

**PET OWNERSHIP IS GOOD FOR YOUR HEALTH AND SAVES
PUBLIC EXPENDITURE TOO:**

AUSTRALIAN AND GERMAN LONGITUDINAL EVIDENCE

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Conference: the 20th Anniversary of the German Socio-Economic Panel, Berlin, July, 2003

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Abstract

New longitudinal (multi-year) evidence from the German Socio-Economic Panel and the International Social Science Survey Australia show that pets bring long term health benefits to their owners. Pet owners have better health and go to the doctor less than non-owners. The benefits appear to be mainly long term, not short term. Using the evidence that owners go to the doctor less, we make preliminary estimates of savings in national health expenditure due to pets. For the year 2000 savings were estimated to be Euros 5.59 billion for Germany and \$3.86 billion for Australia.

The German Socio-Economic Panel Survey (GSOEP) and the International Social Science Survey Australia (ISSS-A) provide new evidence on the benefits of pet ownership for human health. So far as we know, these are the first two surveys of the general population which, because they are longitudinal, enable us to detect that owning a pet improves long term health. Many previous studies have claimed that pets produce health benefits, but the claim has been disputed, either because the studies were cross-sectional and so could not establish causal direction, or because they were small scale interventions in which specific groups (mainly older and institutionalised people) were given a pet. The people concerned might well have known or suspected that the aim was to improve their health and this could have affected their survey responses.

So the German and Australian evidence strongly suggest that owning a pet benefits one's health. And because the data come from large representative national samples, it is possible to make reasonable, if fairly crude, estimates of savings to national health budgets which flow from ownership.

Previous research in the US, Britain, Canada and Australia has shown plausible evidence of a linkage between pet ownership and better human health. But most studies were cross-sectional, and while they indicated possible benefits, their design made it impossible to know whether owners enjoyed better health as a consequence of having a pet in the home, or whether people who were healthier in the first place tended to acquire pets (Anderson, Reid and Jennings, 1992; Headey, 1999; Headey and Krause, 1999; Robinson, 1995; Marx, 1984; Garrity and Stallones, 1998). An apparent breakthrough was made by Friedmann et al (1980) who found that patients

who owned pets were much less likely to die in the year following a heart attack than patients with no pet at home. The methods used in this study were criticised by Wright and Moore (1982) but it has since been replicated on a larger scale and the finding seems fairly well established (Friedmann, 1995).

There have been several investigations of physiological and exercise related responses to the presence of pets in the home. Blood pressure and other autonomic responses to mild mental stress are lowered by the presence of a pet dog (Friedman et al, 1993; Allen et al, 1991, 2002; Kingwell et al, 2001). Watching fish swim peacefully around in an aquarium can have the same effect (De Schriver and Riddick, 1990). Further, one recent study showed that, while ace inhibitor (ACE) therapy lowers resting blood pressure, the presence of a pet is more effective if mild mental stress occurs (Allen et al, 2001). Finally, dog owners average higher levels of exercise than matched groups of non-owners and this has measurable health benefits (Bauman and Schroeder, 2001).

We now review previous studies which did have a longitudinal design. An important British study by Serpell (1991) showed that people who had not recently owned a dog or cat and then acquired one, or were given one by the researchers, showed improvements over the next ten months in their health, psychological well-being, self-esteem and exercise levels; this compared with a control group who did not get a pet. Results were clearly statistically significant but the study is open to the potential criticism that some subjects may well have guessed that they were given a pet to improve their health and their survey responses could have been affected. This objection cannot be levelled at Siegel's (1990) study of 938 American Medicaid enrollees, some of whom owned pets and some did not. During the follow-up period it was found that pet owners were less distressed by adverse life events and made fewer doctor visits. Similarly, Raina et al (1998) found that elderly people who had pets declined less in physical and mental health in a one year period than a matched group without pets. However, in this study the people who had pets were somewhat healthier than non-owners when research began, and this casts some doubt over results.

It should be noted that several studies have found no relationship between pet ownership and health, or have concluded that the sequence is probably that people who enjoy good health are more likely to get pets (Beck and Katcher, 1984; Goldemeier, 1986; Jorm et al, 1997; Lawton, Moss and Moles, 1984; Miller and Lago, 1989; Ory and Goldberg, 1983; Robb and Stegman, 1983). However, all these studies were limited to small samples and specific population groups rather than applying to the general population.

The immediate background to this article is that Headey previously reported survey results from both Australia and Germany showing statistically significant cross-sectional relationships between pet ownership and fewer annual doctor visits (Headey, 1999; Headey and Krause, 1999). In such research it is essential to control for other variables which are known to affect health and use of health services in order to avoid reporting potentially upwardly biased estimates of the benefits of pets. Two variables one must always adjust for are gender (women use services more) and age (obviously older people are less healthy). Headey adjusted for these variables and still found fewer doctor visits by both sexes and all age groups; even younger people whose health could hardly be a barrier to owning a pet. Even so, in the absence of longitudinal data, the direction of causation remained unknown, or to put it another way, it was not clear whether acquiring a pet would improve subsequent health and whether losing one would damage health.

This issue can now be addressed, given that in 2001 the same panel of German respondents, who had previously answered in 1996, were again asked about pet ownership, health and doctor visits, and in the intervening period many had gained and many had lost a pet. In Australia the procedure was different and somewhat less reliable. In the year 2001, ISSS-A respondents were asked about both their current pet ownership and ownership five years ago; the same time interval as the German survey. Additionally, they were asked about ownership ten years ago and during childhood. They were also asked about their current health and frequency of doctor visits, but not about their previous health, since plainly answers would not have been reliable.

The outcome we seek to explain is survey respondents' reports of the number of doctor visits (general practitioners and all other doctors) they made in the last year. This variable appears to be as strongly affected by pet ownership as other health variables included in GSOEP and ISSS-A, including self-reported health status (a 5-point scale running from 'very good' to 'very bad') and nights spent in hospital in the last year. Annual doctor visits appear to be a good proxy for health, being correlated about 0.4 in both countries with the self-report measure. Crucially for our purposes, evidence about the frequency of doctor visits also has the merit that it can be used as a basis for inferring health savings due to pet ownership.

METHODS

The German Socio-Economic Panel (GSOEP) and the International Social Science Survey Australia (ISSS-A)

GSOEP is conducted by the German Institute for Economic Research in Berlin, one of the five economic think tanks charged with forecasting and advising the Federal Government (Wagner, Burkhauser and Behringer, 1993). The panel survey began in 1984 in West Germany and, just before reunification, was extended to East Germany in 1990. The initial sample included over 12,000 respondents with everyone aged 16 and over in sample households being interviewed. In the years 1995, 1998 and 2000 new samples were drawn which approximately doubled the initial sample size. The sample analysed here comprises about 10,000 respondents who answered all questions about health and pet ownership in both 1996 and 2001.

The ISSS-A is conducted annually by a team headed by Jonathan Kelley of Australian National University and the Melbourne Institute and Mariah Evans of the Melbourne Institute. For the survey in 2001 a national sample of 1246 was drawn from the Federal electoral rolls. The survey was conducted by mail, and over the years has proved to be statistically representative of the electorate from which it is drawn (Sikora, 1997).

Measures: health and pet ownership

Questions about health are asked every year in GSOEP but questions about pets have only been asked twice in special modules in 1996 and 2001. The pet sequence is that respondents are first asked whether they own a pet or not, and if they do, whether they own a dog, cat, bird, fish, horse or ‘other’ pet. In the ISSS-A respondents were asked just about dogs, cats and ‘other’ pets. We found in both countries that there was a statistically significant (5% level) Pearson correlation between ownership of all types of pet and measures of self-reported health and annual doctor visits. So rather than analyse the effects of each type of pet separately (which would have given small numbers for all but dogs and cats), we relied on a dichotomous (yes-no) measure of pet ownership.¹ We further divided survey respondents into four groups:

- ‘PetAlways’ – owned a pet now and five years ago
- ‘PetNow’ – owned a pet now but not 5 years ago
- ‘Pet5ago’ – owned a pet 5 years ago but not now
- ‘PetNever’ – did not own now or 5 years ago.

In the regression analyses which follow, the ‘PetNever’ group was used as a reference group or baseline, and the health of the other groups was compared with them. It was hypothesised that the ‘PetAlways’ group would score highest on health measures (net of other variables), and also show the largest gains in health in the last five years (or perhaps the smallest losses in health since everyone was five years older!). We expected the ‘PetNow’ group to do next best and to show an improvement in health or a lesser decline than the ‘Pet5ago’ and ‘PetNever’ groups. There was no strong reason to expect any difference between the last two groups, although it seemed possible that, if pet ownership had lingering benefits, the Pet5ago group would have better health than PetNever.

A special feature of the ISSS-A questionnaire, not present in the German one, was that we sought to discover family histories of pet ownership. As well as asking about ‘pets now’ and ‘pets five years ago’, we asked whether respondents had pets in the family ‘about 10 years ago’ and also ‘when you were growing up, say about 14 years

¹ This was done only after initial checks showed that owning multiple pets confers no additional health benefits.

old'. The aim was to see whether there were still detectable benefits of pet ownership from relatively long ago; benefits which might be over and above current benefits.

The measure of doctor visits in GSOEP was: *During the last three months how many times have you been to a doctor – I mean your family doctor, specialists or any type of doctor?* We multiplied this measure by four to get an estimate of annual doctor visits. In the ISSS-A the same question was posed, except that the period covered was directly the last year rather than the last three months. The measure of self-reported health in both surveys was: *'How would you rate your health at the present time – very good, good, fair, bad, very bad?'* This measure is used in many national and international surveys and is known to correlate satisfactorily with medical evaluations (Schwarze et al, 2000).

Government and private health expenditures

Estimates of possible savings in government and personal health expenditures due to linkages between pet ownership and better health are based on the assumption that annual expenditures can be apportioned between pet owners and non-owners in the ratio in which they make doctor visits. The assumption here is that, since doctors (especially general practitioners) are the first point of contact with the health system in Germany as well as in Australia, then hospital, pharmaceutical and other service costs will be approximately proportional to doctor visits (Headey, 1995). In Germany in 2000 current expenditure on health 218.4 billion Euros or 10.7% of GDP (Statistisches Bundesamt, 2001).² About 76% of this expenditure was by Federal, State and local governments and 24% was private. In Australia national health expenditure in financial year 1999-2000 was \$53.7 billion (8.5% of GDP) of which 71% was governmental and 29% was personal.

RESULTS

First some basic information: in 1996 37.7% of Germans owned a pet (mostly a dog or cat or both) and by 2001 this had fallen slightly to 36.3%. Despite the small shift in the aggregate figure – and fortunately for our analysis of the health effects of change – over a thousand people had newly acquired a pet during the five years (11.4% of the

² Budget figures for 2000 are used for both Australia and Germany; 2001 data are not yet available.

sample) and even more no longer had a pet (12.8%). In 1996 people who owned a pet averaged 11.1 visits a year to the doctor and non-owners averaged 12.0 visits.

Everyone had aged five years by 2001, so more medical attention would have been expected, but in the event pet owners now went to the doctor 11.0 times a year on average, whereas non-owners were up to 12.9 visits.

In Australia 64.3% of respondents owned pets in 2001, down from 71.6% in 1996, although still a much higher figure than in Germany. As in Germany the largest numbers owned dogs (25.2%) and cats (19.6%), with cat ownership having fallen by a quarter in the last five years. On average pet owners had been to the doctor 4.9 times in the last year, compared with 5.6 times for non-owners. Despite Australians making many fewer doctor visits than Germans, the percentage difference between owners and non-owners is about the same.³

Before analysing change, we now give some straightforward measures of association between pet ownership and health measures. The Pearson correlation between pet ownership and self-reported health in Germany was 0.06 in 2001, and between pet ownership and annual doctor visits it was -0.05 . In Australia the correlation between pet ownership and health was 0.04 and between ownership and doctor visits -0.10 . Given the large samples, these correlations are statistically significant, but of course the apparent relationships could be wholly or partly due to demographic variables also related to health and doctor visits.

German pets and health: equations

What model – what equations – can best enable us to assess whether pet ownership improves health? We estimated three equations, using ordinary least squares (OLS) regression analysis. The outcome variable in all equations is doctor visits in 2001. Explanatory variables essentially included as ‘controls’, and also measured in 2001, are sex (female=1, male=0), age, partnership status (partnered=1, not partnered=0) and family income.⁴ An important inclusion is self-reported health status, but measured in 1996 not 2001. Then come the variables of key interest relating to pet ownership. In the first equation we just insert a dichotomous variable (pet owner in

³ It is possible that one reason Australians appear to go to the doctor so much less than Germans relates to the difference in questions; recall that Australians were asked to report visits for a 12 month period, whereas the German respondents reported only on 3 months of visits, with the researchers then multiplying by four to get an annual figure.

⁴ Measures of educational attainment and occupational status were tried but were statistically insignificant in equations in which income was included.

2001=1, non-owner=0), and in the second equation we include the 4-way split discussed above: PetAlways, PetNow, Pet5ago, with PetNever being used as the reference group. Results from this model only confirmed our expectations with regard to PetAlways. Post hoc we were led to formulate a third slightly revised model which essentially postulates that the benefits of pet ownership increase over time and that, in the German data, medium term ownership (1996-2001) has greater benefits than short term (2001 only). In this model the distinction between PetNever and Pet5ago is dropped.

The inclusion of the lagged (1996) measure of self-reported health is crucial because it means that, if we find that pet owners made fewer doctor visits in 2001 than non-owners, we can say that this appears to be true, making a ‘fair’ comparison between owners and non-owners who had the same standard of health five years before. Or to put it another way, we can say that owning a pet improves health over time compared with not owning one.⁵

⁵ To be strictly correct we have included the health scale as a set of dummy variables rather than as a continuous 5-point scale. Inspection showed that doctor visits were not related in approximately equal intervals to the 5 points. The people with the worst health (health=1) were used as the reference group for those who scored 2-5.

Table 1

Germany: Pet Ownership and Annual Doctor Visits (N= 9511)

Explanatory variables (2001 unless otherwise shown)	Outcome variable: doctor visits in 2001		
	Equation 1 coefficients: t-values in a brackets	Equation 2 coefficients: t-values in a brackets	Equation 3 coefficients: t-values a in brackets
Sex (f=1, m=0)	2.73 (7.58)	2.76 (7.65)	2.74 (7.62)
Age (years)	0.19 (15.87)	0.19 (15.86)	0.19 (15.85)
Partnered (yes=1, no=0)	0.19 (0.46)	0.21 (0.50)	0.19 (0.47)
Disposable income (log)	- 1.89 (4.91)	- 1.89 (4.91)	- 1.90 (4.91)
Health 1996 (very good) ¹	-1.31 (1.06)	1.38 (1.12)	- 1.35 (1.10)
Health 1996 (good)	- 0.78 (0.69)	- 0.83 (0.74)	-0.80 (0.72)
Health 1996 (fair)	- 1.08 (0.95)	-1.12 (0.99)	-1.10 (0.98)
Health 1996 (bad)	0.14 (0.12)	0.10 (0.08)	0.11 (0.09)
Pet owner (yes=1, no=0)	- 0.84 (2.27)		
PetAlways ²		- 1.12 (2.35)	- 1.26 (2.78)
PetNow		- 0.25 (0.49)	- 0.38 (0.78)
Pet5ago		0.41 (0.84)	
	R ² (adj.) = 4.3%	R ² (adj.) = 4.3%	R ² (adj.) = 4.3%

a. t-values over 2.0 are significant at the 5% level.

1. Reference group: Health 1996 (very bad).

2. Reference group: PetNever in equation 2.

All three equations show that owning a pet appears to confer significant health benefits. The first simply reports that pet owners averaged 0.84 fewer doctor visits in 2001 than non-owners, even if they had the same standard of health in 1996 (and controlling for sex, age, partner status and income). The second gives more detail. It shows that people who had ‘always’ had a pet (i.e. in 1996 as well as 2001) clearly enjoyed the best health and averaged 1.12 fewer doctor visits than people who ‘never’ had a pet; a difference of about 10%. However, other hypotheses were not confirmed. Although people who had no pet in 1996 but had acquired one by 2001 (PetNow) perhaps had better health than the remaining two groups, the results were not significant at the 5% level. Furthermore, people who no longer had a pet in 2001 but did five years ago (Pet5ago) perhaps had slightly worse health on average than people who ‘never’ had a pet. This appears to mean that giving up a pet has fairly immediate health costs. The third equation shows that medium term owners (PetAlways)

averaged 1.26 fewer doctor visits per year than all others combined; the strongest result obtained. However, short term owners only averaged 0.38 fewer visits; a difference which is not statistically significant, and which we will examine again in the light of the Australian data. There is really little to choose between the second and third equations; they show nearly the same results and fit the data equally well.

Australian pets and health: equations

The Australian equations are somewhat different. Because all information was collected in 2000 we have no lagged measure of health. Table 2 gives three equations. The first comes as near as possible to replicating the first German equation, but is purely static; it tells us nothing about change. It assesses whether or not current pet ownership is associated with fewer doctor visits, controlling for sex, age etc. The second equation does address issues of change. It asks whether people who own a pet now make fewer doctor visits, controlling for pet ownership not just five years ago, but also ten years ago and during childhood. This is the same as asking whether having a pet now benefits current health (measured by doctor visits), regardless of whether you had a pet in the recent or distant past. The final equation comes close to replicating the third German equation, but necessarily omits the lagged health measure and merges those who were pet owners ten years ago with owners five years ago, since inspection showed these groups to have almost identical membership and similar health benefits.

Table 2

Australia: Pet Ownership and Annual Doctor Visits (N=1246)

Explanatory variables (2000 unless otherwise shown)	Outcome variable: doctor visits in 2000		
	Equation 1 coefficients: t-values in brackets ^a	Equation 2 coefficients: t-values in brackets ^a	Equation 3 coefficients: t-values in brackets ^a
Sex (f=1, m=0)	0.58 (2.84)	0.60 (2.92)	0.60 (2.93)
Age (years)	0.06 (7.96)	0.06 (7.74)	0.06 (7.71)
Partnered (yes=1, no=0)	0.42 (1.54)	0.42 (1.53)	0.43 (1.58)
Disposable income (log)	- 0.93 (6.54)	- 0.90 (6.18)	- 0.90 (6.18)
Pet owner (yes=1, no=0)	- 0.51 (2.39)		
Pet5Child		0.42 (1.54)	0.42 (1.53)
Pet10ago		0.26 (0.89)	0.35 (1.34)
PetAlways ¹		- 0.57 (1.87)	- 0.72 (3.04)
PetNow		0.29 (0.64)	0.19 (0.45)
Pet5ago		0.28 (0.74)	
	R ² (adj.) = 11.1%	R ² (adj.) = 11.0%	R ² (adj.) = 11.1%

a. t-values over 2.0 are significant at the 5% level.

1. Reference group = PetNever in equation 2.

The three equations are highly consistent and confirm the main German result for medium term owners. The first equation shows that current pet owners in 2000 averaged 0.51 fewer doctor visits than non-owners. As in Germany this is a difference of about 10%. The second equation indicates that PetAlways (owner in 2001 and five years before) produced a better health outcome regardless of one's previous history of ownership (i.e. controlling for PetChild and Pet10ago). A second important point - shown more clearly in the Australian than German data - is that people who only recently acquired a pet (PetNow) show no health benefits. The third equation is a little more parsimonious and confirms both these results. It shows PetAlways owners averaging 0.72 fewer doctor visits than all others, controlling for PetChild and Pet10ago, and confirms that acquisition of a pet produces no immediate benefits.

Taking results for both countries together leads to a partial reinterpretation of previous research. Apparently health gains take time to build up, but loss of a pet produces immediate losses. Previously reported cross-sectional relationships between pet

ownership and better health may be misleading and may be based on confounding two groups which overlap a lot, namely people who have had a pet for a good many years and people who recently acquired one.

Health expenditure savings

Now some small-scale simulations of the public expenditure consequences of abolishing pets in Germany and Australia. Imagine that, with pets abolished, everyone was in the PetNever category. How many extra doctor visits would occur and what would be the flow-on effects for national health spending?

Extrapolating from equation 2 for each country, we assume that everyone now goes to the doctor as often as the PetNever group. This means that in Germany the PetAlways group would, on average, go 1.12 times more a year and in Australia 0.57 times more. We also assume that the PetNow and the Pet5ago groups would be forcibly switched to PetNever and go to the doctor just as frequently.

Germany

Simple multiplication shows that if the 21.3% of the population who ‘always’ owned a pet in Germany went to the doctor 1.12 times a year more often, and the PetNow and Pet5ago groups also went as often as the PetNever group, then *the total increase in doctor visits nation-wide would be 2.56%*. Health expenditure (2000) was 218.4 billion Euros. So loss of all pets would bring in its train an increase in national health expenditure of 5.59 *billion Euros* (0.0256×218.4 billion Euros). Another way of viewing the issue is to say that every 1% fall in pet ownership in the PetAlways group results in extra health costs of about 262 million Euros per year. So the actual fall in ownership of 1.4% which occurred between 1996 and 2001 probably cost about 367 million Euros.⁶

Australia

In Australia far more people own pets, so the imputed losses are proportionately larger. If the 56.9% of Australians who ‘always’ owned a pet went to the doctor as often as non-owners (i.e. 0.57 times a year more than they do now), and if

⁶ This assumes that the fall occurred among long term or PetAlways owners.

adjustments are also made for the PetNow and Pet5ago groups, then *the national increase in doctor visits and in resulting health expenditure would be 7.19%*. Given that national health expenditure in 1999-2000 was \$53.7 billion, this would represent an expenditure increase of *\$3.86 billion*. Or, to put it another way, the decline in pet ownership of 7.3% which the ISSS-A estimates to have occurred between 1996 and 2001 may have cost about \$495 million in increased health expenditure. About \$351 million (71%) of this would have been borne by governments and about \$144 million (29%) would have been privately incurred health expenditure.

DISCUSSION

This paper has used longitudinal data to assess whether retaining and/or acquiring a pet produces health benefits, as indicated by fewer annual doctor visits. Most previous studies, being cross-sectional, were open to the objection that it was possible that healthy people acquired pets, rather than that people became healthier as a consequence of pet ownership. We have found that the healthiest population group in both Germany and Australia – the group which made the fewest doctor visits – were the medium to long term owners who had a pet at least five ago and retained it ‘now’. However, people who had acquired a pet in the last five years did not record significantly fewer doctor visits than people who had ‘never’ owned a pet or no longer did so. Our results can be interpreted as suggesting that giving up a pet has fairly immediate health costs, but that acquiring one takes time to produce benefits. How long a time it takes before maximum benefits are felt is an important research issue to resolve.

Because the GSOEP and ISSS-A are based on large representative national samples, it was possible to make preliminary estimates of savings in national health expenditure due to pet ownership. Because medium to long term pet owners in both countries go to the doctor about 10% less than non-owners (controlling for other variables), the savings appear substantial. Plainly, however, calculations which assume that all health expenditures can be apportioned on the basis of frequency of doctor visits are crude, although not in any obvious way biased. In future research it will be important to collect much more detailed evidence about the use pet owners and non-owners make of health services: hospitals, pharmaceuticals, ancillary services and so on.

It will also be desirable to get detailed information about which household members mainly care for pets. One might expect that 'main carers' would gain more health benefits than other household members (Headey, 1999). Indeed, as a result of not being able to differentiate between main carers and others in the GSOEP and ISSS-A surveys, it is likely that we have understated benefits to the former and overstated benefits to the latter.

A final point: it seems possible that the mechanisms through which pets bring benefits differ for different population groups. Older people, and shy or lonely people, perhaps gain most from companionship. Stressed people may relax and their blood pressure come down. Otherwise sedentary people may be induced to take exercise if they have a dog. The finding that it takes several years of ownership before health benefits accrue perhaps suggests that, for some people, the immune system is involved and that having pets around builds resistance to some viruses. Younger people would seem the most likely beneficiaries. These are all issues worth continued investigation.

REFERENCES

- Allen KM and Blascovich, J (1991) 'Presence of human friends and pet dogs as moderators of autonomic responses to stress in women', *Journal of Personality and Social Psychology*, 61, 582-89.
- Allen, KM, Shykoff, BE et al (2001) 'Pet ownership, but not ace inhibitor therapy, blunts home blood pressure responses to mental stress', *Hypertension*, 38, 815-20.
- Allen, KM, Blascovich, J and Mendes, WB (2002) 'Cardiovascular reactivity and the presence of pets, friends and spouses: the truth about cats and dogs', *Psychological Medicine*, 64, 727-39.
- Anderson, WP, Reid, CM and Jennings, GL (1992) 'Pet ownership and risk factors for cardiovascular disease', *The Medical Journal of Australia*, 157, 298-301.
- Beck, AM and Katcher, AH (1984) 'A new look at pet-facilitated psychotherapy', *Journal of the American Veterinary Association*, 184, 414-21.
- De Schriver, MM and Riddick, CC (1990) 'Effects of watching aquariums on elders' stress', *Anthrozoos*, 4, 44-48.
- Friedmann, E, Katcher, AH, Lynch, JJ and Thomas, SA (1980) 'Animal companions and one year survival of patients after discharge from a coronary care unit', *Public Health Reports*, 95, 307-12.
- Friedmann, E (1985) 'Pet ownership, social support and one year survival after acute myocardial infarction in the cardiac arrhythmic suppression trial, CAST', *American Journal of Cardiology*, 76, 1213-17.
- Garrity, TF and Stallones, L (1998) 'Effects of pet contact on human well-being: review of recent research' in CC Wilson and DC Turner eds., *Companion Animals in Human Health* London, Sage, 3-22.
- Goldemeier, J (1986) 'Pets or people: another research note', *Gerontologist*, 26, 203-206.
- Headey, BW (1999) 'Health benefits and health cost savings due to pets: preliminary estimates from an Australian national survey', *Social Indicators Research*, 47, 233-43.
- Headey, BW and Krause, P (1999) 'Health benefits and potential budget savings due to pets: Australian and German survey results', *Australian Social Monitor*, 2, 37-41.
- Jorm, AF, Jacomb, PA, Christensen, H, Henderson, S, Korten, AE and Rodgers, B (1997) 'Impact of pet ownership on elderly Australians' use of medical services: an analysis using Medicare data', *Medical Journal of Australia*, 166, 376-77.

- Kingwell, BA and Lomdahl, A et al (2001) 'Presence of a pet dog and human cardiovascular responses to mild mental stress', *Clinical Autonomic Response*, 11, 313-17.
- Lawton, M, Moss, M and Moles, E (1984) 'Pet ownership: a research note', *Gerontologist*, 24, 208-10.
- Marx, M (1984) 'The salubrious endearment. Review of new perspectives in our lives with companion animals', *Contemporary Psychology*, 29, 902-903.
- Miller, M and Lago, D (1989) 'The well-being of older women; the importance of pet and human relations', *Anthrozoos*, 3, 35-44.
- Ory, MG and Goldberg, EL (1983) 'Pet possession and life satisfaction in elderly women' in AH Katcher and AM Beck eds. *New Perspectives on Our Lives with Companion Animals* Philadelphia, Univ. of Pennsylvania Press.
- Raina, P (1998) 'Relationship between pet ownership and health care use among seniors', Conference of the International Association of Human-Animal Interaction Organisations, Sept. 10-11.
- Robb, S and Stegman, C (1983) 'Companion animals and elderly people: a challenge for evaluations of social support', *Gerontologist*, 23, 277-82.
- Schwarze, J, Andersen, H and Silke, A (2000) 'Self-rated health and changes in self-rated health as predictors of mortality – first evidence from the German panel data', DIW Discussion Paper No. 203, Berlin, DIW.
- Serpell, JA (1991) 'Beneficial aspects of pet ownership on some aspects of human health and behaviour', *Journal of the Royal Society of Medicine*, 84, 717-20.
- Siegel, JM (1990) 'Stressful life events and the use of physician services among the elderly: the moderating effects of pet ownership', *Journal of Personality and Social Psychology*, 58, 1081-86.
- Sikora, J (1997) 'International Survey of Economic Attitudes in Australia, Finland and Poland: comparison with the Census', WwA: Worldwide Attitudes 1997.12.31:18. Available at www.international-survey.org
- Statistisches Bundesamt (Federal Statistical Office) (2002) *Press Release*, <http://www.destatis.de> (May 28).
- Wagner, GG, Burkhauser, RV and Behringer, F (1993) 'The English language public use file of the German Socio-Economic Panel', *Journal of Human Resources*, 28, 429-33.
- Wright, JC and Moore, D (1982) 'Comments on animal companions and one-year survival of patients after discharge', *Public Health Reports*, 97, 380-81.