Interface of epidemiology, pet population issues and policy

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Abstract

Progress has been made towards eliminating Rowan’s “statistical black hole” regarding pet populations and their dynamics, although deficiencies remain. The challenge in the coming decade will be to continue the progress, and generate meaningful epidemiologic data. Veterinary epidemiologists will continue to play an important role in the generation, dissemination and translation of results from their studies into coherent, effective companion animal welfare policy.

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1. Introduction

It is with great pleasure that I accepted the invitation to speak at this Calvin Schwabe Symposium honoring Dr. R.K. Anderson. R.K. was my advisor in the Veterinary Public Health program at the University of Minnesota where I received my M.P.H. He was formally my advisor for only one year, but his advice lead me to pursue a Ph.D. in epidemiology and an academic career. His sage advice, his example, and his encouragement have provided me with a lifetime of guidance and support.

I was asked to speak about epidemiology and its impact on pet population studies. I elected to highlight some of the recent history leading to a flurry of epidemiologic studies of pet population issues in the past decade, their results, the implications these results have for policy, and the challenges faced by epidemiologists assisting in the translation of this information into meaningful pet population policy. (For purposes of this talk, the term “pets” refers to dogs and cats.)

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2. Importance of good data

In the late 1980s and early 1990s, a series of papers by Dr. Andrew Rowan, then Director of the Tufts Center for Animals and Public Policy, highlighted the need for data regarding pet populations and their dynamics, and labeled the lack of such data, a “statistical black hole” (Rowan, 1991, 1992). Dr. Rowan observed that, despite the expenditure of millions of dollars annually by humane organizations to reduce the abandonment and euthanasia of dogs and cats in animal shelters, few data existed to address even basic questions. Furthermore, the quality and general applicability of data that did exist were largely unknown. He pointed out that data regarding the number of animal shelters in the United States, the number of animals euthanized, and the effectiveness of spay/neuter and other control programs were either of limited application or non-existent. Without such information, Rowan questioned how the humane community knew if it was allocating its resources wisely.

At about the same time, Dr. Patricia Olson was challenged by a veterinary student who asked what the profession would do if a disease were to strike the pet population and result in the death of one tenth to one quarter of the country’s pets. Dr. Olson confidently replied that the profession would muster its resources and respond quickly, as it had in the mid 1970s during the parvovirus pandemic (Kahler, 1992). The student then questioned why the profession allowed millions of healthy dogs and cats to die annually in animal shelters while doing little or nothing to reduce the loss of life. This challenge became a motivating force in Dr. Olson’s career and led her to assemble (with the support of the Editor-in-Chief of the Journal of the American Veterinary Medical Association (JAVMA)) a series of manuscripts addressing pet overpopulation in the 1 April 1991 issue of JAVMA. She also contacted Dr. Mo Salman, a veterinary epidemiologist, seeking advice regarding the collection of pet population data. Drs. Olson and Salman’s early collaboration lead to a publication (Olson et al., 1991), and to the organization of a conference in St. Paul, MN in 1992 designed to introduce representatives to each other from the humane and veterinary communities (including epidemiologists), as well as other companion animal-interested organizations. The primary objectives of this workshop were to re-emphasize the importance of quality pet population data and to facilitate data collection (by fostering liaisons between veterinary epidemiologists and representatives of potential funding sources). This meeting ultimately succeeded in renewing a spirit of enthusiasm and cooperation among a diverse set of organizations, fostered numerous studies (Salman et al., 1998, 2000; Scarlett et al., 1999; New et al., 2002; Patronek et al., 1996a, 1996b), and gave rise to the National Council on Pet Population Study and Policy (NCPPSP).

The NCPPSP continues today with the stated mission “to gather and analyze reliable data that further characterize the number, origin, and disposition of dogs and cats in the United States.” (http://www.petpopulation.org). Its members include the American Veterinary Medical Association, the Association for Veterinary Epidemiology and Preventive Medicine, the American Animal Hospital Association, the Humane Society of the United States, the American Society for the Prevention of Cruelty to Animals, the Massachusetts Society for the Prevention of Cruelty to Animals, the American Humane Association, the Cat Fanciers Association, the National Animal Control Association, the Society of Animal Welfare Administrators, and the American Pet Products Manufacturer’s Association.

Following the 1992 workshop, the NCPPSP launched a series of three studies: (1) the Shelter Statistics Study to identify all animal shelters in the U.S. and obtain national euthanasia, impoundment and adoption estimates; (2) the Regional Shelter Relinquishment Study to elucidate reasons for relinquishment of dogs and cats (Salman et al., 1998; New et al., 1999;
Scarlett et al., 1999; Kass et al., 2001) and (3) the National Household Survey to identify factors putting animals at risk of surrender and owners at risk to surrender their pets to animals shelters (New et al., 2002). This study also estimated birth and death rates, and animal movement in U.S. households (New et al., 2004). Other studies are continuing to be published (Kass and Hart, 1998; Wenstrup and Dowidchuk, 1999; DiGiacomo et al., 1999). This growing body of epidemiologic studies has provided answers to some of the questions raised by Rowan. These studies have utilized a variety of epidemiologic methodologies including observational (descriptive and analytic), experimental (intervention), and qualitative designs. In this talk I will highlight the results from some of these studies, point out some of the remaining gaps, and discuss the challenges to epidemiologists in disseminating and interpreting the data and assisting shelters to develop sound policies based on these results.

3. Demographic characteristics of community animals

Repeated efforts by humane groups to have pet-related questions inserted into the human census in the U.S. have been unsuccessful. Therefore, surveys such as those by the Pet Food Institute (NPD, 2003), the American Pet Products Manufacturer’s Association (APPMA, 2000) and the American Veterinary Medical Association (AVMA, 2002) provide the data most widely quoted for pet populations. These surveys, conducted by commercial survey companies, are based on non-randomly assembled household panels selected to be representative of American households on factors such as income, household size and market size (Patronek and Rowan, 1995). Estimates of the size of owned canine and feline populations from two of these studies are provided in Table 1. Patronek and his colleagues compared results of these panel-based surveys with those obtained from community and regional studies conducted using random digit dialing, and suggested that the estimates derived from household panels might overestimate pet populations by as much as twenty percent (Patronek and Rowan, 1995).

Using data from the 1992 AVMA survey (AVMA, 1992), from shelters in the states of Iowa and Washington and from previous studies, Patronek and Glickman (1994) also developed a model of U.S. dog population dynamics, underscoring the complexity and lack of information regarding pet movement in this country. Their model provided estimates such as canine birth and death rates, reproductive rates among female dogs and pet retention rates in homes, some of which have been replicated in subsequent studies. For example, the NCPPSP sponsored-National Household Study provided estimates of canine birth and death rates (New et al., 2004) remarkably similar to those predicted from the Patronek et al. model (Table 2). Similarly, the

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Estimates of owned dog and cat populations, % of households owning and animals per household by source of estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AVMA(^a) (in thousands)</td>
</tr>
<tr>
<td>No. of U.S. households</td>
<td>104,856</td>
</tr>
<tr>
<td>No. of dogs</td>
<td>61,572</td>
</tr>
<tr>
<td>% of households with dogs</td>
<td>36.1</td>
</tr>
<tr>
<td>Dogs per household</td>
<td>1.6</td>
</tr>
<tr>
<td>No. of cats</td>
<td>70,796</td>
</tr>
<tr>
<td>% of households with cats</td>
<td>31.6</td>
</tr>
<tr>
<td>Cats per household</td>
<td>2.1</td>
</tr>
</tbody>
</table>

\(^a\) America Veterinary Medical Association (2002).

\(^b\) Pet Food Institute, NPD Group (2003).
model suggested that only 2.8% of dog-owning households were responsible for dog births, consistent with the 2.6% estimate (95% confidence interval: 2.1–3.1%) provided by the household survey in dog-owning households (New et al., 2004). The Patronek et al. model also suggested far smaller estimates of total shelter euthanasia’s than previously reported (see shelter demographics section below).

Despite the large stray cat population in the United States, a similar model for cats has not been developed. The National Household Study, however, offered insight into the dynamics of the national owned cat population. The crude birth rate for owned cats (11.2 kittens/100 cats) was similar to that of dogs (11.4 puppies/100 dogs), but undoubtedly underestimated the true feline birth rate because of the large un-owned, largely un-neutered, cat population in the U.S. More American households (5.2%: 95% C.I.: 4.5–5.9%) reported cats queening annually as compared to dogs, and litters of kittens were almost twice as likely to be unplanned (83% were unplanned) as compared to puppies (43% were unplanned). Reasons cited for unplanned kittens included cost of neutering, inconvenience of scheduling the surgery, undetected heat and belief that female cats were too young to become pregnant. For dogs, undetected heat, cost, and lack of time for neutering were the top reasons cited for unplanned pregnancies (New et al., 2004). These results are similar to those of previous studies (Johnson, 1997; Patronek et al., 1997). Such data are important to humane and veterinary organizations. Many shelters run low- or no-cost spay/neuter programs that are often unpopular with community veterinarians. These data and those of other surveys document that cost is an issue preventing some animal owners from having their animals neutered and resulting in the birth of unplanned litters. These data also support veterinary and humane organization efforts to enhance the convenience of surgery, to continue educating pet owners regarding the age range when dogs and cats attain sexual maturity, the necessity of neutering, and the advantages of neutering before the traditionally recommended age of 6 months.

Not surprisingly, the death rates estimated from the household data were lower than the birth rates. If the number of animal-owning households in a community remains constant, communities should strive to reach an equilibrium between the birth and death rates, such that use of euthanasia as a population control tool is unnecessary.

Births and deaths accounted for only a portion of pet movement in U.S. households. Animals left their homes for a variety of other reasons. In the National Household Study, it was estimated that over 18 million adult dogs and cats left their households annually, only 43% of whom died or were euthanized (New et al., 2004). The reasons for turnover included surrender to shelters, given
or sold to new homes, disappeared and miscellaneous reasons. The disappearance of cats was
about 3 times that of dogs. The data document the importance of programs to identify cats
permanently, encourage people to check their local shelters within 2–3 days of a cat’s
disappearance, and underscore the wisdom of keeping cats indoors. For those that wonder at the
sources of stray cats in their communities, these data document a continuing source of such
animals.

4. Demographic characteristics of shelter animals (descriptive studies)

Providing accurate national statistics regarding the number and disposition of animals in
animal shelters is limited by the lack of information regarding the number and type of shelters
operating in the U.S. The Shelter Statistics Study in the mid 1990s attempted to identify all U.S.
shelters, but was thwarted by: (1) shelter suspicion about providing data, (2) the birth and
disappearance of organizations (e.g., rescue groups), (3) changes in the names and locations of
shelters and (4) the lack of a standard definition of shelter (Zawistowski and Morris, 1998). The
lack of a sampling frame and the reluctance of some identified shelters to provide data has
resulted in widely conflicting estimates of the numbers of dogs and cats euthanized in animal
shelters. In 1990, the Humane Society of the United States suggested that 7.5 million dogs and
cats were euthanized in shelters in the U.S (Cassidy, 1990). Also in that year an American
Humane Association survey (based on reports of 140 non-randomly selected animal shelters in
the U.S.) estimated that 5.4–9.1 million dogs and 5.7–9.5 million cats were euthanized in the U.S.
shelters (Nasser et al., 1992). These and similarly collected figures were widely quoted by
humane and veterinary groups to draw attention to the problem of excess pet euthanasia.

Using the model previously described, Patronek and Glickman (1994) estimated that 2.2
million dogs was a more valid estimate of the number of euthanasiast. Since about 2 cats enter
shelters for every dog admitted, it has been estimated that at least 4 million cats are euthanized
annually. Local statistics in many shelters and anecdotal stories suggest that progress towards
reducing euthanasiast has been made, but since these estimates have not been scientifically
estimated, particularly at the national level, an accurate assessment of the magnitude of
euthanasiast and accurate tracking of national trends remains impossible.

I have avoided using the terminology, pet overpopulation, because it suggests that if only
birth rates could be reduced, the euthanasiast of healthy dogs and cats would cease.
Anecdotally, shelters, particularly in urban areas in the Northern U.S., have been reporting
declines in the numbers of puppies entering their facilities for many years. Data from several
studies have now documented this trend. The single largest age group of dogs in many
shelters is the adolescent animal (between 6 months and 2 years of age; Salman et al., 1998).
In fact, people looking for puppies in many shelters are strongly encouraged to adopt an adult
dog or have their names added to a waiting list for puppies. The large adolescent dog
population in shelters was owned, but the bond with humans either never formed or was too
weak to withstand the test of time. Understanding the reasons underlying these weak bonds is
essential to the generation of programs to support human–animal relationships before the
decision to relinquish is made.

Data suggest that the situation for cats is somewhat different. Kittens remained the single
largest age group in shelters, constituting 38.1% of cats in shelters in the Shelter Relinquishment
Study (New et al., 2000). The second largest age group of cats was young, previously owned,
adolescent animals. Understanding the reasons for the dissolution of bonds with human owners is
similarly crucial to the development of effective intervention strategies for cats.
4.1. Sources of pets

The top three sources people used to acquire dogs were friends, shelters, and breeders, and for cats, the top sources were friends, strays and shelters (New et al., 2004). Insuring the availability of good advice at the time of adoption is limited by these sources. While the quality of adoption counseling in shelters and by breeders can be good, the quality of advise is more difficult to influence from sources such as friends, neighbors, or strangers that are responsible for a large proportion of adoptions. Making good pre-adoption information available to adopters regarding such factors as pet costs, normal behaviors, and time commitment, remains an important challenge. The veterinary and humane communities can influence the quality of adoptions by making innovative approaches to providing information regarding pet selection available to potential adopters.

People surrendering adult dogs and cats to animal shelters were most likely to have originally acquired their pet from friends. Shelters and breeders were the other top two original sources of surrendered dogs, and shelters and the stray cat population were the top two other sources of cats. As discussed previously, the nature of these sources complicates the genesis of programs to provide good adoption counseling regarding expectations of costs, behavior, and other issues at time of adoption that could reduce relinquishments for these reasons.

5. Risk factors for relinquishment (analytic observational studies)

Since preventive programs are needed, the necessity for studies of risk factors for relinquishment was obvious. Several descriptive and case-control studies have confirmed the importance of suspected risk factors (e.g., behavior), contradicted others long-accepted as shelter dogma (e.g., animals as gifts), and highlighted characteristics of animals and their owners that place animals at high risk of relinquishment to shelters (Patronek et al., 1996a, 1996b; New et al., 2002; Kass and Hart, 1998).

For example, several studies identified animals owned less than 1 year, of young age, mixed breeding, acquired at low cost and housed outside the home as at higher risk of relinquishment than those not having these characteristics (New et al., 2002; Patronek et al., 1996a, 1996b). Similarly, owners with low educational achievement, low income, less than 1 year at their residence or occupying an apartment were at higher risk than those not having these characteristics. Perhaps most surprising to some, was the identification of households with children as being at high risk of surrendering family pets (compared to households with no children), calling into question the portrait of parents, children and their pet as the “ideal” American family (Kidd et al., 1992a, 1992b; Patronek et al., 1996a).

When the reasons for relinquishment were examined, behavioral issues among both dogs and cats were among the most important (Neidhart and Boyd, 2002; Patronek et al., 1996a, 1996b; New et al., 2002; Kass and Hart, 1998). Approximately 40% of dogs surrendered and 28% of cats surrendered to shelters had at least one unwanted behavior as one of the reasons for relinquishment (Salman et al., 1998). Aggression (to animals or people), destructive behaviors and eliminating inappropriately in the house were consistently among the top three behavioral categories associated with relinquishment (with most odds ratios twofold and higher among animals displaying these behaviors) (New et al., 2002; Patronek et al., 1996a, 1996b).

In contrast to the belief of some veterinarians, many animals in shelters have been relinquished from households that utilize veterinary services (Salman et al., 1998). Contact with veterinarians represents an opportunity for intervention for reasons amenable to intervention and
successful resolution. Seventy percent of dogs relinquished to 12 shelters from 4 regions of the country had been to a veterinarian at least once in the year preceding surrender. The percentage of cats seeing a veterinarian in the year before relinquishment was smaller (50%), but still significant. Patronek et al. (1996a) evaluated the impact of veterinary contact on the likelihood of relinquishment, finding that dogs with veterinary care were 3–13 times less likely to be surrendered (depending on the particular behaviors they were displaying) than animals not receiving such care. Similar results were not found for cats receiving veterinary attention (Patronek et al., 1996b). More research into the reason(s) for this discrepancy is needed.

Other potentially modifiable factors identified to be associated with increased risk of relinquishment include having specific expectations before adoption (cats), inappropriate expectations associated with ownership (dogs, cats), lack of obedience training (dogs), and lack of close attachment (dogs, cats) (Patronek et al., 1996a, 1996b). Dissemination of this information to shelter adoption counselors and veterinarians should lead to measures enhancing adoption counseling and recommendations to strengthen human–animal bonds.

6. Other studies

Since studies of factors impacting the development and maintenance of relationships between humans and pets require measurements of variables such as attachment or feelings of well-being, the skills of sociologists and psychologists have contributed also to understanding of the human/animal bond and its dissolution (Kidd et al., 1992a, 1992b). Similarly, since reasons for human behaviors (such as relinquishment or choosing not to neuter pets) are often complex, studies using qualitative designs have provided greater insight into such behaviors. For example, an in-depth interview protocol with a small sample of people following surrender of their animals revealed that most people struggled for an extended period before relinquishment (DiGiacomo et al., 1999). These data help explain why strategies such as telling people at the time of surrender that the animal will be euthanized does little to change owners’ decisions. Based on results from these and other studies, intervention studies are underway to improve adoption counseling and increase the percentage of adopted animals retained in their adoptive homes. Similarly, many shelters are providing advice to pet owners regarding behavioral problems.

6.1. Epidemiologists and their role in development of public policy

With the rapid accumulation of new data comes the task of disseminating results to the appropriate people, explaining their strengths and limitations, and assisting policy makers translate appropriate results into reasonable policy. Disseminating the results is one challenge. Frequently, potential policy makers (e.g., staff at national humane organizations, executive directors and managers of animal shelters) do not have ready access to the scientific literature and when they do have access, the literature is written in the professional jargon of epidemiologists. Presentations at national humane and veterinary meetings reach only a select segment of these populations. Postings on the web and trade magazines help, but articles are frequently written by lay people with little understanding of epidemiologic design and data issues. Representatives of other constituencies (such as state and local legislative bodies, or local administrators) may simply be unaware that data exist. Even when studies are available, issues familiar to epidemiologists (such as the difficulty of establishing causation in risk factor studies or the need for replication of studies) are unfamiliar to most pet policy makers. The challenge to epidemiologists is to determine how best to disseminate and translate their results.
Are the translation and dissemination of epidemiological data to policy makers the purview of veterinary epidemiologists? In Public Health it has been argued that epidemiology should be more than a set of designs and methods (King, 2004; Beaglehole and Bonita, 1997). Proponents of this view believe that epidemiologists should be encouraged to discuss policy implications of their research and assist policy makers in making good policy. William Forge (former Director of the Centers for Disease Control) coined the terminology *consequential epidemiology* to describe applied research that has the potential to improve public health policy. In the relatively small circle of people interested in pet issues, if epidemiologists do not assist in interpretation of the results of their studies, it is questionable who can.

Identifying and utilizing the “best” means to provide input, however, presents a continuing challenge to veterinary epidemiologists. Presentations by epidemiologist using lay language at national humane meetings (e.g., Animal Care Expo) are one means of disseminating and interpreting results from epidemiologic studies for members of the humane community. Other venues for presentations could include the annual meetings of organizations such as the Society for Animal Welfare Administrators or the American Humane Association. Leaders in the humane field are often well represented at these meetings and can transmit information back to their respective shelters and communities. To facilitate these presentations, epidemiologists must plan time to attend meetings that are not usually on their travel docket.

Similarly, articles in non-scientific magazines such as the widely read magazine, *Animal Sheltering* (published by the Humane Society of the United States), are another means to share information with non-epidemiologists. Personal relationships with veterinarians working in shelters and with other members of the humane community facilitate dissemination of accurate information regarding epidemiologic studies and may be among the most effective (if not efficient) means to explain epidemiologic results and influence policy (both within shelters and within the national humane organizations).

Influencing policy in veterinary organizations is, perhaps, the most challenging. Long-standing distrust between the humane and veterinary communities regarding companion animal welfare issues (particularly, subsidized spay/neuter programs) complicates the dissemination of data collected in epidemiologic studies regarding companion animal welfare and shelter issues. Veterinary epidemiologists are publishing an increasing number of studies relating to shelters and companion animal welfare in scientific veterinary journals. This ensures that the information is accessible to those interested in the issues. Similarly, presentations at national veterinary meetings (such as at the North American Veterinary Conference) have the potential to reach many veterinarians. Active participation in veterinary organizations may be another means to reach veterinarians who are influential in setting policy in organized veterinary medicine. Despite utilizing the methods discussed above, the dissemination of information and translation into reasonable policy is likely to remain challenging for veterinary epidemiologists into the foreseeable future.

7. Summary

In summary, progress has been made towards eliminating Rowan’s “statistical black hole”. However, basic data still elude us, including: the actual number of animal shelters in the country, national shelter estimates of impoundments and dispositions (euthanasias, adoptions redemptions), and the effectiveness of programs (e.g., neuter, adoption counseling) in reducing euthanasias to cite a few deficiencies. The challenge in the coming decade will be to continue the progress. Veterinary epidemiologists will continue to play an important role in the generation,
dissemination and translation of results from their studies into coherent, effective companion animal welfare policy.

In closing, I want to thank my former mentor and long-time friend, R.K. Anderson, for instilling in me the importance of an inquisitive and analytic mind, for modeling enthusiasm and integrity in all that you did, and for treating everyone (students, co-workers and colleagues) with honesty and respect. R.K., you have been the single most important influence on my professional career. Thank you.

Conflict of interest statement

The author (JMS) does not have a financial or personal relationship with other people or organizations that could inappropriately influence or bias the paper entitled “Interface of epidemiology, pet population issues and policy.”

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