

Preliminary Analysis of Pet Insurance Data

Jeffrey Pai and Kevin Shand

Warren Centre for Actuarial Studies and Research

and

Xikui Wang

Department of Statistics

University of Manitoba

Winnipeg, Manitoba R3T 5V4, Canada

Abstract

This paper examines claim transaction data as experienced in the Canadian pet insurance industry. The current practice is to use an exposure unit approach to estimate the pure premium cost. This approach is applied in this paper in order to reveal certain cost patterns in accident, illness and death benefit costs.

Keywords : pricing; loss cost; risk classifications; mortality and morbidity experience

1 Introduction

In 2003, less than 1% of an estimated nine million Canadian pets were insured. The number of pet insurance programs in Canada is very limited and a similar situation can be seen in the United States. As a result, pricing techniques that are used in the pet insurance industry tend to be underdeveloped versus those used in the more traditional insurance markets. As well, the experience data that is maintained and provided to the actuary for pricing purposes may not always be as complete and comprehensible as that presented in traditional rate making practice such as in the casualty/property insurance industry as described by Brown (1993).

The criticism is that there is not enough national data available to allow for a more sophisticated actuarial approach. Basic loss ratio approaches that are used to determine the loss cost or pure premium have become the method of default despite the availability of many statistical methods, such as those discussed in Vinsonhaler (2001). In addition, there is also the issue of sparse and incomplete data and the challenges that this poses. Given the fact that there are a limited number of insurers who participate in this market, the pricing approach is often compromised by market share considerations.

There is very little literature available that has been published with respect to data analysis in the pet insurance market. In fact, existing publications only deal with data that has been

made available in Sweden as detailed in Bonnet, et al. (1997), Egenvall (1999) and Egenvall et al. (1998),(1999), (1999a), (2000). However, these analytical studies were strictly done for data validation purposes. In Canada and the United States, there have been no publications of any kind.

This paper will introduce the data that is to be used in a series of indepth studies that will ultimately address the above issues. It will also provide some rudimentary observations with respect to the data analysis.

2 Description of the Data Set

The data that was provided to us contained the claim transactions for all dogs as covered by a single Canadian pet insurer dating from 01 July 1990 to 30 June 1999, inclusive. Exposure units were also supplied reflecting the period from June, 1993 to June, 1999, inclusive. The insurer in this case had offered coverage under four different plans and the plans are listed in order of their benefit amounts and comprehensiveness of coverage, differentiated by deductibles and coinsurance: Elite, Gold, Silver and Value. The Elite Plan, the only plan that provides for routine maintenance, was established in May, 1996. The Value Plan, the only plan that does not offer a death benefit, was established effective March, 1994 and the Gold and Silver Plans were introduced prior to June, 1993. The data relevant to our study are as follows:

Pet Identification Number: The individual identification number i.e. a policy number for each insured dog (There were 15,029 individual dogs recorded.)

Birth Date: The date of birth of each insured dog

Policy Date: The date that each animal was first insured by this particular Canadian insurer

Breed: The breed type for each insured dog. There were 283 different breed types

Territory: The postal code region for each dog's owner

Transaction Date: The date when a dog was treated for an accident related injury, an illness or when death was reported (This date is used in our study to represent the date of accident, illness or death as well as the claim date.)

Type of Claim: By accident, illness or death

Details of Claim: There were 70 different types of accidents, 411 different types of illnesses and two causes of death (by accident or by illness) that were incurred.

Treatment Cost: The actual cost of an individual treatment that occurred at the Transaction Date

Deductible Paid: The amount of deductible that was paid by the policyholder for an individual treatment that occurred at the Transaction Date

Coinsurance Paid: The amount of coinsurance that was paid by the policyholder for an individual treatment that occurred at the Transaction Date

Claim Amount Paid: The amount that the insurer paid to the policyholder for an individual treatment that occurred at the Transaction Date (Note that the Treatment Cost = Deductible Paid + Coinsurance Paid + Claim Amount Paid.)

Exposure Unit: The total exposure for all insured animals from January 1993 to June 1999 expressed as total number of months. The total exposure was 711,035 months and was broken down by Plan Type, Calendar Month, Breed Type, Territory, Age, and Policy Anniversary.

3 Analysis of Data by Risk Classification

Let $LC^{(j)}$ represent the average monthly Loss Cost from January 1993 to June 1999 inclusive, due to cause j (1 for accident and illnesses, 2 for death, 3 for routine maintenance, and τ for both causes), calculated as follows:

$$LC^{(j)} = \frac{\sum_{id=1}^N TC_{id}^{(j)}}{\sum_{id=1}^N EX_{id}},$$

where $TC_{id}^{(j)}$ represents the total Treatment Cost for cause j as experienced by dog id and EX_{id} represents each dog's total monthly exposure for the above period. We let N represent the number of dogs that are to be evaluated according to the risk classification employed.

By examining the Loss Cost, we are able to identify various patterns in the insurer's mortality and morbidity experience. It is these patterns that may warrant a risk classification and an appropriate adjustment in the premium to be charged. The following table illustrates the Loss Cost identified by each cause:

	Cause j			
	Acc./Illness	Death	Maint.	τ
$LC^{(j)}$	19.90	0.36	7.17	5.14
$\%LC^{(\tau)}$	78%	2%	20%	100%

For this particular insurer, past practice has been to charge monthly premiums that vary by a number of risk classifications. We will review three of those classifications.

3.1 Age

Policies are renewable as long as a dog's initial insurable age is less than 11 years. As an animal gets older it is expected that the Loss Cost would increase. This increasing pattern can be seen from Figure 1 which illustrates the Average Monthly Loss Cost, by Age, for Accident and Illness Claims. The higher amounts of Loss Cost reflect the larger benefit levels. Notice that the Costs

Figure 1: Average monthly loss cost by age for Accident and Illness claims

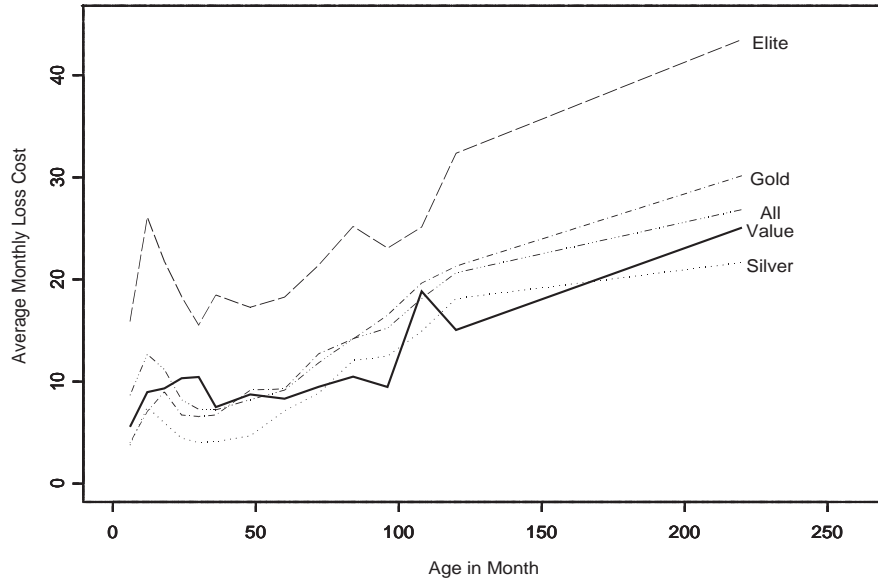
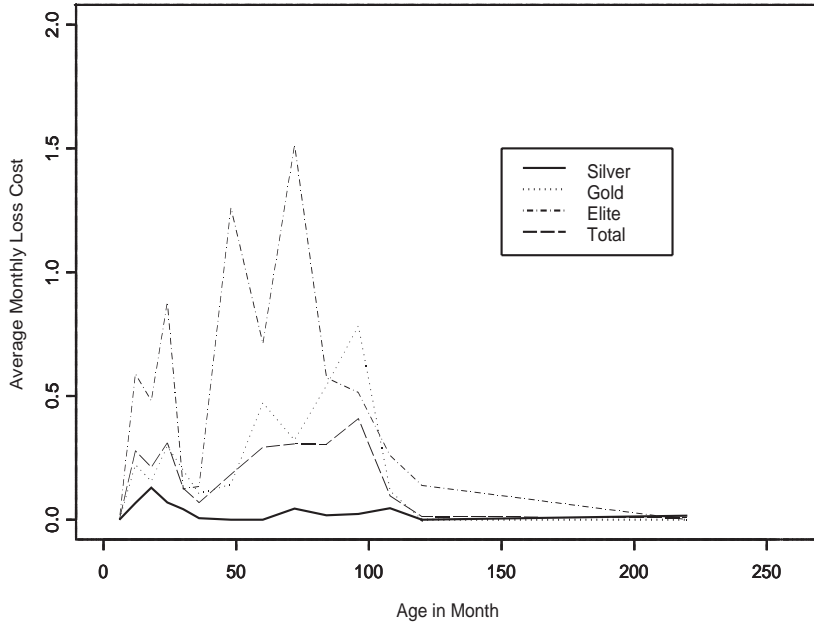


Figure 2: Average monthly loss cost by age for Death claims



spike at the earlier ages where accidents are more likely to occur than illnesses. After a certain age, the Costs predominantly reflect illnesses rather than accidents.

Figure 3: Average monthly loss cost by age for Routine Maintenance costs

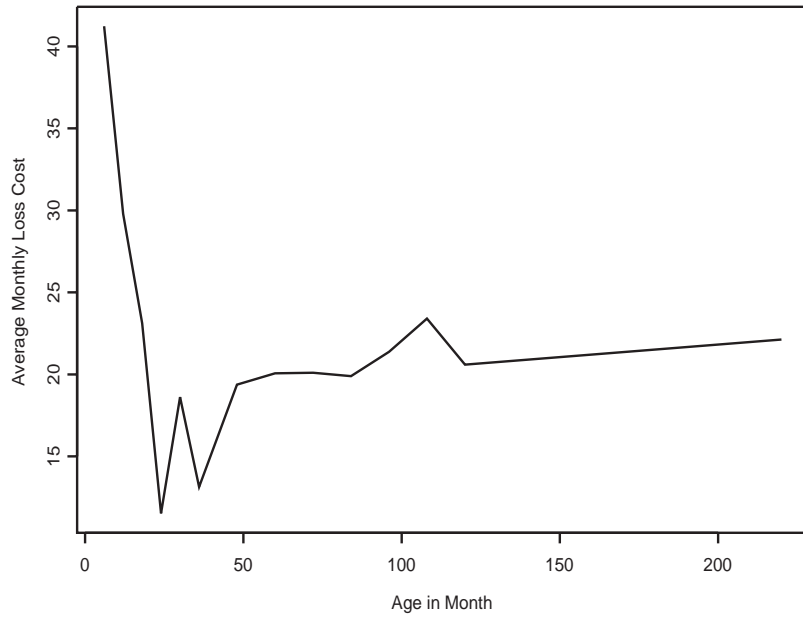
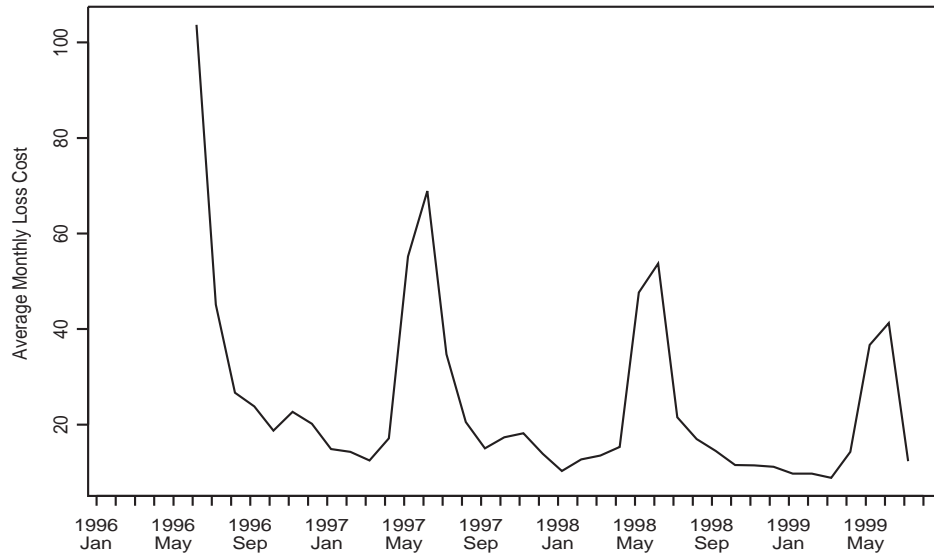


Figure 4: Average monthly loss cost by calendar year for Routine Maintenance costs

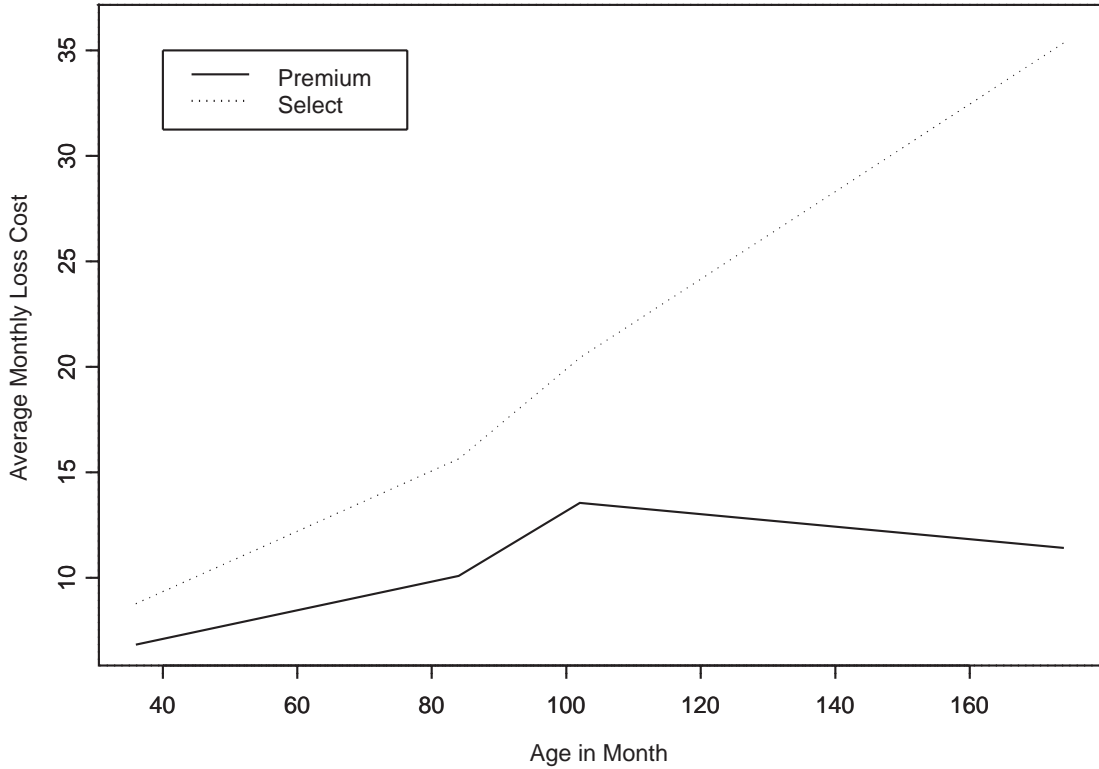


The Death Claim experience is shown in Figure 2. Note that the relatively low cost levels that exist after 100 months is due to the fact that the plans cease to pay death benefits due to illness once a dog has reached age 8, 96 months (or age 6, 72 months, if the dog's breed is considered to be more fragile). The result is that deaths after this select period would be strictly due to Accident

and as a dog ages, they will tend to become less active; thereby reducing the probability of an accidental death. Our observations also noted that 77% of the Death Claims were due to Illnesses as opposed to Accidents and that the average Death Claim due to illnesses was about 13% higher.

Routine maintenance costs are also expected to increase as an animal ages. The graph in Figure 3 illustrates this pattern. As can be seen, Maintenance Costs are higher at the very earliest of ages before they settle into their expected pattern. Of particular interest is the timing of the routine maintenance, which appears to occur seasonally (peaks in summer months) as reflected in Figure 4. Note that these seasonal peaks have been dropping which reflects the insurer’s negotiating policy with the veterinaries as more animals become eligible for routine maintenance.

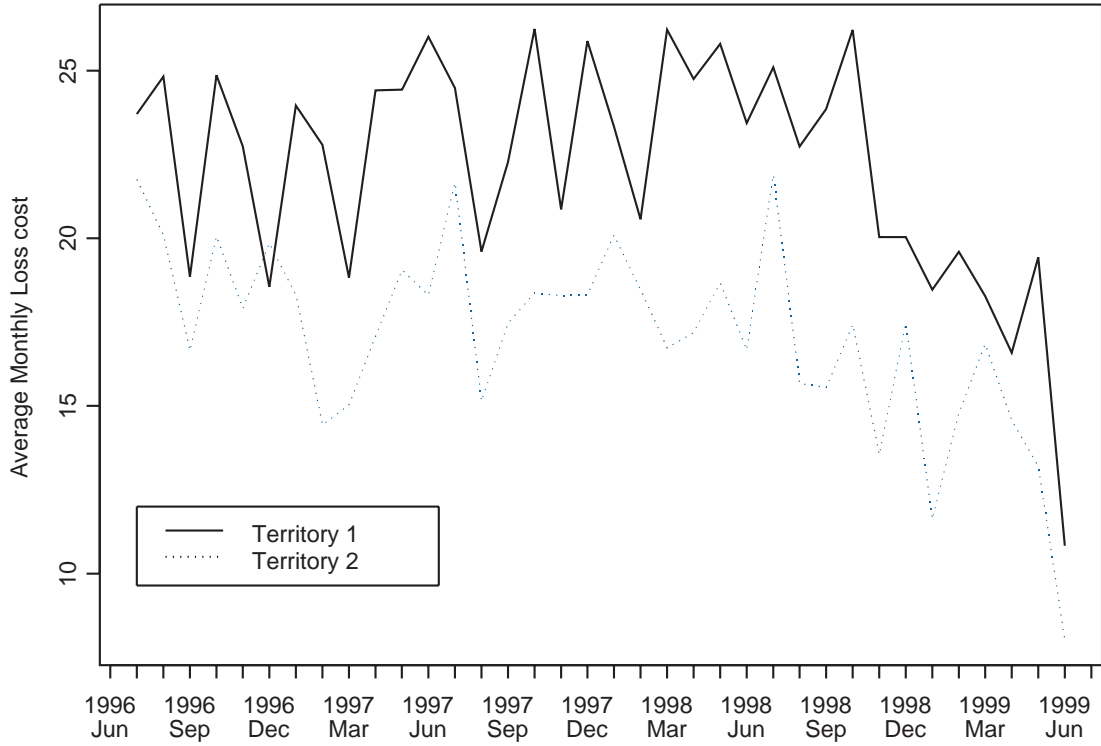
Figure 5: Average monthly loss cost by age for breed classifications



3.2 Breed

Certain breed types are considered to be more “fragile” and are required to pay higher premiums. Of the 283 identified breeds, 191 breeds were classified at the higher rate and further subdivided into two classes (Premium and Select) leaving a remaining group of animals classified as Others. Figure 5 illustrates the experience, by age, of the monthly Accident and Illness Loss Costs for the Premium and Select breed classifications. As can be seen, the graph is displaying lower costs for the Premium breed. This is contrary to what the insurer expects. Part of the reason for this

Figure 6: Average monthly loss cost by calendar year for territory classifications



anomaly may be due to the fact that the Premium breeds could be receiving higher standards of maintenance under the Elite Plan. Further investigation of this is warranted.

3.3 Territory

Treatment costs vary geographically in Canada. There are 35 regions that were classified at the higher rate. Figure 6 illustrates the calendar year experience of the monthly Accident and Illness Loss Costs for two territory classifications. Note that the costs for Routine Maintenance would produce similar difference between territories.

References

Bonnet, B.N., Egenvall, A., Olson, P. and Hedhammer, Å. (1997). Mortality in insured Swedish dogs: rates and causes of death in various breeds. *Veterinary Record* **141**: 40-44.

Brown, R. (1993). *Introduction to Ratemaking and Loss Reserving for Property and Casualty Insurance*. ACTEX Publications.

Egenvall, A. (1999). *Canine health, disease and death - data from a Swedish animal insurance database*. Ph.D. Thesis, Swedish University of Agricultural Sciences, Uppsala.

Egenvall, A., Bonnet, B.N., Olson, P. and Hedhammer, Å. (1998). Validation of computerized Swedish dog and cat insurance data against veterinary practice records. *Preventive Veterinary Medicine* **36**: 51-65.

Egenvall, A., Bonnet, B.N., Olson, P. and Hedhammer, Å. (1999). Gender, age and breed pattern of diagnoses for veterinary care events in insured dogs during 1996. *Veterinary Record* (companion article).

Egenvall, A., Bonnet, B.N., Olson, P. and Hedhammer, Å. (1999a). Survey of the Swedish Dog Population: Age, Gender, Breed, Location and enrollment in Animal Insurance. *Acta Vet Scand.* **40**: 231-240.

Egenvall, A., Bonnet, B.N., Shoukri, M., Olson, P., Hedhammer, Å. and Dohoo, I. (2000). Age pattern of mortality in eight breeds of insured dogs in Sweden. *Preventive Veterinary Medicine* **46**: 1-14.

Vinsonhaler, C., Ravishanker, N., Vadieloo, J. & Rasonanaivo, G. (2001). Multivariate Analysis of Pension Plan Mortality Data. *North American Actuarial Journal* **5**, No.2, 126-138.