
Animal Companions and One-Year Survival of Patients After Discharge From a Coronary Care Unit

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SOCIAL ISOLATION, family breakdown, social and geographic mobility, and deterioration of neighborhood environments and institutions have been shown to adversely affect physical and emotional health in children and adults. There is ample evidence that persons who are single or divorced or whose spouses have died have higher age-specific death rates than married persons. These groups also have higher prevalences of a broad spectrum of diseases, including degenerative diseases—such as coronary artery disease—and behavioral disorders—such as alcoholism, suicide, accidents, and mental illnesses (1,2). Bereavement also has been associated with increased cigarette smoking and alcohol consumption (3,4). Moreover, the death rates for bereaved persons under age 65 increase significantly within the first 2 years (5–7)—a phenomenon not clearly explained (8). However, it is reasonable to hypothesize that this increased mortality and morbidity may be due to the emotional and behavioral effects of the absence of companionship, including depression and loneliness (9).

Depression is a complex state, in which changes in physiological state and activity patterns can affect the progress of a variety of pathological processes (10). Alternatively, the absence of significant companions may interfere with peoples' ability to maintain normal

activity levels and healthy behaviors. In turn, this effect may influence the progress of illness.

Survival of coronary heart disease (CHD) patients for varying periods is often studied to test the effectiveness of treatment protocols and to describe the natural history of the disease. Most of these studies are concerned only with relating survival to the physiological condition of the subject before and during the period of acute illness (11–24). Although a wide range of psychological and social factors have been related to CHD incidence, only a few studies have related social or psychological factors to survival of CHD patients (25,26).

Studies that use a multivariate approach in which physiological and psychosocial variables are considered simultaneously are surprisingly lacking. Patients are discharged to different environments after their hospital stays, and they spend most of the time in which survival is evaluated in these environments. Any analysis of the effect of social predictors on survival must demonstrate the independent effect of these social factors after the effect of the patient's physiological status is evaluated; such analysis requires a complex design to account for these differences.

In one study, psychological and physiological variables were studied simultaneously. Garrity and associates (27) investigated the relationship of patterns of emotional adjustment in the coronary care unit (CCU) and the 6-month survival of 48 myocardial infarction (MI) patients. In a simple correlation analysis, a "lack of behavioral adjustment" (for example, aggressive behavior toward staff or noncompliance with ward routines) was correlated significantly with mortality ($r = 0.38, P < 0.01$) and with "prior heart trouble" ($r = 0.26, P < 0.05$), but not with the severity of the infarction. Mortality was related significantly to the severity of the infarction ($r = 0.32, P < 0.05$) and to prior heart trouble ($r = 0.25, P < 0.05$). In a multiple regression analysis, severity and lack of behavioral ad-

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justment during the CCU stay were related significantly to the 6-month mortality rate. Psychological and physiological measures were combined to explain more variance in survival than physiological parameters alone; this suggests that other nonphysiological variables also may influence prognosis.

In this study, we looked at the effects of social isolation and social support on the survival of patients who were hospitalized in a CCU with a diagnosis of MI or angina pectoris (AP). Social factors have been reported to account for some of the variation in the incidence of MI and AP (25,28), but no multivariate prospective studies have been made of the influence of such factors as social isolation on survival after MI (24). Because pets, like human beings, are a source of companionship, we also explored the association between pet ownership and survival. To our knowledge, the influence of nonhuman companions on the incidence or prevalence of somatic illness has not been studied previously.

Methods

All white patients with a diagnosis of MI or AP on admission to the coronary care unit, medical intensive care unit, or coronary care stepdown unit of a large university hospital, between August 1975 and March 1977, were invited to participate in this study. Informed consent was obtained from a total of 96 (85 percent) of the patients contacted. These patients, 29 women and 67 men, were interviewed in the hospital. The initial interview consisted of an inventory of social data and an adjective checklist for psychological mood status. The social inventory was designed to assess the patient's socioeconomic status, social network, geographic mobility, and living situation. Pet ownership was one item in a large schedule of information. The complete inventory has been published (26).

The known physiological predictors of survival for periods longer than 4 months after myocardial infarction (11-24)—congestive heart failure, cardiomegaly, arrhythmia, previous myocardial infarction, and age—were recorded to determine if the influence of social factors was independent of the subjects' preexisting medical conditions.

Two patients whose discharge diagnoses did not include AP or MI or whose physiological data were incomplete were eliminated from the study.

After 1 year, we contacted all the surviving patients; two patients could not be located. Of the 92 remaining subjects, 28 women and 64 men, 14 had died during the year. Each death was confirmed by hospital records or by interviews with the next of kin, and the cause of death was noted.

Physiological data were obtained from a review of

patients' charts. Discharge diagnosis, based on electrocardiographic and enzyme changes, was completed by the attending physician after each patient's discharge from the hospital. All other physiological data were obtained from records completed during hospitalization. A general index of physiological severity—a modified coronary prognostic index—was created by use of a method similar to Norris' (11,19).

A discharge diagnosis of myocardial infarction was scored 2 points and angina pectoris 1 point; congestive heart failure and premature ventricular contractions each added 1 point. Each previous myocardial infarction added ½ point. Age was included as an independent predictor, along with the severity index, in the following analysis. The physiological index was based on all the variables that have been related significantly to survival for periods longer than 4 months (26): congestive heart failure (11,15,17,20), previous MIs (11,19,21), premature ventricular contractions (14,21,24), and cardiomegaly (11,15,19,21). Age (11,13-15,19,21,24) was a separate, independent variable. Other physiological factors have been studied in relation to long-term survival with either mixed significance or no statistical analyses (26).

Results

The 1-year survival rate for our patient population was 84 percent; 78 of the 92 patients were alive 1 year after their hospital admission. A total of 58 percent of the subjects (53 of 92) had 1 or more pets. The relationship between pet ownership and 1-year survival status for the 92 patients studied was as follows.

<i>Patient status</i>	<i>Number patients with—</i>	
	<i>No pets</i>	<i>Pets</i>
Alive	28	50
Dead	11	3

$$\chi^2 = 8.9, P < 0.002.$$

Of the 39 patients who did not own pets, 11 (28 percent) died, whereas only 3 (6 percent) of the 53 pet owners died within 1 year. Since pet ownership may require some exertion by the owner, pet ownership may be a measure of the physical status of the patient. Because dogs require a considerable amount of care and energy compared with most other pets, a second comparison was made between owners of pets other than dogs and patients who owned no pets.

<i>Patient status</i>	<i>Number of patients with—</i>	
	<i>No pets</i>	<i>Pets other than dogs</i>
Alive	28	10
Dead	11	0

$$\text{Fisher's exact test, } P < 0.05.$$

Results of discriminant analysis used to examine interactive and independent effects of physiological severity index and pet ownership on patient survival

Variables	Percent of total variance explained	Percent of variance added	Significance of addition
Physiological severity ..	21.0	21.0	$P < 0.001$
Physiological severity plus pet ownership ¹ .	23.5	2.5	$P < 0.004$
Physiological severity plus pet plus age ² ..	24.9	0.6	NS
Physiological severity plus age ²	21.9	0.9	$P < 0.014$

¹ Variance added and significance of addition are for pet ownership.
² Variance added and significance of addition are for age.
 NOTE: NS indicates not significant at the $P < 0.05$ level.

A total of 10 pet owners did not have dogs and none of these persons died. The relationship between pet ownership and survival remained significant even when subjects owning dogs were eliminated from the analyses.

We also examined the relationship between pet ownership and severity of the cardiovascular disease. The average physiological severity score was 2.0, with a range of 1 to 6. This index was correlated significantly with 1-year mortality for all subjects ($r = 0.4185$, $R^2 = 0.235$, $P < 0.001$) and for each diagnostic group (myocardial infarction, $r = 0.24$, $P < 0.01$; angina pectoris, $r = 0.26$, $P < 0.01$). The mean age of all the subjects was 58.1 years, and the range was 37 to 79 years. Age was correlated with mortality ($r = 0.29$, $R^2 = 0.084$, $P < 0.005$) and with physiological severity ($r = 0.22$, $R^2 = 0.048$, $P < 0.05$). Pet ownership was correlated with survival ($r = 0.26$, $R^2 = 0.067$, $P < 0.01$) but not with physiological severity ($r = 0.035$, $P < 0.50$).

More men than women died within the first year, but the difference between the sexes was significant only for those who had myocardial infarctions. The relationship of pet ownership to survival was similar for men and women. Thus, it appears that the relationship between pet ownership and survival does not depend on sex or the physiological status of the patient.

Discriminant analysis was used to examine the interactive and independent effects of physiological severity and pet ownership on patient survival. The groups discriminated were 1-year survivors and nonsurvivors, and the independent variables were physiological severity, age, and pet ownership. The results are shown in the table.

The physiological index alone explained 21 percent of the variance between survivors and nonsurvivors. The addition of pet ownership to the physiological severity index contributed significantly to the power of the discriminant function. These two variables explained a

total of 23.5 percent of the variance. The addition of age to these two variables did not significantly increase the amount of variance explained.

In this study, other social factors, including "urban-ness" (portion of life spent in urban areas) and employment variables, were also related significantly to 1-year survival. A total of eight variables—physiological severity index, age, and six psychosocial variables (including pet ownership)—explained a total of 39.5 percent ($r = 0.629$) of the variance in 1-year survival. Variables for inclusion in the discriminant analysis were preselected on the basis of univariate relationships to survival in each race-sex group (26). The following simultaneous discriminant analysis equation was 85 percent accurate at predicting survival status for the 87 subjects with complete social data.

Variable	Standardized discriminant function coefficients
Physiological severity	-.51
Age	-.25
Less anger (mood)	-.25
Solely self-supported	-.29
No change in residence area type	-.36
Born in urban area	-.28
No pet	-.12
Speaks with fewer people each day	-.15

Canonical correlation = 0.629; Wilk's lambda = 0.6042, $P < 0.001$.

The classification table for the preceding discriminant analysis was:

Actual status	Predicted alive	Predicted dead
Alive	63	11
Dead	2	11

74 of 87 subjects = 85.06 correct.
 $\chi^2 = 28.84$, $P < 0.001$.

Since a relatively small number of variables was used to create the discriminant function, this function should be generalizable to other independent populations. The discriminant function was cross-validated by successively eliminating each subject from the derivation of a discriminant analysis function and predicting the survival status of that subject. The predicted outcome for each subject was then tabulated and compared with the actual 1-year status of each subject, as follows.

Actual status	Predicted alive	Predicted dead
Alive	63	11
Dead	5	8

71 of 87 subjects = 81.6 percent correct.
 $\chi^2 = 14.20$, $P < 0.001$.

A significant proportion of the predictions agreed with the actual 1-year status of the subjects. This finding implies that the discriminant function may be generalizable to other similar independent populations.

Discussion

The findings of this study confirm and extend previous findings that social affiliation and companionship have important health effects. The four-item physiological severity index used in this study accounted for 21 percent of the variance in 1-year survival, which is as much as or more than the variation in survival explained in other studies. In fact, by using up to 20 physiological variables (14,21,24,27), previous investigators have explained a maximum of 11 percent of the variance in survival. Thus, it is unlikely that the effect of adding social variables to the physiological index in this study is an artifact of a failure to account adequately for the effect of disease severity.

From our findings, it seems that social variables such as pet ownership can add significantly to the variance in survival explained by the severity of the cardiovascular disease. Therefore, the beneficial effect of pet ownership is not a statistical artifact produced by differences in age or health status between patients with and without pets. Moreover, the benefit is probably not a result of the protective effect of the physical activity needed to walk dogs, since owners of pets other than dogs had a better survival rate than the subjects without pets. Currently, the major unanswered question relates to the source of the apparent influence of pets on survival.

The research hypothesis that guided our study postulated an adverse effect of social isolation and a beneficial effect of companionship on survival. Familiar social contacts were assumed to have the ability to lessen the painful, physiologically arousing feelings that are associated with uncertainty, loneliness, and isolation. However, our findings did not lend strong support to this hypothesis. Survival was not more frequent among married subjects, and engagement in social activities did not influence 1-year survival. Moreover, the effect of pet ownership was not limited to those who were unmarried or socially isolated; thus, pet ownership could not be said to substitute for the beneficial effects of human contact.

The apparent effect of pets on survival may not depend on the pets; rather, it may result from differences in personality or social condition between those who have pets and those who do not. We found no differences in measures of tension, anxiety, depression, confusion, vigor, or fatigue between pet owners and

nonowners. We believe that further investigation of possible personality differences and pet ownership is indicated.

Unfortunately, little substantive information is available on the interactive process in relationships between people and their pets. We know that such relationships are attractive by virtue of the extremely large numbers of pet dogs and cats in the United States (29). Some authors have called attention to the importance of the pet-owner bond by recounting anecdotal information (30,31). Others have detailed the strength of the grief response that can follow the death of a pet (32,33). Yet, we still have no useful information that indicates a mechanism for pets' effects on health. The little evidence we do have suggests several possible avenues of inquiry.

In a study of healthy aged men by the National Institutes of Health (34,35), complex, varied, and interesting daily activity was found to be the strongest social predictor of longevity. This study did not examine specifically the role of pet animals in providing a complex lifestyle. However, pets do provide an important focus of pleasurable daily activity for their owners. Feeding, toileting, walking, talking to, and petting animals are important and regular daily events. Pets may serve as "clocks" by providing a source of order and responsibility for people who are no longer working or have no responsibility for scheduled activity.

Pets are also a constantly available source of and direction for attention. The unambivalent nature of the exchange of affection between people and animals differs from exchanges with close family members and other relatives. These interpersonal relationships frequently are charged with ambivalence and negative emotional states. Human love and attention may be earned only with difficulty and sacrifice, or it may be entirely unavailable. Pets are a source of comfort that can be scheduled on demand of the owner, in almost any quantity, without bargaining or supplication (36).

The contact comfort and target for attention provided by pets may have direct physiological effects. The cardiovascular response to being petted has been found to be profound in pet dogs and horses (37-39). This response usually takes the form of a significant reduction in the heart rate and blood pressure (40,41). Unfortunately, we have no information about the physiological responses of the person doing the petting; but there is evidence that simple kinds of contact comfort can produce physiological changes in human beings. Interactions as simple as a nurse holding a patient's hand while taking the pulse produce changes in the heart rate and the frequency of arrhythmia in coronary care patients (42,43). Such responses to human touch

have even been observed in curarized patients in a shock trauma unit (44).

More information is available about the effects of contact comfort than about the physiological effects of attention paid to animals or to other living creatures. Attention directed outward, whether to music or to a visual signal, is associated with a decrease in heart rate and other signs of sympathetic arousal (45). Although we have no data on the relative effectiveness of living beings as opposed to inanimate objects, the pleasure of watching a cat at play or a fish in a tank may produce the kind of relaxation that effectively decreases ambient arousal in the way that more formal kinds of directed attention—such as hypnosis or meditation—produce a relaxation response (46).

Another consideration is the potential value of dumb as opposed to speaking companions. Interaction with people usually demands the use of speech, frequently narrative with emotional content, as a means of sustaining interaction. Such speech is innately arousing and consistently elevates blood pressure, in contrast to periods when the participants remain silent (47). Exchanges of affection or attention between persons and their pets can take place with or without words by these persons. The speechless kind of companionship shared with pets may provide a source of relaxation that human companions who demand talk as the price of companionship may not provide.

Conclusions

The findings of this study confirm the independent importance of social factors in the determination of health status. Social data obtained during patients' hospitalization can be valuable in discriminating 1-year survivors from nonsurvivors. These social data can add to the prognostic discrimination beyond the effects of the well-known physiological predictors. More information is needed about all forms of human companionship and disease. Thus, it is important that future investigations of prognosis in various disease states include measures of the patient's social and psychological status with measures of disease severity.

The phenomenon of pet ownership and the potential value of pets as a source of companionship activity or attention deserves more careful attention than that recorded in the literature. Almost half of the homes in the United States have some kind of pet. Yet, to our knowledge, no previous studies have included pet ownership among the social variables examined to explain disease distribution. Little cost is incurred by the inclusion of pet ownership in such studies, and it is certainly justified by the importance of pets in the lives of people today and the long history of association

between human beings and companion animals (29).

The existence of pets as important household members should be considered by those who are responsible for medical treatment. The need to care for a pet or to arrange for its care may delay hospitalization; it may also be a source of concern for patients who are hospitalized. Recognition of this concern by physicians, nurses, and social workers may alleviate emotional stress among such patients.

The therapeutic uses of pets have been considered for patients hospitalized with mental illnesses (48) and the elderly (49). We suggest that patients with coronary heart disease should also be included in this consideration. Large numbers of older patients with coronary heart disease are socially isolated and lonely. While it is not yet possible to conclude that pet ownership is beneficial to these patients, pets are an easily attainable source of psychological comfort with relatively few risks.

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