Impact of Publicly Sponsored Neutering Programs on Animal Population Dynamics at Animal Shelters: The New Hampshire and Austin Experiences

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This study found that government-funded surgical sterilization of companion animals has been widely promoted as a means of decreasing shelter intake and euthanasia. However, little information is available about the true impact of these programs on community and shelter nonhuman animal population dynamics. This study estimated the impact of the Animal Population Control Program in New Hampshire by comparing shelter intake and euthanasia data before and after the onset of the neutering initiative. Regression analysis demonstrated a significant decrease in cat intake and euthanasia during the years after program onset, a trend that appears to begin prior to the program’s initiation; however, there was no decrease in dog intake or euthanasia. This study also estimated the impact of the Austin-based EmanciPET Free Spay/Neuter Program by comparing shelter intake and euthanasia data from the targeted program areas versus nonprogram areas within the city. Regression analysis demonstrated a significantly lower rate of increase for dog and cat intake and euthanasia in the program areas. Prospective studies should determine the effectiveness and affordability of different models for funding and delivering neutering services.

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Various approaches have been adopted by communities in the United States to diminish the intake and euthanasia of nonhuman animals, dogs and cats, in animal shelters. Community programs vary by their funding source, geographic location, target populations, and the strategies employed. Many of the programs include neutering of dogs and cats as the centerpiece of their efforts. Unfortunately, most programs lack an evaluation component, making it impossible to assess their effectiveness and to facilitate comparisons across programs. As more communities seek strategies to diminish animal-control costs and euthanasia of dogs and cats in their own shelters, it is imperative that data be analyzed from current programs to determine the effectiveness and relative costs of different approaches.

Previously published studies have shown the effectiveness of certain models of neutering programs on reducing dog and cat overpopulation. Trap-neuter-return (TNR) programs have been studied in both cats and dogs. A TNR program in Jaipur, India, sterilized and rabies-vaccinated 24,986 dogs between 1994 and 2002. Direct observational surveys of the local dog population indicated that 65% of the females were sterilized and vaccinated and that the population declined by 28% (Recce & Chawla, 2006). A study of a cat colony on a university campus in Florida saw a 66% decrease in the resident cat population after the onset of a TNR program and concluded that a comprehensive long-term program of neutering followed by adoption or return to the resident colony can result in a sustained reduction of free-roaming cat populations in urban areas (Levy, Gale, & Gale, 2003).

Another model for neuter delivery for animal population control is low-cost, subsidized, targeted neutering programs for companion animals in low-income households. One analysis of this type of neutering delivery in five Maddie's Fund community programs (the state of Utah [all large counties], the state of Alabama [all large counties], Maricopa County in Arizona, Lodi in California, and Alachua County in Florida) showed no clear impact of total spays and castrations (hereinafter collectively referred to as neuters) on shelter intake (Frank & Carlisle-Frank, 2007). However, this analysis demonstrated that low-cost neutering programs are effective at increasing the total number of neuters in the program community rather than simply causing a substitution of sources for neutering services. In one mathematical model of neutering for animal population control, neutering programs were found to be effective at reducing shelter euthanasia. However, the model also predicted that the full impact of a one-time permanent increase in the neutering rate may not be felt for as much as 40 years (Frank, 2004).

American Veterinary Medical Association (AVMA) policy guidelines for dog and cat population control (AVMA, 2005) indicate that "state and local governments must . . . promote surgical and nonsurgical sterilization of intact
dogs and cats.” However, there are no published analyses of outcomes from state or locally funded neutering programs on which to base this assertion. The purpose of this study was to evaluate the impact and cost of two long-standing government-funded neutering programs: the Animal Population Control Program in New Hampshire and the Austin-based EmanciPET Free Spay/Neuter Program on admission rates and euthanasias at animal shelters.

MATERIALS AND METHODS

Description of New Hampshire Animal Population Control Program

In 1993, the New Hampshire legislature passed two state-funded neutering assistance programs (State of New Hampshire, 1993). These programs began July 1, 1994, and have been operating since that time. Funding is derived from a $2 surcharge on all dog licenses issued in the state annually and maintained in a dedicated account by the State Treasurer. The program utilizes veterinarians throughout the state who agree to accept 80% of their customary fee for services (State of New Hampshire, 1994). The number of animals neutered each year is limited by the availability of funds. Initial poor licensing compliance was increased with a requirement that veterinarians send copies of all the rabies certificates they issued to local licensing officials, a procedure that increased licenses by 50% (Marsh, 2003). Despite this increased compliance rate, calculations based on the AVMA's U.S. Pet Ownership Calculator (AVMA, 2008) indicate that approximately half of the dogs in New Hampshire are still not licensed.

The New Hampshire initiative has two programs: a shelter adopter’s program and a low-income program. In the shelter adopter’s program (Plan A), New Hampshire residents adopting unaltered animals from New Hampshire animal shelters pay a copayment (originally $25, currently $40) to have their animals neutered at participating veterinary hospitals. The low-income program (Plan B) is open to recipients of Medicaid, food stamps, and help from any of five other public assistance programs in New Hampshire. These clients pay a copayment (originally $10, currently $25) to have their dogs or cats sterilized (and immunized) by participating veterinarians (State of New Hampshire, 1993, 2005). Initially, the Animal Population Control Program (APCP) did not limit the number of pets per household participating in the program; however, since fiscal year 2004, the state veterinarian has imposed a limit of three pets per household per year (P. Marsh, personal communication, March 12, 2008). The state subsequently reimburses veterinarians for the cost of surgery and
all postsurgical care (up to the prenegotiated cost of the surgery as described earlier). Presurgical examinations and immunizations are the responsibility of the adopters and owners.

The New Hampshire Federation of Humane Organizations (NHFHO) collected shelter animal intake and disposition data for member organizations from 1983 through 2005. The NHFHO membership includes all the large, nonprofit humane societies in New Hampshire; the organization estimates that its statistics represent more than 95% of sheltered animals in New Hampshire. These data were made available for analysis in this report. Data from the New Hampshire state APCP regarding numbers and types of surgeries performed each year are reported by the New Hampshire Department of Agriculture. APCP data for this study were collected through fiscal year 2006, which ended on June 30, 2006.

Demographic data for New Hampshire were obtained through the U.S. Census Bureau Web site (http://factfinder.census.gov). Calculations based on these data indicate that human population in New Hampshire grew at annualized rates of 1.86% between 1980 and 1990, 1.08% between 1990 and 2000, and 1.11% between 2000 and 2005.

Description of EmanciPET Free Spay/Neuter Program

Since 2000, the City of Austin, in conjunction with EmanciPET Mobile Spay/Neuter Clinic, a nonprofit organization, has offered a free neutering program in targeted zip codes in East, South, and Southeast areas of Austin and Travis County. The free program operates 2 days a week for 9 months of the year and 1 day a week for the remaining 3 months of the year. This program is funded by the City of Austin. The Mobile Spay/Neuter Clinic is not open to residents of other zip codes on those days. The program also provides rabies vaccination and city registration at no charge to the owner. Client eligibility for the program is confirmed by staff at the time of animal intake by verifying that the address given for purposes of pet registration corresponds to the eligible areas.

The City of Austin is located mostly, although not entirely, within Travis County. Austin is centrally located in Travis County and is the largest city in the county. Travis County has 49 zip codes (excluding zip codes for post office boxes and organizations). In addition, the City of Austin extends into 3 zip codes outside Travis County, leading to a total of 52 residential zip codes (Figure 1) served by Town Lake Animal Center (TLAC).

The program is free to residents who live in one of seven targeted zip codes. Target zip code selection was based on zip codes having a comparatively high shelter intake, a scarcity of veterinary facilities, and a relatively low average household income (United States Census Bureau, 2008). As compared with overall demographics for the City of Austin, all target zip codes had a lower median household income:
Overall, despite the selection criteria, shelter intake from these zip codes is proportional to the size of the human population. In 1999, prior to program onset, the target zip codes' human population comprised 20.7% of the population of Travis County. The 20.7% included the portions of adjacent Williamson and Hays counties located in the City of Austin, as well as the portion of one of the target zip codes located in Bastrop County (United States Census Bureau, 2008), and was responsible for 21.7% of shelter intakes at TLAC. Zip code information at TLAC was collected at animal admission from the surrendering person or from the animal-control officer. Zip code information was available for nearly 99% of incoming cats and dogs.

Human population growth from 2000 to 2005 for the target zip codes as a group was similar to population growth in Austin as a whole. Calculations based on a City of Austin zip code population forecast (Robinson, 2004) estimate that
human population in the target zip codes grew at an annualized rate of 1.17%, and the population of the entire City of Austin grew at 1.24% per year.

Five of the seven target zip codes contain no veterinary facilities; the other two zip codes together contain 11 practices (Magic Yellow, 2007). Travis County is home to 81 veterinary practices. Thus, the target zip codes house only 13.5% of the veterinary services in the county but contain more than 21% of the county’s population (United States Census Bureau, 2008) and 12.5% of the county’s landmass (BrainyMedia, 2007).

The TLAC is the largest animal shelter in Central Texas, providing shelter to more than 23,000 animals annually and animal-control services to all of Austin and Travis County. TLAC receives approximately 90% of the cat and dog shelter intakes in Travis County. It is a division of the Austin/Travis County Health and Human Services Department and is the only open-admission facility in Austin/Travis County (City of Austin, 2007).

TLAC dog and cat intake and disposition data from 1998 to October 2007 were collected from the shelter database. Number of neuter surgeries, percentage of dogs and cats, and cost to the City of Austin for the EmanciPET free neutering program were collected. Human demographic data for Austin by zip code were obtained through the U.S. Census Bureau Web site from 2000 to 2006.

Statistical Analysis

New Hampshire data were available only on a yearly basis, but the Austin data were analyzed on a monthly basis to maximize the information content and explanatory power. Linear regression was used to analyze cat and dog intake and euthanasia trends by year in each of the study areas for before and after initiation of the spay/neuter program (New Hampshire) and within and outside of the spay/neuter program areas (Austin, TX). All calculations were performed in Microsoft Excel using the Poptools add-in module (Hood, 2008).

The potential effect of the government-funded targeted neutering program on these trends was assessed by comparing the regression slopes using a t statistic, which tests the null hypothesis that the difference between two regression slopes is zero (Kleinbaum, Lawrence, Kupper, & Muller, 1997). The slope estimates in these analyses indicate the estimated rate of increase (or decrease) in the number of animals admitted (or euthanized) per year in the shelters as predicted by the analysis. The $r^2$ values indicate how closely the observed data cluster around the line predicted by the analysis. The closer the $r^2$ is to 1.0, the closer the observed data are to the predicted line and the better the line describes what has been observed. All statistical tests were considered significant at a $p$ value of $\leq .05$. 
RESULTS

New Hampshire

Between July 1994, the date of APCP onset and the beginning of fiscal year (FY) 1995, and June 2006, representing the end of FY 2006, a total of 50,462 surgeries were performed through the APCP, including 32,152 Plan A shelter-adoptees surgeries and 18,410 Plan B low-income surgeries.

Program usage of Plan A by shelter adopters was high. A total of 27% of the sheltered cats and dogs who were not euthanized at the shelters utilized the program from January 1, 1995, to December 31, 2005, with a peak Plan A utilization of 42.2% in 1999. From 2000 onward, the proportion of Plan A to Plan B surgeries began to decline as many NHFHO shelters began to pursue neuter-before-adoptive policies, making these surgeries ineligible for APCP funding. The lowest number of shelter-adoptees surgeries of any program year occurred in FY 2006, with 1,513 Plan A surgeries (Figure 2).

Conversely, APCP utilization by the low-income public was low, with an average of 1.24 surgeries per year per 1,000 New Hampshire residents. It is difficult to pinpoint the number of APCP-eligible New Hampshire citizens because eligibility depends on utilization of assistance programs, and many eligible citizens utilize more than one assistance program. A minimal estimate of eligible households is derived from the number of New Hampshire Food Stamps recipients, which numbered 27,377 households in 2006 (United States Department of Agriculture, 2008). FY 2006 was also the year of greatest use of APCP’s Plan B, with 2,318 surgeries performed. Thus, given the minimum estimate for eligibility, the annual APCP usage by low-income pet owners

![Figure 2](image-url)  
**FIGURE 2** Number of surgeries performed annually under New Hampshire's Animal Population Control Program.
reaches a maximum of 8.5% of the eligible households each year. In fact, the percentage of eligible households utilizing the program is likely to be much lower than this due to multiple pets from one household utilizing the program as well as greater program eligibility than can be estimated on the basis of food stamp recipients alone.

Cats represented a majority of patients in the program, comprising 77.4% of APCP surgeries since 1998 when tracking by species began. Cats have increased from 71% of patients in 1998 to 81% of patients in 2006. A lack of adequate funding to meet demand for the APCP limited the program’s capacity during 6 of the 12 study years. The APCP ceases to fund more surgeries during a fiscal year once it has used up its funds for that year. Because the New Hampshire fiscal year ends on June 30, this led to suspension of the program during the spring of each affected year, with resumption occurring with the onset of the new fiscal year on July 1. In total, during the 12 program years, the APCP was unavailable for use during 17 months, or 12% of the time.

During the years of the study, the State of New Hampshire’s cost for the program totaled $2,610,713. The average cost to the program (excluding the copayment) per surgery in FY 1995 (July 1994–June 1995) was $35.79; the average cost to the program (excluding the copayment) per surgery in FY 2006 was $81.23.

In 2003, the NHFHO began separately tracking the number of animals transferred into New Hampshire shelters from other shelters or rescue organizations. By 2005, 1,249 of 5,435 dogs (22.9%) admitted to New Hampshire shelters were transferred from other organizations. The majority of these dogs (77.5%) were transferred into New Hampshire from out of state. By contrast, transfer of cats in New Hampshire shelters is minimal. In 2005, only 143 of 10,168 cats (1.4%) admitted to New Hampshire shelters were transferred from other organizations, and only 41 of these cats (29% of cat transfers, or 0.4% of total shelter cats) were transferred into New Hampshire from out of state. Prior to 2005, these out-of-state transport animals were eligible to use the APCP; however, in 2005, a revision to the APCP statute discontinued their eligibility.

Cat-intake numbers were generally increasing from 1983 until peaking in 1992, 2 years before the program was initiated. Postprogram cat-intake numbers have declined significantly. From 2001 to 2005, cat intake appears to be increasing again, although it remains below the preprogram levels. The pre- and postprogram slopes are significantly different ($t = 4.77, p < .001$; Figure 3).

Similarly, cat-euthanasia numbers were generally increasing prior to the program inception, peaking in 1993, 1 year prior to the onset of the APCP. Postprogram cat-euthanasia numbers have declined significantly. Although it is probably too early to state with confidence, the numbers of cat euthanasia appear to have leveled off between 2003 and 2005. The pre- and postprogram slopes are significantly different (Figure 4).
FIGURE 3  Cat intake into New Hampshire shelters (1983–2005). Prior to onset of the Animal Population Control Program in July 1994, cat intake was increasing (squares and dotted line, slope = 297 cats/year, $r^2 = 0.67$, $p = .001$), whereas after program onset cat intake has declined significantly (diamonds and dashed line, slope = $-276$ cats/year, $r^2 = 0.37$, $p = .02$). The pre- and postprogram slopes are significantly different ($t = 4.77$, $p < .001$).

Dog intakes increased to a peak in 1986 and then decreased steadily until APCP onset. The overall trend prior to program onset was a significant decline. Following the introduction of the program, dog intake stabilized until 2000. Since that time, the rate of intakes appears to be increasing again (Figure 5). Since 1983, the overall trend in dog intake has been a significant decline.

Prior to program inception, dog euthanasia numbers were generally decreasing; in contrast to the case for dog intake, postprogram dog-euthanasia numbers have also declined significantly, though at a slower rate. The rate of decline in canine euthanasias slowed significantly after the program was introduced, going from a decline of approximately 248 dogs per year preprogram to a decline of 77 dogs per year postprogram (Figure 6).

EmanciPET

The EmanciPET Free Spay/Neuter Program altered 7,166 dogs and 8,931 cats between October 2000 and September 2007 for an average of 2,300 surgeries annually. According to the 2000 census, there were approximately 66,668 households, or 171,866 individuals, in the target area. Thus, the average annual
program usage was 13.4 surgeries per 1,000 residents, or 35 surgeries per 1,000 households.

Throughout the study period, dog and cat intakes and euthanasias at TLAC increased for both target and nontarget zip codes. However, the rate of increase for all these parameters was greater in nontarget zip codes as compared with targeted zip codes. Monthly cat intakes and euthanasias appear to vary according to a strong cyclical pattern, whereas the seasonal variations in dog intakes and euthanasias are less obvious.

Although cat intake and euthanasia numbers in both program and nonprogram areas have increased significantly over time, the slope for the program areas is significantly lower than for the nonprogram areas. Cat intake in nonprogram areas increased 4.2 times faster, and euthanasia rates increased 3.7 times faster than in program areas, although the impact in actual numbers of cats is small (Figures 7 and 8). For example, over a 12-month period, the rate of increase was approximately 10 fewer cats admitted to the shelter from the program compared with the nonprogram areas.

Although dog intake and euthanasia numbers in both program and nonprogram areas have increased significantly over time, the slope for the program areas is significantly lower than for the nonprogram areas. Dog intake in nonprogram
areas increased 6.1 times faster than in program areas, and dog euthanasia in nonprogram areas increased 3.1 times faster than in program areas (Figures 9 and 10). As was true for cats, the impact on the actual rate of intake and euthanasia between the two areas was small.

Intake data from TLAC were further examined to determine whether there was a change in the relative intake of juvenile versus adult cats and dogs admitted to TLAC during the study period. For cats, there were no significant trends in the intake of kittens in program ($r^2 = 0.002$, $p = .63$) or nonprogram ($r^2 = 0.01$, $p = .32$) areas. There was a very slight but significant increase in proportion of intake composed of puppies from nonprogram areas ($r^2 = 0.06$, $p = .006$), whereas there was no significant trend in proportion of intake composed of puppies from program areas ($r^2 = 0.01$, $p = .75$).

**DISCUSSION**

The New Hampshire APCP and the EmanciPET Free Spay Neuter Program represent two different methods of providing government-subsidized neutering services to targeted pet populations. Each program has funded the neutering...
FIGURE 6 Dog euthanasia totals for New Hampshire shelters (1983–2005). Dog euthanasia declined steeply prior to Animal Population Control Program onset in 1994 (squares and dotted line, slope = −248 dogs/year, \( r^2 = 0.74, p = .0004 \)) and have declined slightly since that time (diamonds and dashed line, slope = −77 dogs/year, \( r^2 = 0.67, p = .0007 \)). The pre- and postprogram slopes are significantly different but, unlike cat trends, are in the same direction (\( t = 3.56, p < .001 \)).

of thousands of animals from the target groups during the study period; each program continues to function at the present time.

The changes in human population during the study periods were small, relatively consistent over time within each study area, and consistent between target and nontarget areas in both Austin and New Hampshire. Thus, shelter-animal intake data were not corrected based on human population increases prior to analysis.

New Hampshire

The New Hampshire APCP is a statewide neutering assistance program enacted by the New Hampshire legislature in 1993 and funded by a $2 surcharge on all dog licenses in the state. Analysis of New Hampshire animal-shelter intake and euthanasia rates prior to and after the onset of the statewide program shows that although the program was not associated with an accelerated decrease in dog intake and euthanasia compared with previous years, both cat intake and euthanasia decreased in the years following passage of the APCP.

The overall declines in shelter intake and euthanasia in New Hampshire documented since the early 1990s have been presented previously and attributed
to the APCP, though without statistical analysis or historical perspective. Handy (2001) reported that in the first 6 years of APCP operation, 30,985 fewer dogs and cats entered New Hampshire shelters compared with the 6 years preceding the program. With an estimated average cost of $105/animal to impound and shelter each animal, Handy estimated a savings in impoundment costs alone of $3.2 million. Because the total cost of the program during that same time interval was just over $1 million, Handy stated that taxpayers saved about $3.23 for every dollar spent on the program. However, this analysis assumes that if the program did not exist, all animals neutered in the program would have been admitted to animal shelters and that the total costs of animal control and sheltering are directly related to the number of animals admitted. This is not correct because there are certain fixed costs of maintaining a facility and maintaining animal-control services.

Although housing a smaller number of animals is likely to result in some savings, in many cases reduced intake allows animal shelters to house animals longer and to reduce euthanasia rates without reducing actual costs. Animal sheltering costs are not necessarily reduced when intake numbers fall. Analyses
FIGURE 8  Cat euthanasia numbers at Austin’s Town Lake Animal Center from EmanciPET Free Spay/Neuter Program areas (nonfilled squares) and nonprogram areas (filled squares). The program began in October 2000. Cat euthanasia numbers in nonprogram areas (slope = 1.03 cats/month, \( r^2 = 0.22, p < .0001 \)) and program areas (slope = 0.28 cats/month, \( r^2 = 0.20, p < .0001 \)) have increased significantly over time. However, the slope in program areas was significantly lower than that in nonprogram areas (\( t = 3.76, p < .0001 \)).

of animal-control budgets in New Hampshire are also problematic as all the large shelters in the state are nonprofits funded by private donations. Budget variations may depend more on individual organizations’ changing leadership and missions during the study period than on the number of animals cared for. Government contributions to New Hampshire shelters are generally limited to municipal stray dog contracts, which fund the housing of stray dogs during the legally mandated holding period. Because dog intake and euthanasia do not appear to be related to the APCP, municipalities would not have seen any decrease in animal-control contract expenses due to the program.

Handy’s (2001) report, however compelling it may be, fails to analyze the widely divergent trends in cat versus dog intake that has occurred in New Hampshire shelters since the 1980s. Dog intake and euthanasia numbers in New Hampshire have been decreasing since the 1980s, well before the program’s onset, whereas cat intake and euthanasia reached a peak in the early 1990s, just prior to the program’s onset. Furthermore, larger, regional trends toward decreased shelter intake and decreased euthanasias throughout New England in the late 1980s and 1990s (Howard, 1992; Maine Federation of Humane Societies,
FIGURE 9  Dog intake into Austin's Town Lake Animal Center from EmanciPET Free Spay/Neuter Program areas (nonfilled squares) and nonprogram areas (filled squares). The program began in October 2000. Dog intake numbers in nonprogram areas (slope = 1.22 dogs/month, \( r^2 = 0.54, p < .0001 \)) and program areas (slope = 0.20 dogs/month, \( r^2 = 0.17, p < .0001 \)) have increased significantly. However, the slope in program areas was significantly lower than that in nonprogram areas (\( t = 3.36, p < .0001 \)).

2005: Vermont Humane Federation, 2003, 2004) are not taken into consideration in previous presentations of the data.

In recent years, dog intake in New Hampshire shelters has increased. This increase is in part due to the effects of in-state and out-of-state transfer of dogs into NHFHO shelters, which the NHFHO began tracking in 2003. In 2005, nearly a quarter of the dogs admitted to NHFHO shelters had been transferred from another shelter, and more than three quarters of these transferred dogs came from out-of-state shelters. This increased intake due to transport has complicated the use of shelter dog intake as a measure of dog overpopulation in the state and also may be a factor in New Hampshire shelters' declining use of Plan A. By means of a 2005 revision to New Hampshire's APCP statute, dogs and cats transported from outside New Hampshire are no longer eligible for participation in APCP's Plan A, forcing shelters to establish new means of neutering many shelter dogs.

The actual influence of the APCP on shelter-animal intake and euthanasia in New Hampshire appears to be more complex than previous descriptions imply. The observed results were likely due not only to the direct funding provided for
neuter surgeries but also to the educational and publicity efforts surrounding the legislative effort, the variable degree of influence of the legislation on sheltered animals versus owned animals, and the attitudes of shelter leaders of the time.

The early 1990s saw a galvanization of the humane community in New Hampshire. Shelters utilized public access cable television, public service announcements, political rallies, and activism to publicize the high euthanasia rate of cats in shelters and to push for the passage of neutering legislation (Humane Perspectives, 1992). In 1991, members of the New Hampshire humane community formed Solutions To Overpopulation of Pets (STOP) and began leafleting and lobbying in Concord (Klein, 1991).

Thus, euthanasia was taken out of shelter back rooms and put into public view; the need to curb pet overpopulation was brought to light. The discussion of the bill brought forth support for shelters from the veterinary and legislative communities. Indeed, two thirds of New Hampshire licensed veterinarians participate in the APCP (American Society for the Prevention of Cruelty to Animals [ASPCA], 2007), indicating widespread veterinary support. The effects of this publicity, empowerment, and community support on New Hampshire’s pet-population dynamics are impossible to separate from the effects of the APCP.
legislation itself. It is notable, according to the NHFHIO intake data, that New Hampshire shelter cat intake peaked in 1992, whereas the onset of the APCP occurred in July 1994.

Because a much greater proportion of shelter animals was altered through the program as compared with owned animals, the APCP’s influence on the population of shelter adoptees was likely proportionally greater than its influence on the general population of animals already owned. Before 1994, relatively few shelter animals in New Hampshire were altered by shelters prior to adoption. Several New Hampshire shelters required adopters to pay a refundable deposit when adopting unaltered animals and other shelters provided adopters with neuter certificates for redemption at local veterinarians (J. Bourbeau, personal communication, February 26, 2007; J. McGovern, personal communication, February 25, 2007; B. Troughton, personal communication, April 15, 2007). The APCP provided a means to enhance the numbers of shelter adoptees altered by their new owners; in 1999, its use peaked at more than 42% of surviving shelter animals. Conversely, use of the APCP by low-income families remained low; fewer than 8.5% of the eligible households took advantage of the reduced-cost neutering in any given year.

Secovich (2003) argues that, despite the lower number of surgeries and lower proportion of the target clients served, the Plan B low-income program, not the Plan A shelter adopters program, was likely the major contributing factor in lowering shelter intakes and euthanasias in New Hampshire. Secovich suggests that the principal influence of Plan A was to increase adoptions by making adoption more affordable, whereas Plan B was primarily responsible for lowering shelter intake. This suggestion is based on the assumption that, in the absence of Plan A vouchers, shelters would neuter animals prior to adoption or that shelter adopters would neuter their adopted pets promptly after adoption. However, neuter-before-adoption was not common in New Hampshire shelters at the time of APCP onset, and adopters’ neuter compliance prior to APCP onset is unknown. Thus, the number of Plan A surgeries that would not otherwise have been performed is not known, and it is not possible to determine the differential effect of Plan A and Plan B on the intake and euthanasia trends in New Hampshire.

It has been estimated that approximately 95% of New Hampshire’s shelter animals are included in the NHFHIO data. However, because shelter data reporting to the state is not mandatory, this number is only an estimate. It is not known how many animals are housed by veterinary offices, small independent shelters, municipalities, or other nonmember organizations. It is also not known whether the proportion of sheltered New Hampshire animals who are housed within NHFHIO shelters has changed during the study period.

A key feature of the APCP has been its use of existing veterinary office infrastructure to provide service. This has resulted in wide geographical spread
and low start-up costs as compared with other types of neutering efforts. The use of veterinary clinics also encourages the involvement of the veterinary community throughout in assisting in animal population control and enhances their support for the program. Veterinary support was further enhanced by the inclusion of the Plan A program for altering animals for shelter adopters; veterinarians may see these owners as likely to be better prospects for long-term clients than low-income individuals. However, the use of private practices to provide large numbers of neutering surgeries fails to achieve the economic efficiency of high-quality, high-volume neutering clinics. Between 1995 and 2006, the per-surgery cost to New Hampshire more than doubled from $35.79 in FY 1995 to $81.23 in FY 2006, even as the client copayments increased 60% for Plan A surgeries and 150% for Plan B surgeries during this time. This escalating cost has limited the number of surgeries performed by the program, has been a factor in the program’s early termination during many fiscal years, and has led to an ongoing search for new revenue sources (ASPCA, 2007).

Currently, the APCP is not widely promoted or advertised in New Hampshire, except by the shelters that still use the Plan A shelter adopters program. It is likely that many eligible and potentially interested individuals are unaware of the program. However, because funding limits the number of surgeries performed, wide promotion of the program has not been a priority.

Primarily, the APCP is a program that alters cats but is financed via income from dog licenses, a feature that has plagued it from the beginning (Klein, 1991). Although dog-license income has been a sustainable source of funding for this program, the failure of cats to “pay for themselves” has been fodder for argument in legislative committee hearings and a source of resentment for some in the dog community. Other states or municipalities interested in enacting similar legislation should be aware of this potential resistance and might consider funding sources that avoid this conflict.

Austin

The EmanciPET Free Spay/Neuter Program offers another model for targeted delivery of neuter surgeries. Unlike the New Hampshire APCP, this program operates on a city/county level and targets clients based on geographic demographics rather than based on individual need. Furthermore, unlike APCP, it does not include provisions for funding neutering of shelter animals. Animals adopted from TLAC are neutered prior to adoption if they are healthy and weigh more than 3 lb. Those animals adopted intact are adopted with a $50 deposit, refundable with proof of neuter (City of Austin, 2007).

The divergence in the rates of increase of intakes and euthanasias of animals from targeted and nontargeted areas is significant. The introduction of the free neutering program is the only known intervention that occurred only in the target
The wide monthly variability in dog and cat intake and euthanasia numbers at TLAC, demonstrated by low $r^2$ values, can partly be explained by seasonal variations in reproductive cycles, particularly in the case of cats. Other reasons for the variability in monthly intakes and euthanasias could include the surrender of pets from large households or the onset or resolution of court cases such as hoarding or animal-fighting cases.

The EmanciPET Free Spay/Neuter Program was used by only a small proportion of the target households each year (about 35 surgeries per 1,000 eligible households). Although we cannot identify how many people within these zip codes are pet owners, how many dogs and cats live in these neighborhoods, or how many of the resident dogs and cats are already altered, the low percentage of the human population utilizing the free service suggests that there is still a large proportion of eligible animals who are not seen by the program. Based on the human population of these zip codes, the AVMA pet ownership calculator (AVMA, 2008) estimates that these zip codes would house a population of 43,448 dogs and 49,016 cats. At a rate of 2,300 surgeries annually, the program would have altered approximately 2.5% of the target area’s cats and dogs each year. Because few veterinary practices are located in these zip codes, the number of animals from these neighborhoods altered by private veterinary hospitals may be low; however, these surgeries are not readily available for inclusion in the analysis.

Despite the apparent impact of the free neutering program, the dog and cat intake and euthanasia numbers from both the target and nontarget areas continued to increase during the study period. Furthermore, there was no decrease in the proportion of juvenile cats or dogs admitted to TLAC from target neighborhoods, suggesting that the reproductive capacity of dogs and cats in these areas remained high. Although it appears that the free neutering program has led to a change in the expected rates of increase in intake and euthanasia, a much higher proportion of the animals in target areas would need to be altered to result in a decrease in the proportion of puppies and kittens admitted to TLAC or of the total intake numbers overall.

Many of the advantages of EmanciPET Free Spay/Neuter Program are the opposite of those of New Hampshire’s APCP. A greater economy was achieved by utilizing a high-quality, high-volume neutering service, reducing the total per-surgery cost to the government to an average of $30 and the cost to the client to zero. Conversely, the average cost of surgery for a low-income animal through the New Hampshire APCP in 2006 was $81 from the state and a $25 copayment from the owner: a total of $105 per surgery.
The lack of available data has limited evaluation of each of the programs in this study. In New Hampshire, the breakdown of APCP usage into dogs versus cats in the Plan A (shelter-adopters) and the Plan B (low-income) programs was unavailable. Access to this information might have helped determine the relative influence of Plan A versus Plan B surgeries on shelter intakes. In Austin, the shelter admissions by zip code were unavailable prior to 1999. Without this information, it was impossible to analyze trends before and after the onset of the free neutering program. In both study areas, there was no information available about neutering procedures performed by clinics outside the subsidized program; consequently, the background rate of neutering in the community before and during the subsidized program could not be determined. These weaknesses are a common feature of retrospective studies, which frequently do not allow for inclusion of other factors that contribute to shelter population dynamics. In this study, the total populations of pets in the target areas were not known; also unknown was whether the programs resulted in additional neuters performed above the existing baseline versus providing an alternative funding source for neuters that would have been performed regardless.

Shelter intake and euthanasia numbers are imperfect for use as measures of pet overpopulation, though they are the most specific numbers available. Many homeless or unwanted animals are not served by shelters for various reasons. Some people live in communities with no access to an animal shelter or have limited access to transportation, and others are unable or unwilling to pay the fees that may be charged for relinquishing animals to a shelter. Some unwanted animals never arrive in shelters, die of disease or trauma, or are feral. Shelters may change admission and euthanasia policies, directly affecting animal admission and euthanasia rates.

This study does not show which model for subsidized, targeted neutering delivery is most likely to lead to fewer homeless pets or unwanted litters. Even these long-term, sustainable programs operating at their full capacity have been able to reach only a small portion of the target population. Despite this small population reached, statistically significant changes in shelter intake and euthanasia have occurred—in both dogs and cats in Austin and in cats in New Hampshire. Greater funding of programs or combining these existing programs with other accessible neutering efforts in these study areas would lead to (a) greater surgical capacity, (b) a greater proportion of the target population reached, (c) possibly a greater effect on shelter intake, or (d) a decreasing proportion of juvenile animals admitted to shelters.

In addition to increasing the volume of subsidized surgeries and encouraging more thorough data collection, public education is likely to be a vital part of any successful neutering initiative. The onset of New Hampshire’s APCP was preceded by 3 years of active lobbying and public relations, and decreases in shelter-cat intakes began during the height of this publicity campaign. Advertis-
Neutering remains at the core of any program seeking to reduce pet overpopulation and shelter euthanasia. In the future, prospective studies should be performed in order to determine the effectiveness of different models for funding and delivery of neutering services and to identify best practices. This will allow governments and animal welfare organizations to direct their efforts at the most effective and economical ways of providing neutering services in their communities.

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REFERENCES


