An important personality characteristic that is believed to play a stress buffering role is locus of control. Johnson and Sarason (1978) found the relationship between recent stressful life changes and anxiety and depression to be stronger among persons with an external as compared to internal locus of control. Ziegler and Reid (1979) found that internal locus of control was negatively correlated with depression and positively correlated with good health. Similarly, Lefcourt, Martin and Salek (1983) found internality to have a moderating effect upon the relationship between stress and mood disturbances.

Several other studies of elderly individuals also have indicated that when elderly persons either reported having, or were given greater personal control in their lives, they were more likely to be positive in their psychological adjustment than people who did not have such control (Kobasa, 1979; Palmore & Luikart, 1972; Ziegler & Reid, 1979). McFarlane et al (1980) suggested that individuals who perceive themselves as being in control become less demoralized when faced with stressful situations and are less likely to develop illness symptoms.

Another coping style that has been identified as protective against the adverse effects of stressful life changes is the ability to establish a social support network. Cobb (1976) has shown that social support moderates the stress-disease relationship. That is, when social support is high, it tends to protect against the negative effects of stress; when it is low it tends to magnify it.

Such a support network might be protective for several reasons. Individuals may cope more adequately with life stresses when they have the support and encouragement of kin, friends, neighbors, and colleagues (Cobb, 1976; McFarlane et al., 1980). Thus, the closeness among individuals in a social network serves to promote feelings of security, which in turn, help to reduce stress. Alternatively, the isolation resulting from a lack of social support or closeness with others may foster insecure feelings that might be highly stressful (Cobb, 1976). Finally, the existence of a support network might also promote better health because a person who is able to establish a social network is usually someone who has an internal locus of control and, therefore, is willing to take charge in establishing needed support.

Findings from the stress literature are consistent in indicating that high levels of stress create deleterious effects on health and well-being in general and accentuate the risk of mortality. However, the influence of certain variables, which seem to buffer or mediate the effects of high levels of stress on the elderly individual and thereby protect against the adverse effects of stress have been demonstrated. Such mediating variables as internal locus of control and social support networks may decrease the intensity of the

stressful impact of life events by increasing the individual's ability to cope with threatening situations.

These conclusions lead to the fourth hypothesis of the present study; that is, elderly individuals who experience high levels of stress should have greater mortality rates than individuals who experience low levels of life stress. In addition, individuals who experience high levels of stress but have extended support systems and/or have an internal locus of control will have greater longevity than individuals who experience high levels of stress but have little support available and/or have no control over their lives.

Cognitive Functioning

Level of intellectual performance has been shown to be positively related to survival in the older age group. However, the diversity of findings from the literature is striking: Some studies indicate an important decrease in cognitive functioning in elderly people, whereas, other findings indicate stability with little or no decline in intelligence across the life span. These differences among the findings are primarily caused by the type of design researchers adopt and the type of cognitive abilities measured.

Since most researchers employ either cross-sectional, longitudinal or cross-sequential designs, these findings are reviewed in order to allow for comparisons among the studies, as well as to provide a basis for hypotheses about the specific relationships between cognitive functioning in elderly individuals and longevity.

Findings from cross-sectional studies. Virtually all of the research on age differences and age changes in problem-solving ability during the adult years, indicates that elderly individuals perform at a lower level than younger individuals, and that problem-solving

ability decreases greatly with increasing age (Denney, 1979). It is important to note, however, that the majority of studies that indicate such an important decrease in cognitive ability are cross-sectional in nature (Baltes, Schaie & Nardi, 1971).

Results of these studies all point to the fact that both performance and verbal test scores decline with advancing age, with performance test scores showing greater decline. These studies indicate that verbal information, that has been previously stored, is better maintained than the perceptual-integrative skills and processing of new information needed on the performance tests (Denney, 1979; Denney & Palmer, 1981). In addition, the concept of an age-related slowing in the speed of information processing has been used to account for age differences in cognitive functioning (Cerella, Poon & Williams, 1980; Madden, 1985; Mueller, Kausler & Faherty, 1980).

Recent investigations on the effects of presentation rate and encoding tasks on age-related memory deficits, have shown that the decrease in performance of elderly subjects was often overemphasized by experimental conditions (Craig & Rabinowitz, 1985). For example, age deficits are often reduced in paired-associate tasks when the length of the anticipation interval is increased (Arenberg, 1965; Monge & Hultsch, 1971). In these studies, both young and old adults benefit from longer anticipation times, but the benefit is consistently greater for the older adults (Craig & Rabinowitz, 1985). However, the most important finding of these studies was the fact that the elderly subjects were able to recall the information. If the elderly individual was incapable of organizing the material spontaneously, then increases in presentation time should not be

advantageous for them (Craik, 1983; Craik & Byrd, 1982; Craik & Rabinowitz, 1985).

Similarly, Baron and Menich (1985) showed that the psychomotor functioning of older adults can be improved through operant conditioning procedures that explicitly reinforce rapid responding (Baron & Menich, 1985; Baron, Menich & Perone, 1983). Since no significant differences were found between younger and older adults in response speed and memory, Baron and Menich (1985) concluded that short-term memory deficits were not characteristic of older adults. Baron and Menich's results (1985) support the finding that the memory of older men improved substantially as a result of training.

Results from the Craik and Rabinowitz (1985) and Baron and Menich (1985) studies indicated that there was a slight decrease in information processing in the elderly individual when compared to younger adults. However, once experimental conditions are modified and allow for the elderly subject's memory to be tested, without the artifact of time pressure, results indicated a less substantial decrease in the elderly person's performance as compared to young adults.

A factor that can confound cross-sectional studies is health. Siegler (1980), for example, has noted in normal elderly subjects that high intellectual skills were significantly related to survival, and that poor health (particularly changes in the cardiovascular system) was related to poorer cognitive performance. Similarly, Herzog, Schaie and Gribbin (1978) showed that cardiovascular disease is a good predictor of decline in cognitive functions in the elderly.

Moreover, in a ten-year follow-up examination of patients with high blood pressure, Wilkie and Eisdorfer (1971) found that persons

with high blood pressure showed a decline of almost ten points in the performance subtests of the WAIS, whereas participants with normal blood pressure, showed no significant changes in intelligence. These authors suggested that when intelligence does decline during old age, it may be caused not by age itself, but rather by high blood pressure (Wilkie & Eisdorfer, 1971). Because there are more people with health problems in older age groups, cross-sectional studies would tend to overemphasize this decline as compared to longitudinal studies.

To summarize, the major difficulty with cross-sectional designs in studying intelligence in elderly individuals is that, the results might indicate a decrease in cognitive ability in the aged, but the uncertainty remains as to whether the observed differences among age groups are produced by the aging process itself or by cohort differences.

Findings from longitudinal and cross-sequential studies. The finding of declining intellectual functioning with increasing age has not been completely supported by longitudinal studies. These studies are less likely to find intellectual decline than cross-sectional ones and, even when such decline is found, the decrease is not as substantial as that found in cross-sectional studies (Botwinick, 1977).

For example, Schaie and Strother (1968) used a cross-sequential design in order to examine cognitive functioning in the elderly. Using the Thurstone Primary Mental Ability Test, Schaie and Strother (1968) tested individuals ranging in age from 20 to 70. Seven years later, they reexamined 302 of the original 500 subjects in their sample using the same test. Results indicated that when only cross-

sectional differences were considered, there was an apparent decline in intellectual abilities. However, longitudinal data indicated that there was no substantial decline with advancing age. Schaie and Strother (1968) concluded that there are important environmental influences, such as education, on intelligence test scores that may result in a noticeable decline in cognitive abilities in the elderly individual. However when these variables are controlled for (i.e., by using a longitudinal design) results indicate that aging per se is not accompanied by any significant decline in the abilities measured by cognitive tests.

Other longitudinal studies indicate an absence of decline in intelligence test performance with increasing age. Owens (1966) for example, used the Army Alpha test to retest a group of males who were tested as college freshmen in 1919, from 1949 to 1950, and in 1961. He found that total scores on the test increased from 1919 to 1950 and then leveled off, showing only a slight decline from 1950 to 1961. Although this study had some shortcomings (e.g., subject attrition) the data clearly indicated that intelligence test scores do not necessarily decline with advancing age.

In addition, a number of investigations have attempted to extend longitudinal research on intellectual change into the seventh, eighth and ninth decades of life. For example, Eisdorfer and Wilkie (1973) reported the results of a ten-year longitudinal study of individuals whose ages ranged between 60 and 79 at initial testing. The most substantial declines were found in the oldest individuals at initial testing. However, especially striking was the fact that there was only a small magnitude of decline with increasing age. That is, the average decline for subjects in the 60 to 69 age group at initial

testing, was less than four points, and the decline of subjects in the 70 to 79 age group at initial testing was less than eight points. These data indicate that there are declines in intelligence test scores performance in the eighth and ninth decades of life, but they are relatively small in magnitude (Eisdorfer & Wilkie, 1973; Jarvik, Eisdorfer & Blum, 1973).

In general, longitudinal studies report a decline in intellectual performance with advancing age, but the decline is smaller in magnitude than that found by cross-sectional studies.

Cognitive functioning and longevity. A growing body of literature has focussed on the relationship between cognitive functioning and longevity. In an analysis of survivor-nonsurvivor differences in intelligence and memory test scores, Berg (1980) found that survivors had higher scores on all tests, and that differences were significant on verbal meaning, reasoning and spatial ability. Using a discriminant function analysis, 67 percent of the survivors could be correctly classified on the basis of sex, spatial ability and verbal meaning (Berg, 1980). Similarly, in longitudinal studies of noninstitutionalized elderly populations, Palmore (1970, 1980, 1982) and Lehr and Schmitz-Scherzer (1976) found that higher intelligence quotient was positively related to longevity. Palmore (1982) concluded that cognitive functioning may contribute to longevity through greater problem-solving ability and better coping mechanisms when dealing with everyday situations.

One of the most controversial aspects of the cognitive literature has been the terminal drop hypothesis. Some studies have found that death is often preceded by a "terminal drop" in cognitive functioning.

Kleemeier (1962) was the first to observe this effect in elderly men. After half of the subjects of the original sample had died, Kleemeier demonstrated that the drop in scores was greater for the deceased than for the living. Similarly, in a twenty-year longitudinal follow-up study of senescent twins, Blum, Fosshage and Jarvik (1972) showed that greater decline in intellectual abilities may predict early mortality in males. The test battery included five subtests from the Wechsler-Bellevue test: Similarities, digits forward, digits backward, digit symbol substitution, and block design. However, the relationship between test scores and outcome was not linear. There appears to be a critical level of performance below which the chances of dying increases progressively over the next two years. Above this level, no association between low test scores and mortality was found.

Botwinick, West and Storandt (1978) have also shown that intelligence test performance of elderly subjects may be used to predict death, with poor test performance possibly signaling death within five years after testing.

However, when Palmore and Cleveland (1976) reviewed the records of 178 members of the Duke longitudinal study who had died from natural causes, they found that only a few individuals showed marked terminal drop effects and most subjects showed normal intellectual test scores of aged individuals. These authors concluded that if terminal drops occur, the effect of the drop in intellectual performance should be noticeable only a few days to a few weeks before death and not several months before death (Palmore & Cleveland, 1976).

In general, it seems clear that survivor's scores on intellectual performance are consistently higher than nonsurvivors scores. However, to date, there is little support for the terminal drop

hypothesis; it may only be that poor scores reflect pathology which leads to earlier demise. As Savage, Britton, Bolton and Hall (1973) suggest, it may be the presence of organic brain disorders that is largely responsible for the significant survivor-nonsurvivor differences in intellectual functioning. Moreover, in a seven year follow-up of Savage et al's (1973) study, Kay, Britton, Bergman and Foster (1977) found a significant relationship between low WAIS scores and death within two years. These authors argued that impaired cognitive functioning may be caused by the presence of generalized disease, especially cardiovascular disease and specific brain pathology. In addition, Birren (1968) emphasized that only verbal information skills distinguished survivors from nonsurvivors, with the WAIS verbal scores of survivors being consistently higher than those of nonsurvivors. Birren (1968) concluded that these results may indicate that it is the verbal skills rather than performance skills which closely reflect the presence of vascular disease. In general, cognitive functioning is believed to be an important factor in longevity, with higher intelligence test scores relating positively to longevity.

These findings give rise to the fifth hypothesis of the present study; that is, elderly individuals who score higher on cognitive functioning measures and are more involved in intellectually demanding activities should have greater longevity than elderly individuals who score low on such measures.

Statement of the problem

As indicated by the literature review, several aspects of psychological functioning appear to be related to longevity. However, to date, few studies have focussed on the interrelationships among such psychological variables in relation to longevity. Most studies have focussed on the relationship between one or a few psychological variables with longevity without controlling for interdependencies among the effects of these variables.

The purpose of the present study was to investigate the role of several psychological variables in relation to longevity, and to develop specific hypotheses about the relation of these variables to longevity. More specifically, the present study was designed to focus on whether variables such as, life satisfaction, social support systems, personality, stress and cognitive functioning were related to longevity in a sample of noninstitutionalized elderly.

The first hypothesis of the present study examined whether elderly individuals who report greater satisfaction with their lives have greater longevity than elderly individuals who report lesser amounts of satisfaction with their lives. In addition, the contribution of life satisfaction to longevity was tested for subjective age, and self-perceived satisfaction with health and financial situation. That is, elderly individuals who report a younger subjective age and are satisfied with their health and financial situation should live longer than individuals who score low on these two measures.

The second hypothesis of the present study examined whether elderly people who have an extended and supportive family network have

greater longevity than elderly people who are isolated from their families, that is, those who have either few relatives or few contacts with family members. In addition, elderly individuals who are socially active should have greater longevity than individuals who are isolated from social interactions.

The third hypothesis of this study examined whether elderly individuals who are extraverts, have an internal locus of control and have low scores of maladjustment on the neuroticism measure have greater longevity than elderly individuals who are introverts, have an external locus of control and score high on the neuroticism scale.

The fourth hypothesis examined whether elderly individuals who experience high levels of stress have greater risks of mortality than individuals who experience low levels of life stress. In addition, it was proposed that individuals who experience high levels of stress but have an extended support systems, are involved in socially demanding activities and/or have an internal locus of control should have greater longevity than individuals who do not have these particular personality traits and/or have little or no support available from the community.

Finally, the fifth hypothesis of the present study examined whether elderly individuals who are involved in intellectually demanding activities and have higher intellectual skills have greater longevity than individuals who score low on these two cognitive measures.

In conclusion, several variables seem to contribute to longevity either independently, or in combination with other variables. The major goal of the present study was to provide more information on the effects of life satisfaction, personality, social support, stress and

cognitive functioning, in a longitudinal study of elderly individuals residing in the community, and to try to determine their value as predictors of longevity.

Method

Subjects

Subjects were 346 volunteers, 65 years of age and older (mean age = 72.90), who were residing independently and maintaining an active life in the community. They were recruited through several agencies such as, university alumni associations, retirement clubs, and community centers that have older people as their clients. Sampling was done by recruiting both males and females, francophones and anglophones, as well as people of middle and working class background on the Blishen scale (Blishen & McRoberts, 1976). The initial examination was done during the period of 1981 to 1983, and consisted of a comprehensive survey of the psychological functioning of elderly people (Andres, Gold & Schwartzman, 1983; Arbuckle, Gold, & Andres, 1986; Gold, 1985; Gold & Andres, 1985; Gold, Andres & Arbuckle, 1985 a; Gold, Andres & Arbuckle, 1985 b; Gold, Andres & Schwartzman, 1985; Gold, Andres & Schwartzman, 1986).

The present study consisted of a follow-up examination of the same pool of subjects tested in the study carried out by Gold et al. (1985 a, b). Each subject was recontacted during the period of 1984 to 1985 and, of the 346 subjects originally tested, 300 (86.7%) were still alive, 28 (8.09 %) had died, and 18 (5.21 %) could not be located.

Measures

In the original data collection stage from 1981 to 1983, participants received a comprehensive battery of standardized measures, either developed to be used with elderly populations or used extensively with them, to assess psychological functioning. Each of

the relevant measures from the 1981-1983 study are described below, grouped in terms of the particular hypothesized variables being examined in the present study.

Life Satisfaction

The Memorial University of Newfoundland Scale of Happiness (MUNSH) (Kozma & Stones, 1978, 1980, 1983 a, b), is a measure relating to affect and adjustment. This is a two part questionnaire: The first ten questions deal with happiness during the past year and the following 14 questions deal with more general life experiences, that is, happiness during the past ten years. The MUNSH is designed to assess both positive and negative emotional states and consists of 24 questions answered by "yes" or "no". A "yes" answer is given a score of one and a "no" answer, a score of zero. A final score is obtained by summing up the positive items. This scale has an acceptable level of internal consistency ($\alpha = .80$), good test-retest reliability ($r = .70$), and correlation coefficients representing validity ranged from .63 to .84, a range fairly consistent with the scale's standardization data (Kozma & Stones, 1978, 1980, 1983 a, b).

Subjects also rated the adequacy of aspects of their lives, such as financial situation and health for everyday functioning (TRI scales) (Schonfeld, 1973). Subjects were asked to rate their health and financial situation on a scale ranging from one to nine; one referred to extremely ill and nine referred to extremely vigorous for health ratings, whereas one referred to extremely poor and seven referred to extremely wealthy, for the financial situation ratings.

Finally, The Subjective Age Questionnaire (Reid & Ziegler, 1977, 1980, 1980-81) was designed to measure the extent to which a person perceives him/herself as old and as having lost capacities. The scale

consists of 15 questions such as "How old would you say you feel compared to others of your own age?". Follow-up studies of either 6, 12, or 18 months intervals with the Subjective Age Questionnaire resulted in validity coefficients ranging from .40 to .72 and a test-retest reliability of .59.

Social Support

Social support was measured by a work and family interview and by an activities questionnaire (Savage et al., 1977). The work and family interview provided data for a measure of social networks. In this interview, subjects had to answer many questions about their school, work and family history. School history was assessed by the educational level and type of studies pursued during school. Work history was determined by asking the subjects what type of work they did after graduating from school, what their work consisted of, and how long they kept this work. This was repeated for each job the subject had. Family history was assessed by asking the subjects if they were married and for how long, if they had any children and grand-children, and if so, where these children and grand-children were residing. Subjects were also asked the frequency (how many times per year) and the type of contacts (in person, by phone, through letters) they had with their relatives. For the purpose of the present study, a variable of total family contact (i.e., by person, phone or through letters) was created.

The activities questionnaire consists of a comprehensive standard list of social, recreational, physical, family, intellectual, occupational and community activities which is designed to assess which activities the subjects engaged in regularly (Savage et al.,

1977). The scale consists of 23 items, such as, time spent socializing (not with family), gardening, reading, housework, shopping, and so on. The frequency of time spent for each item is recorded on a five-point scale ranging from less than once a year to daily.

Personality

The Eysenck Personality Inventory (EPI) is a standardized objective personality questionnaire consisting of 48 items, which requires "yes" or "no" answers. It is frequently used to measure personality changes occurring with age and is designed to measure introversion, extraversion, neuroticism, and lie (or the tendency to answer in a socially desirable fashion). Each correct response is given a score of one and the final score is obtained for the above mentioned categories by adding the relevant number of items in each category. Test-retest reliabilities range between .84 and .94 for the complete form, and split-half reliabilities run from .74 to .91. Moreover, validity coefficients range from .79 to .92 in differentiating different types of contrasting groups (Eysenck & Eysenck, 1968, 1969).

The Desire and Expectancy locus of control scale (Reid & Ziegler, 1977, 1980-81), is a locus of control scale which has been designed especially for elderly populations. This scale assesses to what extent a person desires those reinforcers which are normally seen as important, and to what extent the subject sees these reinforcers as being under his/her control. Subjects are given a choice from "strongly agree" to "strongly disagree". Each item is scored an appropriate number between 1 to 5, with higher scores indicating an internal locus of control. The Desire and Expectancy locus of control

scale has validity coefficients ranging from .54 to .63 and a one-year test-retest reliability of .59 (Reid & Ziegler, 1977, 1980-81).

Stress

Stressful events were measured by a 19-item shortened version of the Holmes and Rahe Social Readjustment Scale (Holmes & Rahe, 1967). This scale was used to measure the number of stressful events the elderly encountered in the past year. Only items relevant to elderly samples were retained. If the subject experienced a stressful event within the past two years, he/she is given a score of one for the event. The final score is obtained by adding up all of the items answered as stressful. The reliability of this measure was assessed in studies conducted by Gold, Andres and Arbuckle (1985 a, b) and a correlation coefficient of .80 was obtained.

Cognitive Functioning

Cognitive functioning was assessed by three laboratory tasks. The first task was designed to assess how elderly subjects organize and recall material that is meaningful to them, that is, material that they are likely to encounter in everyday life. The first task was a sorting and recall task where the experimenter displayed nine cards in front of the subjects, each one having a word written on it. The nine words were, waiter, restaurant, table, teacher, school, desk, nurse, hospital, bed. Subjects had to place the words into groups that belonged together. The cards could be sorted either by theme (e.g., waiter-restaurant-table) or by taxonomic categories (e.g., waiter-teacher-nurse). Once the cards were organized, the experimenter removed them from the subject's sight. The subjects were then asked to recall the items orally (free recall). The second task consisted

of a forward digit span task where the experimenter read four to ten digits and where the subject's task was to recall them in the correct order. If the subjects missed one series of numbers, he/she could have a second chance with the same length of digits but with different numbers. If the subject did not succeed on the second trial, the task ended. The sequences were presented in ascending order of lengths and the subjects' score consisted of the longest string of digits correctly recalled. The third task consisted of a memory and comprehension of prose task where a story was played on a tape recorder. The story was a 300-word anecdote about Henry Birks and a jewel thief. After listening to the passage, subjects had to answer ten multiple choice questions. Five questions tested memory for the facts stated in the story, and five tested the ability to draw correct inferences based on the story. For the purpose of the present study, scores obtained from the three tasks were combined in order to obtain a single measure of verbal comprehension and memory. In other words, this study was more concerned with the relation of cognitive functioning to longevity than with survivors-nonsurvivors differences on each task.

Intellectual activity was assessed by the relevant items of the activities questionnaire designed by Savage et al (1977). The frequency of time spent for each item involving intellectually demanding activity (e.g., reading, meditation, watching television) was recorded on a five-point scale ranging from less than once a year to daily.

Procedure

Each subject in the original sample was contacted individually in order to determine the number of survivors and nonsurvivors in the

sample. According to mortality tables (Statistics Canada, 1980-82), about three percent of males and one percent of females aged 65 years and older die each year. Therefore, the expected sample for the deceased was assumed to be between 25 to 30 individuals. The 346 subjects were contacted by phone to determine whether a subject was still alive or had died during the years following the initial examination.

Subjects contacted at follow-up consisted of three groups: subjects who were still alive, subjects who had died and subjects who could not be contacted. All the subjects in the alive group (n=300) had been contacted by either the experimenter or a research assistant. For the group of subjects who had died following the initial examination (n=28), the time of death was confirmed by the agency from which these subjects had been originally recruited. Finally, for the group of subjects who could not be reached, the agencies were contacted in order to determine whether a particular subject had died or had moved following the initial examination. Once this procedure was followed, some subjects still could not be contacted (n=18). All the subjects who could not be reached or whose status could not be determined at follow-up were excluded from data analysis.

Results

In order to assess differences in psychological functioning between survivors and nonsurvivors, two sets of analyses were performed on the data. The first set of analyses was designed to determine the overall power of the variables of the study to differentiate between survivors and nonsurvivors. The independent contribution of each variable to longevity was also assessed. The second set of analyses was performed as follow-up analyses in order to determine how well survivors and nonsurvivors can be classified on the basis of the psychological variables.

Multivariate analysis of variance (MANOVA) was performed in order to assess differences in psychological functioning as a function of survival status. Multivariate analysis of variance was chosen instead of multiple regression analysis since the dependent variable (DV) is dichotomous (Tabachnick & Fidell, 1983). In order to test the significant results of the MANOVA, Pillai's V was chosen as a significance test since it is the least affected by positive kurtosis (Olson, 1976) and in cases of unequal sample size, it reduces the Type one error rate (Tabachnick & Fidell, 1983). Post-MANOVA techniques were performed in order to determine which variables contribute most to the differentiation of groups and how the different variables combine to give the significant results (Gabriel, 1979). A series of analysis of variance (ANOVA) and chi-square analyses were performed on each variable in order to assess the contribution of each variable in significantly differentiating between survivors and nonsurvivors. Chi-square analyses were performed whenever the data was nominal, that is, group differences with respect to the relative frequency with

which group members fall in several categories was determined. However, when there was great variability within one variable, analysis of variance was chosen as an alternative. In this case, Bartlett's homogeneity of variance test was performed on each variable in order to assess the appropriateness of an analysis of variance. However, since analysis of variance does not take correlations into account, that is, does not indicate how the different variables combine to give the significant MANOVA effect, results derived from such analyses only indicate what DV would have been significant had separate ANOVAs been performed on each variable (Gabriel, 1979).

Because an important question was how the variables combine to give the significant MANOVA effect, Roy-Bargman stepdown F's were performed as a second post-MANOVA technique on the data set. This technique necessitates putting each DV into a hierarchical analysis where the analysis covaries out the effects of the preceding variables, thereby determining how much a variable contributes uniquely to the MANOVA effect. By doing so, it takes between DV correlations into account, and therefore yields a more adequate picture of the role of each DV in obtaining the significant multivariate effect. Bock and Haggard (1968) and Gabriel (1979) suggest that the variables of greatest interest be placed higher up in the hierarchy. Each successive DV is then tested with priority DVs as covariates, to determine if the new DV significantly adds to the combination of DVs already tested (Tabachnick & Fidell, 1983).

Finally, discriminant function analysis (DFA) was used as a classification technique. Classification refers to the process of identifying the likely group membership of a case when the only information known is the case's values on the variables. Also, by

comparing predicted group membership with actual group membership, the power in discrimination can be observed by the proportion of misclassified cases. In addition, classification scores can be converted into probabilities of group membership, thus, a case is assigned to the group for which it has the greatest probability of membership (Klecka, 1980). Discriminant function analysis was then used in order to assess how well survivors and nonsurvivors can be adequately classified on the basis of several psychological functioning variables.

Testing Assumptions

The mean scores for the total sample as well as that for survivors and nonsurvivors on each measure are presented in Table 1. Bartlett's test of homogeneity of variance was performed for each variable. For all but four variables, Bartlett's test revealed that the variances were not significantly different. However, one variable (cognitive functioning) had many missing data. Tabachnick and Fidell (1983) suggest that when this is the case, in the absence of all other information, the mean value for each group (that is, survivors and nonsurvivors) should be inserted for the missing values. Then, the mean of the distribution as a whole remains the same and the researcher is not required to guess at missing values. This conservative procedure was applied to the data set and Bartlett's F revealed that once this procedure took place, an analysis of variance was appropriate.

The remaining three variables (neuroticism, subjective age, and social activity) had many outliers, that is, extreme scores on a particular variable. Outliers were dropped from the analysis and

Table 1

Mean scores on each variable for the total sample, survivors and nonsurvivors.

<u>Variables</u>	<u>Means (standard deviations)</u>		
	<u>Total sample</u>	<u>survivors</u>	<u>nonsurvivors</u>
Age	72.67 (5.87)	72.39 (5.73)	75.61 (6.70)
School	11.79 (4.83)	11.80 (4.86)	11.71 (4.63)
Happiness	27.32 (5.06)	27.64 (4.84)	23.89 (6.19)
Subjective age	45.78 (5.78)	46.14 (5.42)	42.00 (8.05)
Satisfaction with health	5.97 (1.67)	6.06 (1.63)	5.04 (1.84)
Satisfaction with finances	5.53 (1.17)	5.57 (1.18)	5.11 (0.96)
Social activity	244.71 (38.33)	246.71 (36.27)	222.47 (52.26)
Social support	139.09 (96.10)	142.74 (96.41)	99.96 (84.84)
Extraversion	10.61 (3.29)	10.60 (3.32)	10.79 (3.08)
Neuroticism	7.85 (4.68)	7.80 (4.79)	8.39 (3.18)
Desire in control	66.08 (5.70)	66.25 (5.61)	64.25 (6.46)
Belief in control	59.78 (5.04)	59.79 (5.13)	59.61 (4.09)
Stress	1.72 (1.33)	1.70 (1.33)	2.04 (1.28)
Intellectual activity	274.28 (45.04)	277.22 (43.37)	241.76 (50.99)
Cognitive functioning	21.40 (3.34)	21.57 (3.14)	19.47 (5.04)

Bartlett's F revealed the adequacy of performing analysis of variance on the data set. Results of evaluation of assumptions of normality and homogeneity of variance were satisfactory after deletion of outliers and treatment of missing data. Results of Bartlett's test of homogeneity of variance for each variable are presented in Table 2. Consequently, analysis of variance was performed for each measure in order to assess univariate effects of each variable to longevity.

In addition, two variables, social activity and intellectual activity, were highly correlated, $r=.90$, $p<.01$. Because linear dependency was suspected, (Tabachnick & Fidell, 1983), two different sets of MANOVAs were carried out, each including either social activity or intellectual activity.

Evaluation of assumptions of normality, multicollinearity and homogeneity of variance-covariance matrices revealed no threat to multivariate analyses. Consequently, multivariate analysis of variance was carried out on all the variables. Pillai's criterion was selected for significance testing due to the relatively small sample size (in the nonsurvivors group) and the unequal cell sizes in the design (Tabachnick & Fidell, 1983).

Multivariate Effects

The first set of MANOVAs conducted included all variables. Variables were: Age, school, happiness ratings, subjective age, perceived adequacy of health and financial situation, social support, social activity, extraversion, neuroticism, belief and desire in perceived locus of control, stress, intellectual activity, and cognitive functioning. The linear combination of these dependent variables (including intellectual activity) significantly

Table 2

Results of Bartlett's test of homogeneity of
variance (Box F) for each variable

<u>Variable</u>	<u>Box F</u>	<u>P</u>
Age	1.32	.25
School	4.12	.73
Happiness	3.38	.06
Subjective age	3.25	.07
Satisfaction with health	.74	.39
Satisfaction with finances	2.01	.15
Social activity	3.39	.07
Social support	.75	.39
Extraversion	.27	.60
Neuroticism	2.92	.08
Desire in control	1.12	.28
Belief in control	2.27	.13
Stress	.06	.81
Intellectual activity	1.33	.25
Cognitive functioning	1.02	.31

differentiated between survivors and nonsurvivors, $F(14,313)=2.97$, $p<.01$. The same was true when social activity was included in the variables' list, $F(14,313)=2.77$, $p<.01$.

The second set of MANOVAs carried out included only the variables which significantly differentiated between survivors and nonsurvivors. These variables were happiness, subjective age, perceived adequacy of health and financial situation, social support, intellectual activity, and cognitive functioning. The combination of these variables produced a significant difference between survivors and nonsurvivors $F(7,320)=4.13$, $p<.01$. In addition, when a second set of variables was used, that is, happiness ratings, subjective age, perceived adequacy of health and financial situation, social activity, social support, and cognitive functioning the combination of these variables yielded a significant difference between the two groups, $F(7,320)=3.65$, $p<.01$.

In order to determine the effect of each dependent variable on longevity, univariate analysis of variance was used as a post-MANOVA technique. An analysis of variance on subjects' ages revealed significant differences with survivors being significantly younger than nonsurvivors, $F(1,326)=7.72$, $p<.01$. There were no significant sex differences between the two groups, $\chi^2(1, N=327)=1.27$, $p>.25$. Moreover, no differences were found in terms of marital status between survivors and nonsurvivors, $\chi^2(1, N=323)=7.65$, $p>.17$. Finally, no significant differences were obtained between the two groups in terms of educational level, $F(1,322)=.006$, $p>.94$. The analysis of variance summary table for age and school can be found in Appendix A.

As predicted in Hypothesis 1, survivors reported being less

depressed with their lives than nonsurvivors, $F(1,324)=14.46$, $p<.01$. In addition, survivors had younger subjective ages, $F(1,316)=5.15$, $p<.02$, were more satisfied with their financial situation, $F(1,326)=4.05$, $p<.04$, and their health, $F(1,326)=9.77$, $p<.01$, than nonsurvivors. These results indicate the important contribution of life satisfaction in longevity. That is, elderly individuals who report greater life satisfaction, as well as have younger subjective ages, and perceive their health and financial situation as more adequate, live longer than individuals who report being less satisfied with their lives, have older subjective ages, and are less satisfied with their health and financial situation. These ANOVAs are summarized in Appendix B.

Also, as predicted in Hypothesis 2, there was a significant difference between survivors and nonsurvivors in terms of social activity and social support provided. Survivors participated in significantly more social activities than nonsurvivors $F(1,320)=6.02$, $p<.01$, and survivors had significantly more contact with family members than nonsurvivors $F(1,326)=5.14$, $p<.02$. These findings provide evidence for an association between social activity and social support and longevity whereby elderly individuals who are more socially active and have a more extensive family support system live longer lives than elderly individuals who are isolated from their families and have little or no social activities. The analysis of variance summary table for these effects may be found in Appendix C.

Contrary to Hypothesis 3, none of the personality measures significantly differentiated between survivors and nonsurvivors. ANOVAs on subjects' extraversion scores, neuroticism scores, and desire and belief in personal locus of control measures revealed no

significant differences between the two groups. There was then no apparent contribution of personality measures in differentiating survivors from nonsurvivors. The summary table for these Anovas are presented in Appendix D.

Furthermore, contrary to Hypothesis 4, there was no significant difference between survivors and nonsurvivors in terms of stressful life events, $F(1,324)=1.75, p>.18$. These findings fail to support the hypothesis that individuals who experience stressful lives have greater mortality rates than individuals who experience low levels of life stress. The ANOVA summary table for this effect can be found in Appendix E. In order to test the second part of this hypothesis, variables (i.e., stress, social support, social activity, belief in control and desire in control) were divided into two categories: high and low. That is, subjects who scored above the mean on these variables, respective of their own group (i.e., survivors, nonsurvivors), were tested against subjects who scored below the mean. These variables were then included in several MANOVAs in order to determine if there were significant differences between survivors and nonsurvivors on these variables when the level of life stress is high. Results of these analyses are summarized in Appendix F (see Tables F-1 to F-4).

As predicted, elderly individuals who experienced high levels of stress but were involved in social activities and had an extensive support network lived longer than individuals who had high levels of stress but had low levels of social activity and few contacts with family members. Similar results were found for locus of control. That is, elderly individuals who experienced high levels of stress but

had desire and belief in personal control lived longer than elderly individuals who experienced high levels of stress but scored low on desire and belief in control measures.

These findings provide evidence for the effect of buffer variables in the stress-disease relationship. That is, individuals who experience high levels of stress but are involved in socially demanding activities, have an extended support network and an internal locus of control have greater longevity than elderly individuals who experience high levels of stress but are isolated from family members and others as well as having an external locus of control.

Finally, as predicted by Hypothesis 5, there were significant differences between survivors and nonsurvivors in terms of cognitive functioning. Survivors were involved in significantly more intellectual activities than nonsurvivors, $F(1,324)=16.02, p<.01$. Moreover, survivors scored higher than nonsurvivors on cognitive functioning measures, $F(1,326)=6.17, p<.01$. These findings support the hypothesis that elderly individuals who remain intellectually active and scored high on cognitive measures lived longer than individuals who scored low on such measures. These ANOVAs are summarized in Appendix G.

In conclusion, findings from these analyses revealed that survivors were significantly more likely to be younger, less depressed, to have younger subjective age, and to be more satisfied with their health and financial situation. In addition survivors were engaged in significantly more intellectually and socially demanding activities, had more social support, and scored higher on cognitive functioning measures. Moreover, such demographic variables as sex, marital status and educational level did not differentiate

significantly between the two groups. Finally, there were no significant differences between survivors and nonsurvivors on the personality measures, and on stressful life events scales.

In order to investigate the significant individual contribution of the variables, Roy-Bargman stepdown analysis was performed on the basis of an a priori ordering of the importance of the variables. Gabriel (1979) and Tabachnick and Fidell (1983) suggest that the variables of greatest interest be placed higher up in the hierarchy. Thus, each variable was analyzed in turn, with higher-priority variables treated as covariates and with the highest-priority variable tested in an analysis of variance. The first analysis consisted of intellectual activity, happiness ratings, satisfaction with health, cognitive functioning, social support, subjective age and perceived adequacy of financial situation in that specific order. Results of this analysis are summarized in Table 3. In addition, pooled within-cell correlations among variables are presented in Table 4.

The combination of these variables produced a significant difference between survivors and nonsurvivors, $F(7,320)=4.12$, $p<.01$. A unique contribution to predicting differences between survivors and nonsurvivors was made by intellectual activity, stepdown $F(1,326)=20.44$, $p<.01$. After the pattern of differences measured by this variable was entered, a significant contribution was also made by happiness, stepdown $F(1,325)=3.76$, $p<.05$. However, none of the remaining variables, that is, perceived satisfaction with health and financial situation, cognitive functioning, social support and subjective age made significant contributions to the composite DV that best distinguished survivors

Table 3Stepdown analysis of seven ordered DVs

<u>Variable</u>	<u>Stepdown F</u>	<u>Hypoth. DF</u>	<u>Error DF</u>	<u>Sig. of F</u>
Intellectual activity	20.44	1	326	<.01
Happiness	3.76	1	325	.05
Satisfaction with health	2.17	1	324	.14
Cognitive functioning	.85	1	323	.35
Social support	1.35	1	322	.24
Subjective age	.13	1	321	.72
Satisfaction with finances	.05	1	320	.81

Table 4

Pooled within-cell correlations among seven variables(standard deviations on diagonal)

	IA	H	SH	CF	SS	SA	SF
Intellectual activity (IA)	(48.31)						
Happiness (H)	.32	(5.39)					
Satisfaction with health (SH)	.27	.32	(1.65)				
Cognitive functioning (CF)	.33	.13	.10	(8.94)			
Social support (SS)	.17	.08	.07	.26	(95.51)		
Subjective age (SA)	.32	.40	.33	.17	-.02	(8.37)	
Satisfaction with finances (SF)	.23	.18	.29	.16	.15	.19	(1.17)

from nonsurvivors.

The second stepdown analysis consisted of seven variables, social activity, happiness ratings, satisfaction with health, cognitive functioning, social support, subjective age and perceived adequacy of financial situation in that specific order. Results of this analysis are summarized in Table 5. Also, pooled within-cell correlations among DVs are presented in Table 6.

The combination of these variables produced a significant difference between survivors and nonsurvivors, $F(7,320)=3.65, p<.01$. A unique contribution to predicting differences between the two groups was made by social activity, stepdown $F(1,326)=14.37, p<.01$. A significant contribution was also made by happiness, stepdown $F(1,325)=5.47, p<.02$. Finally, a trend was also found for satisfaction with health, stepdown $F(1,324)=2.76, p>.09$. However, none of the remaining variables were significant.

In general, several psychological functioning variables are involved in distinguishing survivors from nonsurvivors. Results from the stepdown analyses revealed that the most significant contribution to group discrimination was obtained by intellectual activity, social activity and happiness. In addition, the importance of satisfaction with health in group differentiation was partly supported by these results. Finally, variables that were not significantly related to longevity were subjective age, perceived satisfaction with financial situation, social support and cognitive functioning. These results indicate that elderly individuals who are involved in socially and intellectually demanding activities and are satisfied with their lives live longer than elderly individuals who seldom participate in social

Table 5

Stepdown analysis of seven ordered DVs

<u>Variable</u>	<u>Stepdown F</u>	<u>Hypoth. DF</u>	<u>Error DF</u>	<u>Sig. of F</u>
Social activity	14.37	1	326	<.01
Happiness	5.47	1	325	.02
Satisfaction with health	2.76	1	324	.09
Cognitive functioning	1.07	1	323	.30
Social support	1.54	1	322	.21
Subjective age	.04	1	321	.84
Satisfaction with finances	.07	1	320	.78

Table 6

Pooled within-cell correlations among seven variables
(standard deviations on diagonal)

	Sa	H	SH	CF	SS	SA	SF
Social activity (Sa)	(41.86)						
Happiness (H)	.27	(5.39)					
Satisfaction with health (SH)	.24	.31	(1.64)				
Cognitive functioning (CF)	.37	.13	.10	(8.93)			
Social support (SS)	.17	.08	.07	.26	(95.50)		
Subjective age (SA)	.28	.40	.33	.17	-.02	(8.37)	
Satisfaction with finances (SF)	.23	.18	.29	.16	.14	.19	(1.17)

or intellectual activities and who report being dissatisfied with their lives. In addition, elderly individuals who were satisfied with their health status had a tendency to live longer than individuals who report their health status as inadequate. Finally, neither perceived adequacy of financial situation, subjective age, social support nor cognitive functioning contributed significantly in differentiating survivors from nonsurvivors.

Classification Results

Discriminant function analysis (DFA) was used to determine whether survivors and nonsurvivors could be classified correctly on the basis of psychological functioning variables. Since there were two groups, only one function was generated. Wilks' Lambda was used as a significance test because it is the most robust. Again, as for the MANOVAs two sets of DFAs were performed on the data, one including intellectual activity and the other including social activity.

A direct entry DFA was first performed to assess prediction of membership in the two survival status groups for all the variables. Variables were age, school, happiness ratings, subjective age, perceived adequacy of health and financial situation, social support, extraversion, neuroticism, belief and desire in control, stress, intellectual activity and cognitive functioning.

The F values for these variables along with their significance levels (using Wilks' Lambda) are presented in Table 7. Sample sizes were used to estimate prior probabilities of group membership. Survivors had a prior probability of 93% whereas nonsurvivors had a probability of 7%. On the basis of the psychological functioning

Table 7
Univariate F ratio and Wilks Lambda
with 1 and 249 degrees of freedom

<u>Variable</u>	<u>Wilks lambda</u>	<u>F</u>	<u>Significance</u>
Age	.97	8.22	<.01
School	.99	.92	.33
Happiness	.95	13.45	<.01
Subjective age	.94	15.99	<.01
Satisfaction with health	.98	6.18	<.01
Satisfaction with finances	.99	2.06	.15
Social support	.98	4.41	<.04
Extraversion	.99	.17	.68
Neuroticism	.99	.60	.44
Desire in control	.99	2.89	.09
Belief in control	.99	.35	.55
Stress	.99	1.16	.68
Intellectual activity	.96	9.48	<.01
Cognitive functioning	.98	4.82	<.02

variables; 97% of survivors were correctly classified, 32.1% correct classification resulted for the nonsurvivors, and 91.44% of total cases were correctly classified. The classification procedure was significantly more accurate than that produced by relying upon prior probabilities.

In addition, when social activity was included in the variable list instead of intellectual activity, classification results from the discriminant procedure revealed that 97.7% of the survivors were correctly classified, 28.6% correct classification resulted for the nonsurvivors, and 91.74% of total cases were correctly classified. Again, the classification procedure was significantly more accurate than that produced by prior probabilities. Table 8 presents the F values and significance levels for each variable.

In general then, the combination of these variables allows for good classification results for survivors and poor classification results for nonsurvivors. The results of the DFA derived from Tables 7 and 8 indicate that seven variables contribute significantly to the differentiation of the two groups. These variables were age, happiness ratings, subjective age, perceived adequacy of health, social activity, social support, intellectual activity, and cognitive functioning. These variables were found to be the most important predictors of longevity, that is, this combination of variables was believed to be most important in differentiating between survivors and nonsurvivors. This set of variables was entered in a stepwise discriminant function analysis in order to determine whether this reduced set of variables could allow for more discrimination power between the two groups.

Results showed that (when intellectual activity was included in

Table 8

Univariate F ratio and Wilks Lambda
with 1 and 249 degrees of freedom

<u>Variable</u>	<u>Wilks lambda</u>	<u>F</u>	<u>Significance</u>
Age	.97	8.22	<.01
School	.99	.92	.33
Happiness	.95	13.45	<.01
Subjective age	.94	15.99	<.01
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Satisfaction with finances	.99	2.06	.15
Social activity	.98	4.40	<.03
Social support	.98	4.41	<.04
Extraversion	.99	.17	.68
Neuroticism	.99	.60	.44
Desire in control	.99	2.89	.09
Belief in control	.99	.35	.55
Stress	.99	1.16	.68
Cognitive functioning	.98	4.82	<.02

the variable list) subjective age entered at step 1, $F(1,254)=16.53$, $p<.01$. Social support entered at step 2, $F(2,253)=10.79$, $p<.01$. On step 3, age was included in the equation, $F(3,252)=8.10$, $p<.01$. Happiness entered at step 4, $F(4,251)=6.74$, $p<.01$. Finally, intellectual activity entered at step 5, $F(5,250)=5.64$, $p<.01$. None of the other variables reached the significance level required to enter the equation, that is, health satisfaction and cognitive functioning failed to be significant in discriminating between survivors and nonsurvivors. McNemar's χ^2 test for change in proportion of correct classification, revealed statistical significance with the variables entered in the equation, $\chi^2(5)=26.87$, $p<.01$. With the five variables that entered the equation, the classification procedure resulted in 96.7% of survivors being correctly classified, 21.4% of nonsurvivors being correctly classified and 90.21% of the total cases being correctly classified. There was a small decrease in classification accuracy, which resulted from the reduced set of variables.

A similar pattern occurred when social activity was included in the analysis. Subjective age entered at step 1, $F(1,254)=16.52$, $p<.01$. On step 2 social support was included in the equation, $F(2,253)=10.79$, $p<.01$. Age entered on step 3, $F(3,252)=8.10$, $p<.01$. Happiness entered the equation on step 4, $F(4,251)=6.37$, $p<.01$. None of the other variables reached the significance level required to enter the equation. That is, social activity, health satisfaction and cognitive measures were all dropped from further computation. McNemar's χ^2 test for these variables was statistically significant, $\chi^2(4)=25.70$, $p<.01$. Classification results from the

four variables that entered the equation resulted in 97.7% of survivors being correctly classified, 17.9% of nonsurvivors being correctly classified, and 90.83% of the total cases being correctly classified. Again, the reduced set of variables lead to lower accuracy in the classification procedure for the nonsurvivors.

To summarize, the variables that significantly discriminated between the two groups were age, subjective age, social support, intellectual activity, self-rated happiness. However, when only the most significant predictors were included in the stepwise procedure, classification results decreased greatly.

As predicted in Hypothesis 1, elderly individuals who report greater life satisfaction have greater longevity than elderly individuals who are dissatisfied with their lives. Subjective age was also a good predictor of longevity. However, contrary to Hypothesis 1, perceived adequacy of health and financial situation did not contribute significantly in discriminating between the two groups.

As predicted by the second hypothesis, social support contributed significantly in differentiating survivors from nonsurvivors. However, contrary to this hypothesis social activity did not significantly differentiate between the two groups. Elderly individuals who have an extended support network live longer lives than elderly individuals who are isolated and have few contacts with family members.

Contrary to Hypothesis 3, none of the personality variables contributed significantly to discrimination among the groups. Also, contrary to Hypothesis 4, survivors could not be differentiated from nonsurvivors on the basis of stressful life events experienced within the past year.

Finally, as predicted by Hypothesis 5, intellectual activity significantly discriminated survivors from nonsurvivors, whereby survivors were significantly more involved in intellectually demanding activities than nonsurvivors. However, part of this hypothesis was not supported since cognitive measures did not significantly differentiate survivors from nonsurvivors.

Discussion

The purpose of this study was to investigate the relationship between several factors related to psychological functioning and longevity. To this end, a sample of elderly individuals who had been given a battery of psychological tests two years previously was recontacted so that survivors and nonsurvivors could be identified. Psychological functioning had been assessed by: Life satisfaction (including self-rated happiness, subjective age scores and self-perceived adequacy of health and financial situation), social support and social activity measures, a personality inventory, a stress questionnaire, and intellectual activity and cognitive functioning measures.

In general, results of the present study suggest that some aspects of psychological functioning are predictive of survival status. Measures that were significantly related to survival included life satisfaction, social activity, social support and better cognitive functioning. However, neither personality nor stress measures significantly differentiated between survivors and nonsurvivors. As predicted, high levels of life satisfaction, younger subjective age and self-perceived adequacy of health and financial situation all seem to be associated with greater survival in noninstitutionalized elderly individuals. These findings were consistent with earlier investigations which focussed on the relationship between life satisfaction and longevity (e.g., Palmore, 1982; Pfeiffer, 1970; Rose, 1964). These researchers have demonstrated that among elderly individuals, high levels of life satisfaction were positively associated with survival. Similarly,

Harel, Sollod and Bognar (1982) concluded that a major contributing factor to a successful pattern of aging included good physical and mental health along with high levels of life satisfaction.

The fact that a strong relation between high levels of life satisfaction and longevity was found, was also consistent with previous research focussing on the cultural factors involved in survival. Several investigators have found that the most significant factors associated with longevity in the Palauans islands, Turkey and Russia, consisted of the maintenance of meaningful roles in the family and the respect older citizens received from the family and society in general (e.g., Beller & Palmore, 1974; Jensen & Polloi, 1984; Medvedev, 1974). Consequently, research findings from these cultures all support the theory that life satisfaction and a positive view of life are important determinants of longevity. Similarly, findings from studies of institutionalized elderly individuals supported the fact that the maintenance of meaningful goals throughout old age and high life satisfaction were related to increased chances of survival in this population (Muller, Grad & Engelsman, 1975).

Also consistent with previous research was the finding that elderly individuals who report having younger subjective ages were more likely to be among the survivors than elderly individuals who reported older subjective ages. This finding probably reflected better physiological and health functioning of survivors. Markides and Boldt (1983) and Bultena and Powers (1978) have documented the fact that elderly individuals who report feeling younger than their stated age also report higher levels of morale and life satisfaction. This, in turn, also leads to increased survival. The present study's findings support the hypothesis that elderly individuals who report

younger subjective age experience higher levels of life satisfaction and greater longevity.

In addition, two other correlates of life satisfaction, self-perceived adequacy of health and financial situation, were found to be significantly related to survival. Elderly individuals who were satisfied with both their health and financial situation lived longer than individuals who rated their health and financial situation as inadequate. These findings are consistent with research studies which related these two correlates of life satisfaction to longevity (Edwards & Klemmack, 1973; Harel et al., 1982; Palmore & Luikart, 1972; Spreitzer & Snyder, 1974). Consequently, it could be argued that one reason why satisfaction with financial situation is important, especially for older men, is its relation to the elderly individual's perception of control over their lives. An elderly individual may perceive a loss of independence if he/she has to consistently rely on others (usually family members) to ensure the adequacy of their financial situation. The same can be suggested for health satisfaction. Since most elderly individuals are faced with increased health problems, perceived health satisfaction may be an important factor involved in longevity. Individuals who report fewer functional limitations and fewer physical disabilities are more satisfied with their lives and have greater longevity than individuals who report constant health dissatisfactions.

In sum, results of the present study support the hypothesis that elderly individuals who report being satisfied with their lives, have younger subjective ages, and are satisfied with their financial and health status have greater longevity than elderly individuals who

report lower levels of satisfaction in these areas.

Also, as predicted, the present results provide evidence for a relationship between social support received from friends and relatives and longevity. The social activity scale was intended to measure the levels of social activity that the elderly individual engaged in regularly. Consistent with earlier findings (e.g., Arling, 1976; Blau, 1981) the present study indicates that support derived from friendships is important to the well-being of the older individual because of the affectivity and companionship derived from these relations. Also, since friends are contemporaries facing similar problems, these relationships may provide a level of communication, intimacy and understanding which is sometimes not found through family ties. Support received from friends may help the elderly feel respected, by helping them sustain a sense of usefulness and increased self-esteem. Consequently, the presence of social ties may improve the well-being of the elderly person by decreasing the levels of life stressors experienced in daily living, which in turn leads to greater longevity.

Similarly, social support derived from family ties was found to be related to longevity. This finding is consistent with earlier studies (e.g., Cantor, 1975; Lopata, 1979) which found social support received from children and other relatives to be important for the elderly individual. Berkman and Syme (1979) suggest that people with the greatest levels of contact with relatives and children have lower mortality rates than people without such contacts. It is possible that this increased survival is related to the important roles the elderly individual perceive family members as playing in their lives. That is, because family ties involve long term commitments, the


presence of children or other relatives in their lives, may prevent the elderly person from feeling lonely or neglected. In addition, the elderly individual may feel satisfied with these ties because of both the increased well-being experienced from playing meaningful roles in the family and the respect received from the younger generation. The results of the present study are also consistent with earlier findings on the cultural factors involved in longevity. Several investigators (e.g., Beller & Palmore, 1974; Jensen & Polloi, 1984) have shown that the meaningful roles elderly people play in the family and the respect and honor received from family members are related to longevity in elderly individuals residing in the Palauans islands and Turkey. Consequently, support received from family members, especially children, is seen as positive by the elderly and may lead to reduced morbidity by promoting self-esteem and by minimizing major life stressors.

Furthermore, the results of the present study provide partial support for Coe et al's (1984) contention that either type of relationship, that is, interaction with the family network or the friendship network, can function to provide support for elderly individuals. Only when individuals are abandoned by both networks does such loss of support consistently lead to poorer health status. Clearly, future research is needed to substantiate this hypothesis more fully. It appears, however, that an extended family and/or friendship network may function to promote survival by reducing the elderly individuals' appraisal of stressful or negative life events experienced or by reducing the total number of stressful events experienced.

None of the personality measures were significantly related to survival. In other words, survivors did not differ significantly from nonsurvivors on measures of extraversion, neuroticism and desire and belief in personal control. These findings were inconsistent with the Bonn Longitudinal Study of Aging (BLSA) on personality measures and longevity (e.g., Lehr & Schmitz-Scherzer, 1976). These researchers found that more stable personality traits were associated with greater occupational training and status. These greater occupational qualifications in turn lead to increased survival via improved benefits from better socioeconomic status.

However, it is worth mentioning that the BLSA was the only one to draw a clear link between personality variables and longevity. Other research reports were essentially speculative, with suggestions being made that, because extraverts have access to an extended support network, they would experience an increase in life satisfaction, which in turn could lead to greater longevity. Similarly, based on studies of the institutionalized elderly, it was suggested that individuals who have an internal locus of control are better adjusted and have greater longevity than those who have an external locus of control. Since elderly individuals residing in institutions experience substantial loss of control, it was concluded that this loss of control in their lives may in part explain their higher mortality rates compared to noninstitutionalized elderly individuals.

Similar arguments were made in the case of neuroticism. It was assumed that individuals who score high on neuroticism experience more maladjustment and lower levels of life satisfaction than individuals who score low on such a trait. Because adjustment is believed to be an important factor in survival among institutionalized elderly



patients, researchers have hypothesized that greater levels of maladjustment could lead to higher mortality rates in the institutionalized elderly population (Eysenck, 1979; Goldfarb et al., 1966).

There are a number of reasons that would account for the discrepancy between the results of this study and the BLSA study with regards to personality variables. It is possible that the absence of significant results on personality variables in this study was caused by the small sample size in the nonsurvivors group ($n=28$). A more powerful test of relation of personality factors to longevity could have been made had the nonsurvivors group been larger.

There is also the possibility that researchers who have noted personality differences between survivors and nonsurvivors were dealing with more disturbed individuals than those of the present study. That is, because elderly individuals residing in institutions are psychologically more disturbed than noninstitutionalized elderly individuals (Grauer et al., 1981), and because the present study involved community dwellers, it is possible that the relatively low degree of maladjustment in this sample did not provide a sufficient range of values to allow the demonstration of significant differences between the two groups.

Furthermore, open-ended interviews might have been useful in rating the degree of maladjustment of the subjects. This kind of interview has been used by several researchers in institutionalized settings (e.g., Goldfarb et al., 1966; Grauer et al., 1981; Muller et al., 1975), and findings consistently showed the importance of open-ended interviews in determining the survival chances of an individual.

Clearly, future research on how personality traits relate to survival is necessary to substantiate this explanation.

More perplexing was the absence of significant differences between survivors and nonsurvivors on the stress measure. Such a finding was not predicted by the Life Events research. This approach emphasizes the additive impact of stressful events where the greater the number of events, the greater the deleterious effects on survival (Perkins, 1982; Rahe, 1972, 1974). Since there is considerable evidence in the stress literature which indicates that high levels of stress increases the risk of mortality, the absence of such a finding in the present study makes such a result hard to interpret. The absence of significant differences between survivors and nonsurvivors on the stress measure may have been caused by the choice of the stress measure in this study. That is, the only stress measure used was a shortened version of Holmes and Rahe's (1967) Social Readjustment Scale. It is possible that there were too few items (19 questions) on the scale to allow a powerful test of differences between the two groups on this variable. In addition, although several studies have demonstrated a relationship between life events and disease, in a vast majority of cases the magnitude of this relationship was very low. That is, many individuals who experience substantial life changes do not become ill, and many persons who experience only a moderate amount of life changes become ill. Therefore, an alternative to the life events approach may be more adequate when dealing with an elderly population. That is, it might be worthwhile to consider stress to be a characteristic of the ongoing transaction between individuals and their daily environment. Stress is then defined as occurring specifically when the environmental circumstances exceed the

individual's capabilities to cope. Stress defined in this way may show a greater impact on adaptational outcomes such as health and psychological well-being than do life events (Lazarus, 1966; Monroe, 1983; Schroeder & Costa, 1984; Zimmerman, 1983). It might be worthwhile for future research to use this scale in combination with a self-report checklist measuring physical symptoms and diseases (Kobasa, 1979). These ratings on symptomatology and degree of disability may be linked to stressful events for the elderly individual, and may prove a useful measure in distinguishing between the two groups.

Even though there were no significant differences between survivors and nonsurvivors on the level of stress experienced within the past year, there was evidence that buffer variables may reduce the negative consequences of stress and help the individual to cope better with stressful life events. Consistent with earlier findings (e.g., Johnson & Sarason, 1978; Ziegler and Reid, 1979) the present results indicate that elderly individuals who experienced high levels of stress but had an internal locus of control lived longer than elderly individuals who experienced stressful events but had an external locus of control. These findings substantiate McFarlane et al's findings (1980) where elderly individuals who perceive themselves as being in control of their lives become less depressed and are less likely to develop illness symptoms when faced with stressful situations.

Another buffer variable which has been identified as protective against stressful life changes is the ability to establish a social support network. Consistent with Cobb (1976) and McFarlane et al's (1980) findings, the present results indicated that elderly individuals

who were involved in several social activities and had an extensive family support network lived longer than individuals who were more isolated from family and friends. Therefore, closeness experienced with family and friends may serve to promote feelings of security, and may subsequently reduce the impact of stressful events.

The absence of a relationship between stressful life events and mortality clearly contradicts previous research findings. There is, however, evidence for the influence of buffer variables in reducing the effect of stressful events in elderly individuals. However, future research should focus on developing new means to measure stressful events that would be specifically aimed at an elderly population.

As predicted, significant differences on cognitive functioning variables were found between survivors and nonsurvivors. That is, elderly individuals who remained involved in intellectually demanding activities and who scored higher on cognitive measures lived longer than individuals who scored lower on such measures. The results of the present study are consistent with earlier findings on cognitive functioning and longevity (e.g., Berg, 1980; Palmore, 1982; Lehr & Schmitz-Scherzer, 1976). These researchers consistently found higher intelligence test scores to be positively related to longevity. Similarly, Siegler (1980) demonstrated that the absence of cardiovascular disease and high intellectual skills, in the normal elderly individual, were significantly related to survival. It may be possible then, as Palmore (1982) suggests, that greater involvement in intellectually demanding activities and high scores on cognitive functioning measures are related positively to longevity through the greater problem-solving strategies and increased coping abilities the elderly individual possesses when dealing with everyday situations.

The results of the present study are also consistent with previous findings derived from studies of elderly individuals residing in institutions (e.g., Epstein & Simon, 1969; Grauer, Mueller & Zelnicker, 1981). That is, these researchers suggested that better cognitive functioning was positively related to outcome, with elderly patients who scored high on the WAIS having higher chances of survival.

The present study clearly related some aspects of psychological functioning in the elderly individual to longevity. However, there are some difficulties with this study which require discussion. First, the fact that the sample size in the nonsurvivors group was small may have created difficulty in obtaining significant results in this study for variables that had a moderate effect size. It is possible that the differences between survivors and nonsurvivors on some measures could have been significant had the sample size of the nonsurvivors group been larger.

It is also apparent that most studies on longevity have longer follow-up periods than the present study (three years). It has been demonstrated that equal sample size lead to greater accuracy of research findings (Tabachnick & Fidell, 1983). Consequently, in these studies, more of the subjects of the original sample would have died, leading to relatively equal sample size in the survivors-nonsurvivors groups. This, in turn, could have lead to more significant research findings in these studies.

The attrition rate was a further problem of this study. Some subjects could not be contacted and no data was available about their present status. Since no data were available regarding survivor status, all subjects who could not be contacted were eliminated from

the data analysis. It is possible that some of these subjects died after the original interview. Had this been the case, it would have lead to a greater sample size in the nonsurvivors group. This, in turn, could have allowed for a more accurate determination of group differences.

In addition, knowing the cause of death of the nonsurvivors would have been useful. Because this study attempted to relate psychological functioning variables to survival the possibility remains that the nonsurvivors died of causes unrelated to psychological functioning (e.g., car accident). Consequently, these subjects may have had characteristics similar to the survivors but were in the nonsurvivors' group. It would have been worthwhile, had the nonsurvivors' group been larger, to differentiate between nonsurvivors who died from such causes as accidents from the ones who died from other causes (e.g., stroke, Alzheimer's disease).

There was also a high degree of interdependence between two measures used in this study. The social activity scale and intellectual activity scale are highly correlated. While statistical authorities suggest that different sets of analyses be performed for each scale, totally independent measures would have been preferable (Tabachnick & Fidell, 1983). However, a major problem with creating totally independent scales for these two measures is the fact that they are intrinsically related to a large extent and therefore can not be completely separated. Future research should devise new ways of evaluating these two activities where some items would load highly on both activities (e.g., playing bridge) and other items would be totally characteristic of either social activity (e.g., dancing) or intellectual activity (e.g., reading, meditation).

The results of the present study have general implications for understanding the influence of psychological functioning on survival. For instance, it appears that life satisfaction, subjective age, and self-perceived adequacy of health and financial situation are variables closely tied to survival. It is possible that elderly individuals who have high levels of life satisfaction live longer because of the maintenance of meaningful goals, higher morale, and lower incidence of depression these elderly individuals experience. It is also possible that the presence of an extended support network, that is, either support provided from family members or friends, increases longevity mainly through the assistance provided to the elderly individual when dealing with crisis events. Finally, the importance of more adequate intellectual skills and cognitive functioning in survivors, probably reflected the absence of both, severe generalized disease (e.g., Alzheimer's disease) and vascular disease. Intellectual skills may be related to longevity through the greater problem-solving abilities the elderly individual possesses in dealing with everyday events.

A surprising finding was that none of the personality variables were related to longevity. This finding was inconsistent with previous research findings. Because there seems to be a possible link between loss of personal control, greater maladjustment and mortality in institutionalized elderly individuals, future attempts should be made to develop new means of assessing this relationship.

Similarly, contrary to expectations, a clear relationship could not be demonstrated between high levels of stress and mortality. This finding was inconsistent with earlier studies of longevity, indicating

that high levels of stress had deleterious consequences on health and survival. Once more, future research should attempt to design scales intended to assess stressful life events in an elderly population. This is especially important, since some researchers have demonstrated that institutionalization has negative consequences for the elderly individuals in as much as it increases the number of stressful events experienced. There is however the possibility that the noninstitutionalized elderly and the institutionalized elderly are two distinct populations with regards to stress levels experienced. Therefore, generalizations should not be made from a high stress institutionalized sample to a low stress community-based one.

Finally, although age was a significant factor in differentiating survivors from nonsurvivors, it is important to note that whenever age was not included in the statistical analyses differences between the two groups were still present. In addition, even when age was included in a stepwise discriminant function analysis, it entered the equation third, and variables such as subjective age and social support were more important in terms of differentiating between the two groups. Consequently, it is clear that several factors beyond age, sex, race, and physical condition, are important in determining an individual's chances of survival.

The determination of psychological variables that are related to longevity is a research endeavor that has revealed important relationships. Since the elderly population is increasing substantially, future research on the determination of factors that lead to longevity is warranted.

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Appendix A
ANOVA Summary Table for
Age and School

Appendix AANOVA Summary Table forAge and SchoolAge:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>P</u>
Age	260.93	260.93	7.72	1	<.01
Error	10985.25	33.80		325	
Total	11246.18				

School:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>P</u>
School	.15	.15	.006	1	.94
Error	7528.68	23.45		321	
Total	7955.56				

Appendix B

ANOVA Summary Table for Happiness, Subjective Age,
Satisfaction with Health and Satisfaction with Finances

Appendix BANOVA Summary Table for Happiness, Subjective Age,
Health Satisfaction and Financial SatisfactionHappiness:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
Happiness	357.29	357.29	14.46	1	<.01
Error	7977.93	24.69		323	
Total	8335.23				

Subjective Age:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
Subjective age	151.16	151.16	5.15	1	.02
Error	9248.84	29.36		315	
Total	9400.00				

Satisfaction with Health:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
Satisfaction with health	26.52	26.52	9.77	1	<.01
Error	882.10	2.71		325	
Total	908.63				

Satisfaction with Finances:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
Satisfaction with finances	5.53	5.53	4.05	1	.04
Error	443.88	1.36		325	
Total	449.41				

Appendix C

ANOVA Summary Table for Social

Activity and Social Support

Appendix CANOVA Summary Table for SocialActivity and Social SupportSocial Activity:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
Social activity	8032.71	8032.71	6.02	1	<.01
Error	425965.92	1335.32		319	
Total	433998.62				

Social Support:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
Social support	46867.05	46867.05	5.14	1	.02
Error	2973634.20	9121.58		325	
Total	3020501.26				

Appendix D

ANOVA Summary Table for Extraversion, Neuroticism and,
Desire in Control and Belief in Control

Appendix DANOVA Summary Table for Extraversion, Neuroticism and,Desire in Control and Belief in ControlExtraversion:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>P</u>
Extraversion	.89	.89	.08	1	.77
Error	3558.55	10.94		325	
Total	3559.45				

Neuroticism:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>P</u>
Neuroticism	4.25	4.25	.26	1	.61
Error	4604.84	16.45		280	
Total	4609.08				

Desire in Control:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>P</u>
Desire in control	45.76	45.76	.64	1	.42
Error	23473.99	72.00		325	
Total	10439.21				

Belief in Control:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>P</u>
Belief in control	4.31	4.31	.07	1	.78
Error	18866.07	57.87		322	
Total	8244.87				

Appendix E

ANOVA Summary Table for Stress

Appendix EANOVA Summary Table for Stress

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>P</u>
Stress	3.08	3.08	1.75	1	.18
Error	569.31	1.76		323	
Total	572.39				

Appendix F

MANOVA Summary Table for Stress, Social Support,
Social Activity, and Desire and Belief in Personal Control

Table F-1

MANOVA Summary Table for Stress, and High (SS)
and low (ss) Levels of Social Support

High (SS) and Low (ss) levels of Social Support

<u>Effect</u>	<u>Value</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
<u>SS:</u>						
All	.045	---	---	3.28	2,139	.04
SS	---	27926.87	27926.87	5.72	1,140	<.01
Stress	---	1.85	1.85	1.20	1,140	.27
Error:						
All	.929	---	---	--	--	--
SS	---	7419167.35	741967.35	--	--	--
Stress	---	366.08	366.08	--	--	--
<u>ss:</u>						
All	.032	---	---	2.96	2,180	.05
ss	---	8341.90	8341.90	5.16	1,181	.02
Stress	---	1.22	1.22	.63	1,181	.42
Error:						
All	.823	---	---	--	--	--
ss	---	922503.00	922503.00	--	--	--
Stress	---	591.48	591.48	--	--	--

Table F-2

MANOVA Summary Table for Stress, High (SA)
and low (sa) levels of Social Activity

High (SA) and Low (sa) levels of Social Activity

<u>Effect</u>	<u>Value</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
SA:						
All	.097	---	---	9.33	2,173	<.01
SA	---	6581.31	6581.31	17.82	1,174	<.01
Stress	---	1.43	1.43	.82	1,174	.36
Error:						
All	.995	---	---	---	---	---
SA	---	12914361.11	12914361.11	---	---	---
Stress	---	487.77	487.77	---	---	---
sa:						
All	.172	---	---	14.90	2,143	<.01
sa	---	23978.16	23978.16	29.64	1,144	<.01
Stress	---	2.04	2.04	1.13	1,144	.28
Error:						
All	.986	---	---	---	---	---
sa	---	6632933.85	6632933.85	---	---	---
Stress	---	452.39	452.39	---	---	---

Table F-3

MANOVA Summary Table for Stress, and High (DC)
and low (dc) levels of Desire in Personal Control

High (DC) and Low (dc) levels of Desire in personal Control

<u>Effect</u>	<u>Value</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
DC:						
All	.066	---	---	5.41	2,152	<.01
DC	---	55.39	55.39	5.92	1,153	<.01
Stress	---	9.29	9.29	5.55	1,153	<.01
Error:						
All	.998	---	---	---	---	---
DC	---	777525.70	777525.70	---	---	---
Stress	---	422.81	422.81	---	---	---
dc:						
All	.044	---	---	3.84	2,164	.02
dc	---	97.48	97.48	7.46	1,165	<.01
Stress	---	.37	.37	.20	1,165	.65
Error:						
All	.996	---	---	---	---	---
dc	---	635886.37	635886.37	---	---	---
Stress	---	304.42	304.42	---	---	---

Table F-4

MANOVA Summary Table for Stress, and High (BC)
and low (bc) levels of Belief in Personal Control

High (BC) and Low (bc) levels of Belief in personal Control

<u>Effect</u>	<u>Value</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>p</u>
BC:						
All	.027	---	---	2.40	2,167	.09
BC	---	29.78	29.78	2.81	1,168	.09
Stress	---	3.81	3.81	2.26	1,168	.13
Error:						
All	.997	---	---	--	--	--
BC	---	683832.49	683832.49	--	--	--
Stress	---	400.71	400.71	--	--	--
bc:						
All	.002	---	---	.16	2,149	.84
bc	---	1.03	1.03	.09	1,150	.75
Stress	---	.36	.36	.20	1,150	.65
Error:						
All	.996	---	---	--	--	--
bc	---	471645.32	471645.32	--	--	--
Stress	---	557.11	557.11	--	--	--

Appendix G

ANOVA Summary Table for Intellectual
Activity and Cognitive Functioning

Appendix GANOVA Summary Table for Intellectual
Activity and Cognitive FunctioningIntellectual Activity:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>P</u>
Intellectual activity	31160.14	31160.14	16.02	1	<.01
Error	627977.43	1944.20		323	
Total	659137.57				

Cognitive Functioning:

<u>Effect</u>	<u>SS</u>	<u>MS</u>	<u>F</u>	<u>df</u>	<u>P</u>
Cognitive functioning	493.34	493.34	6.17	1	<.01
Error	26048.51	79.90		325	
Total	26541.85				