

Human Dimensions of Urban Deer-related Vehicle Accidents in Berkeley, CA**Kim Xuan Tran**

Abstract The neighborhoods of Berkeley, California are an excellent habitat for the Columbian black-tailed deer (*Odocoileus hemionus columbianus*). Despite a large number of deer-related car accidents in Berkeley, the associated economic and health costs have yet to be adequately addressed by government agencies. Participation from neighborhood residents and wildlife experts is necessary to develop a public-approved contemporary wildlife management plan. Surveys were administered to 50 residents from high, medium, and no accident areas (N = 150) to measure public perceptions of causes of accidents, public opinion of animosity towards deer, and public opinion of different potential management plans. Results indicated 61% of surveyed residents believed accidents occurred due to people driving fast. Of the residents who disliked deer, 82% of residents were involved in accidents. Of the residents who liked deer, 89% was not involved in accidents. Residents favored humanitarian forms of acceptable management plans, with 83% of residents approving Light Reflectors and 73% of residents approving public education programs. Even though 21% of residents approved of hunting, 91% of hunting-approved residents have been in an accident. Results support the hypothesis that people who have bad experiences with deer are more likely to dislike deer than those without bad experiences and that residents with more negative experiences with deer tend to support more lethal forms of management. Speed bumps and road signs may be the most effective and environmentally friendly management plan. However, cost/benefit studies should be researched to see if the management program will be feasible and efficient.

Introduction

Within the San Francisco Bay Area region, specifically Alameda County, the Columbian black-tailed deer (*Odocoileus hemionus columbianus*) have coexisted with residential neighbors in urban areas for decades (Jennings 2001). Caused by two main interrelated factors, urban development (Jennings 2001) and urban backyards providing excellent habitat for deer (McCullough et al. 1997), the black-tailed deer have encroached on urban areas using streets and sidewalks as travel corridors (McCullough et al. 1997).

Through urban development, housing lots cross into deer habitat, promoting greater human-deer interactions (Bender et al. 2004). In turn, deer wander through urban neighborhoods discovering food and shelter in backyards without danger of predation. This gives the impression of an excellent habitat where all the means necessary for survival can be found in a backyard (McCullough et al. 1997).

Deer intrusion in urban areas has produced an array of public health and safety issues to urban residents. One concern is gardens, ornamentals, and landscaping that receive heavy damage, especially roses and apples, which wildlife professionals deemed as easy meals to deer (Decker and Gavin 1987, Baker and Fritsch 1997, Curtis and Hauber 1997, Henderson et al. 2000, Bender et al. 2004). A second concern is the transmission of zoonotic diseases, predominantly Lyme disease, to humans. With higher presence of deer in urban environments, chances of infection increases (Decker and Gavin 1987, Baker and Fritsch 1997, Curtis and Hauber 1997). However, in the San Francisco bay area, transmission of Lyme disease is substantially low (possibility of contracting the disease from a deer is between 1 - 2% for residents) and is not a major concern (McCullough et al. 1997).

A third concern is the attraction of natural predators to urban neighborhoods. Mountain lions (*Puma concolor*) and coyotes (*Canis latrans*) naturally hunt in areas with high deer density. With backyards acting as excellent habitats, predators will be attracted to hunt in urban residents and possibly endangering children and domestic pets (Berger et al. 2001).

A fourth concern, which is the basis for this project, is deer-related vehicle accidents. As deer densities increase within vehicle driven areas, the chance of a car collision increases proportionally (Stout et al. 1993, Baker and Fritsch 1997, Curtis and Hauber 1997, Jennings 2001). As people drive more and deer presence increases, increasing number of accidents will generate complex social and economic consequences that have severe economic and health costs

(Sullivan and Messmer 2003). In a 1995 study, an estimated 1.5 million accidents occurred annually in the United States (Conover et al. 1995) and more than 90% of the deer involved in these vehicle collisions died from their injuries (Allen and McCullough 1976). In terms of human casualties, over 29,000 injuries and 211 human fatalities occur nationwide each year (Conover et al. 1995). Accidents recorded were results of head on collisions with deer and motorists or attempts to avoid a head-on collision (Stout et al. 1993). In addition, economic costs are estimated to have surpassed \$1.1 billion in vehicle damages in 1993 with an average vehicle repair cost of \$1,577 (Conover et al. 1995). It is projected that repair costs will continue to rise as new vehicles will become more costly to repair (Stout et al. 1993, Sullivan and Messmer 2003).

Out of the approximate 1.5 million national accidents, Berkeley, California contributed fifty-seven deer carcasses in 2004 (City of Berkeley Animal Control 2004). This poses an alarm for Berkeley residences in terms of public health and economic costs. Studies on the national level indicate that deer-related accidents may potentially cause fatal human injuries and large financial damages in car repair (Stout et al. 1993, Curtis and Hauber 1997, Loker et al. 1999, Henderson et al. 2000). Despite a large number of accidents in the Berkeley hills, the associated economic and health costs have yet to be adequately resolved by government agencies such as Berkeley Animal Control.

Resolution by government agencies requires cooperation from wildlife management agencies and residents (Decker et al. 1992, Stout et al. 1996, Baker and Fritsch 1997, Curtis and Hauber 1997, Decker and Chase 1997, Stout et al. 1997, Loker et al. 1999, Henderson et al. 2000, Riley et al. 2003, Fulton et al. 2004). Because suburban areas are heavily populated, traditional wildlife management plans, such as hunting, contraception, and relocation, become public health problems due to safety issues such as children playing while hunters shoot deer (Baker and Fritsch 1997, Loker et al. 1999, Fulton et al. 2004). New contemporary social ideals, such as incorporating the wants of residents and experience of professional wildlife managers, must be incorporated to obtain a successful management plan (Decker and Chase 1997, Henderson et al. 2000).

Objective The objective of the project is to collect and evaluate Berkeley residents' public opinion of possible causes of accidents, public opinion of deer animosity, public opinion of acceptable management plans available, and increase public awareness of deer-related accidents in order to provide public approved suggestions on accident-prevention programs and encourage

government action to take place.. Objectives were accomplished using door to door surveys to fifty residents in high, medium, and no accident areas (N = 150).

In evaluating possible causes of accidents, residents were asked if they believed people or deer were the cause of accidents and explain why. Our hypothesis was that more residents believed accidents were human-related than deer-related. The reason is because the area surveyed is made up of steep narrow roads. Cars driving down these roads can pick up high speeds without realizing it and because of narrow roads, there is lack of maneuverability.

When asked if residents liked or hated deer, we hypothesized that residents who had bad experiences with deer, such as a car accident, will more likely dislike deer than those residents who did not encounter a bad experience with deer. We justified that, in general, people tend to dislike things more when they have been traumatized or have had negative experiences with it.

For different potential management plans, residents were asked which management plan they accepted and preferred. We hypothesized that residents with negative experiences with deer are more likely to accept lethal management plans than those without negative experiences. Our reasoning is that people with continuing negative experiences with deer will more likely accept drastic measures in order to get rid of the deer as soon as possible.

While surveying residents, we educated them about deer-accidents occurring in their neighborhood and the potential dangers that deer accidents can inflict. The objective of resident awareness is to promote resident action in finding a solution to the high numbers of deer accidents occurring. Hopefully, residents can get government agencies such as the Berkeley Animal Control involved before a death occurs from these accidents.

Methods

Study Area To develop the site for the study area, deer carcass locations were obtained from Berkeley's Animal Control and plotted on a city road map of Berkeley, CA with the aid of MapQuest. The section of Berkeley that contained the highest density of carcasses was used as the study area and was divided into three regions: high, medium, and no deer density (Fig. 1).

The study area consists of Berkeley's urban area, located in eastern San Francisco Bay Area on the borders of Alameda County. It is northwest of the University of California Berkeley with Tilden Regional Park bordering on its north and the tracks of Bay Area Rapid Transit (BART) bordering on its west. The survey area was held within a four block radius from Marin Avenue

between Creston Road and MLK Jr. Way, Hopkins Street between MLK Jr. Way and Beverly Place, and Cedar St. between MLK Way Sacramento Street. Borders of the three regions within our study area (high, medium, and no deer density) are indicated in Figure 1.

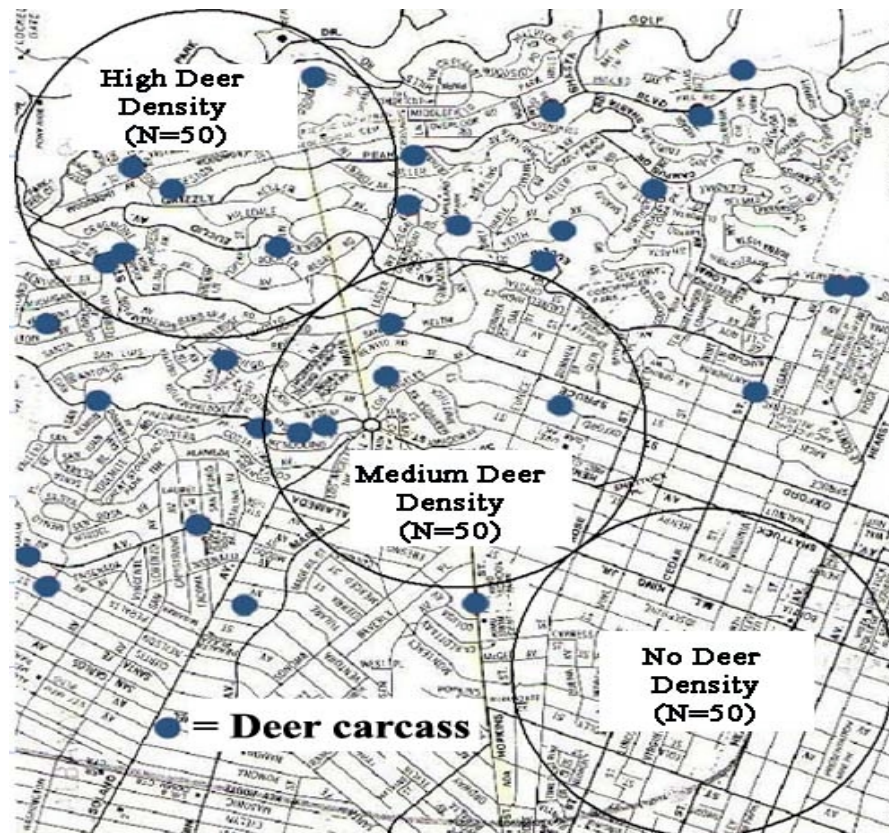


Figure 1. Study Area divided into three regions: high, medium, and no deer density

Survey To assess public opinion of causes of deer accidents, opinion of animosity towards deer, and opinion of acceptable management programs, a door-to-door survey was conducted to fifty randomly selected Berkeley residents from each of our high, medium and no deer density areas (N=150) between October 2004 and March 2005 on various times and days to prevent any bias of survey subjects. Survey sampling of fifteen residents (N = 15) were previously done as a test survey to clarify the purpose of any question that seemed confusing, delete questions that did not pertain to the subject area, and add questions, not originally thought of, that should be asked to accomplish our research project's objective. The results were used to modify the survey to be clear, direct, and ask questions that pertain to the project's objective. To avoid any bias from single families, one survey was given per household with the resident being at least twenty-one

years of age. Participant's identification was protected and was given the option to refuse participation at any time. Following University of California at Berkeley's Committee for Protection of Human Subject's (CPHS) standards, a consent form was given to residents summarizing the purpose of the research project along with contact information if any question regarding the project may arise. The survey averaged seven minutes and was administered orally to allow each survey to be consistent in how the questions were evaluated and leave no room for misinterpretation. Surveys were administered to residents following methods outlined in Jennings (2001).

Statistical Techniques Statistical analysis of data was analyzed using SYSTAT10 (Wilkinson 2000). To answer our hypothesis, calculations of frequencies and summary statistics were done for each survey question. Kendall's tau was used to find if correlation existed between variables (Loker et al. 1999) in question in each hypothesis. Variables involved in analysis were (1) deer densities, (2) attitude towards deer, (3) negative experiences with deer, (4) acceptable management plans, and (5) preferred management plans. Attitudes toward deer were classified as *like*, *dislike*, and *mixed or indifferent*. Negative experiences of deer consisted of having a close call or being involved in a deer accident. Acceptable and preferred management plans included hunting, contraception, relocation, public education, and light reflectors. Two-way cross tabulations and frequency data were used to illustrate statistical significance between two variables in question for each hypothesis (i.e. attitudes toward deer and negative experiences with deer) and a connection between preference of methods and personal experience with deer. From the results collected, table graphs were recorded to illustrate response trends between variables for each hypothesis.

Results

When residents (N = 150) were asked what they believed the cause for deer-related car accidents were, the majority (61%) of residents believed it was human related (Fig. 2). When asked why these accidents were occurring, the majority (72%) of residents believed it was due to fast driving.

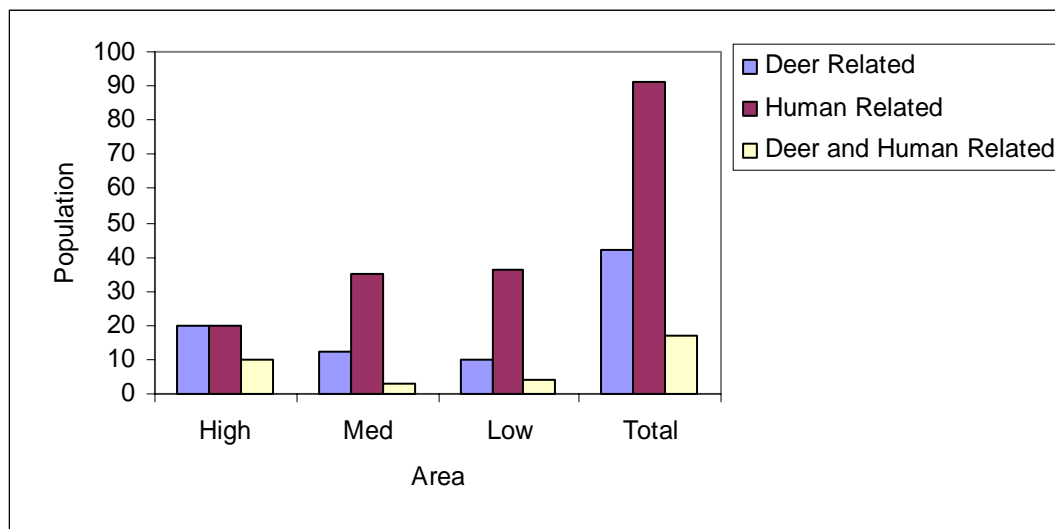


Figure 2: Public Opinion of Cause of Accidents

When residents were asked how they felt towards deer (i.e. love or hate deer), 33% of residents disliked deer, 42% liked deer, and 25% were indifferent towards deer. Of the residents that disliked deer, 82% were involved in deer accidents (negative experience). Of the residents that liked deer, 89% were never involved in deer accidents.

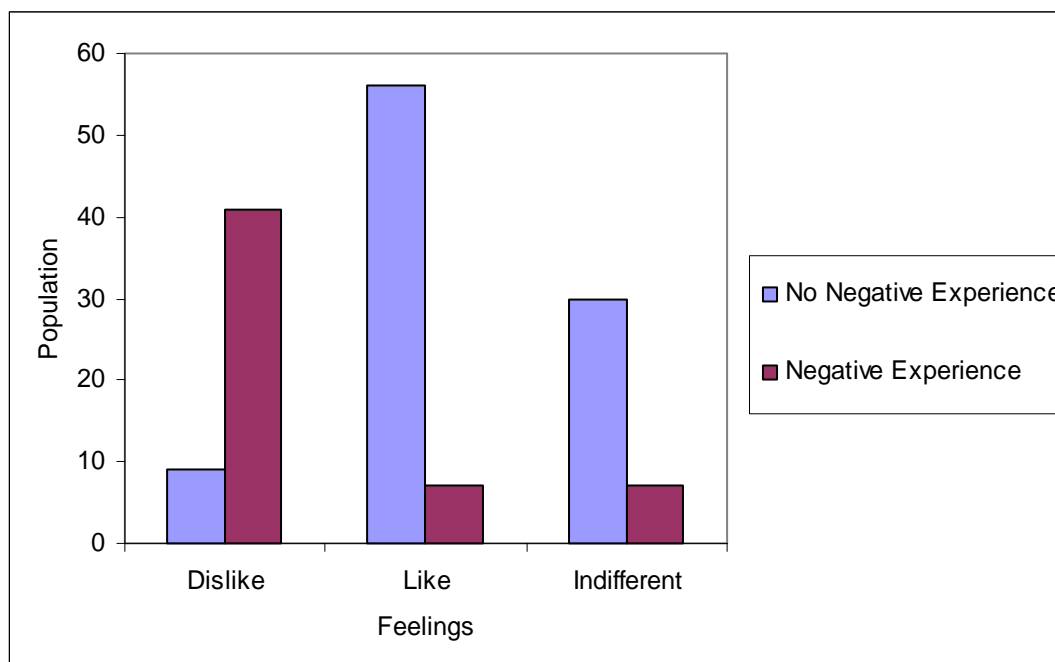


Figure 3: Public Opinion of Deer and their Experience with Deer

Significant difference exists between residents' experience and their feelings toward deer ($\chi^2 = 67, p = 0.0001$). According to *kendall's tau*, a strong *negative* correlation exists between resident's feelings toward deer and resident's personal experience with deer which means as negative experiences increases, feelings toward deer become less likeable and more dislikeable (*kendall's tau* = -0.520). Figure 4 illustrates feelings toward deer from different study regions (high density, medium density, and no density of deer).

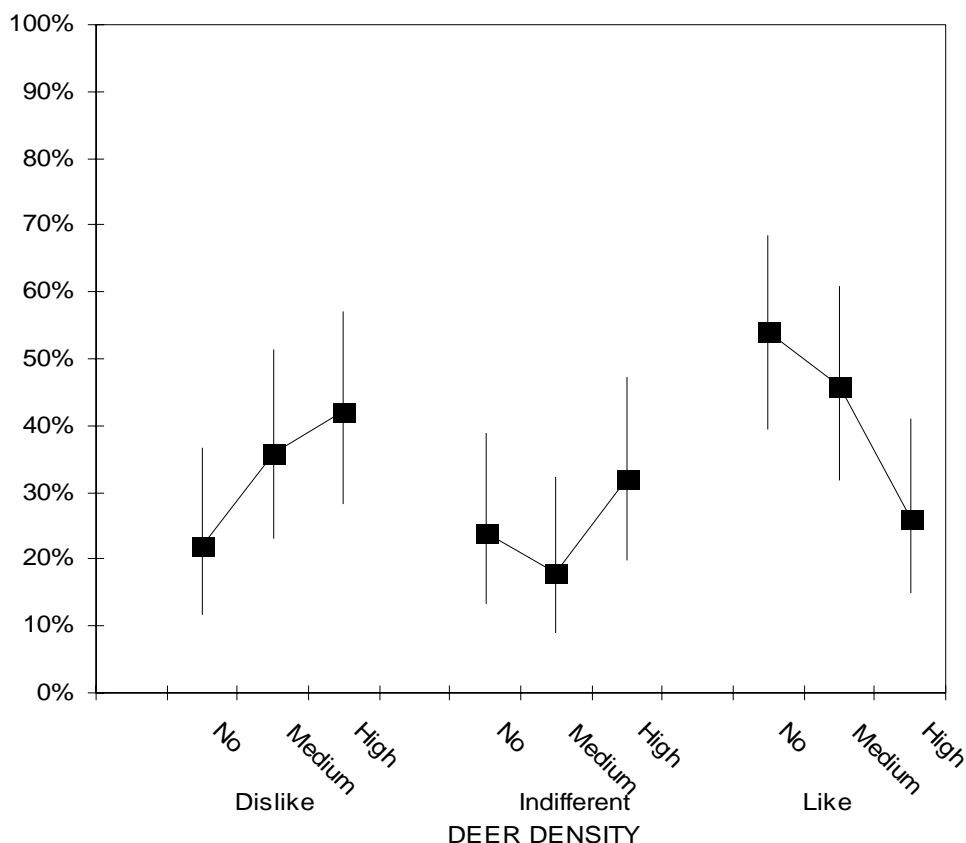


Figure 4: Residents' Feelings toward Deer in Different Deer Densities

From left to right, the trends represent feelings of dislike, indifferent and like towards deer. There is not enough significant difference between feelings toward deer and from which deer density region we are surveying. However, there is a distinct trend between feelings of deer and deer density regions (i.e. as we survey from no to medium to high deer density regions, the percentage of residents who dislike deer increases).

The majority of residents are more acceptable towards humanitarian management plans with 83% of residents approving Light Reflectors and 73% of residents approving public education programs (Fig. 5).

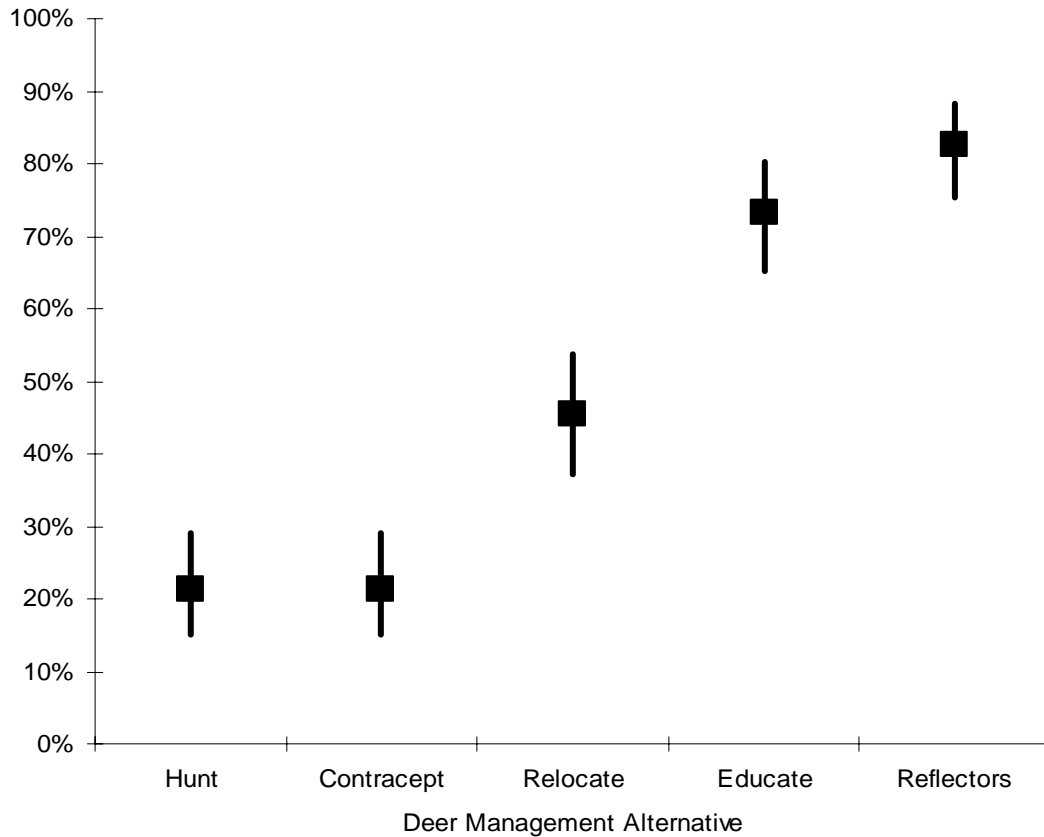


Figure 5: Acceptable Management Plans

Even though 21% of the residents supported hunting as a management plan, 91% of hunting-approved residents have been in an accident. Significant difference exists between acceptable management plans and experience with deer (*chi-square* = 54.4, $p = 0.0001$). According to *kendall's tau*, a strong *positive* correlation exists between resident's feelings toward deer and acceptance of lethal management plans like hunting (*kendall's tau* = 0.602). Meaning, as negative experiences (i.e. deer-related car accidents) increases, the more likely residents will agree lethal management plans are acceptable.

Discussion

In evaluating possible causes of accidents, we hypothesized that more residents believed accidents were human-related than deer-related because cars driving down the narrow steep roads in our study area can pick up high speeds without realizing it and because of narrow roads, there is lack of maneuverability. Majority of the residents agree with our hypothesis and that 61% agree that accidents are human related and 72% of residents believe accidents were caused by fast driving.

When asked if residents liked or hated deer, we hypothesized that residents who had bad experiences with deer, such as a car accident, will more likely dislike deer than those residents who did not encounter a bad experience with deer. Our results agree with our hypothesis in that of the residents that disliked deer, 82% were involved in deer accidents (negative experience) and that of the residents that liked deer, 89% were never involved in deer accidents.

For different potential management plans, we hypothesized that residents with negative experiences with deer are more likely to accept lethal management plans than those without negative experiences because people with continuing negative experiences with deer will more likely accept drastic measures in order to get rid of the deer as soon as possible. Our results agree with our hypothesis in that of the residents who accept lethal methods (i.e. hunting), 91% of these residents have been in an accident. Also, according to *kendall's tau*, our results agree with our hypothesis (*kendall's tau* = 0.602). Meaning, as negative experiences (i.e. deer-related car accidents) increases, the more likely residents will agree lethal management plans are acceptable.

Speed Bumps and Road Signs Management Plan The majority of residents surveyed agreed upon a humanitarian approach towards a management plan with 83% of residents approving Light Reflectors and 73% of residents approving public education programs. Because most residents (61% of residents) believe accidents are human related and that people are driving fast (72% of residents), *speed bumps and road signs* are the most practical management plan. By implementing speed bumps and road signs, changes in accident occurrence and public opinion will occur, with one event affecting another like dominos. For example, let's begin with change in accidents occurring. With speed bumps and road signs, drivers are forced to slow down on these narrow roads. As supported by our data, people who dislike deer have had bad experiences with deer. By decreasing traveling speed, fewer accidents and thus bad experiences will occur. Because bad experiences and dislike of deer are connected, I believe if we prevent accidents

from occurring, then less people will dislike deer. Also, as supported with our data, residents with bad experiences of deer tend to approve of lethal methods. If we decrease bad experiences with deer, people will less likely support lethal methods. Even though 21% of residents accepting lethal methods may seem low and trivial, as the number of accidents increases, the value of lethal method acceptance may increase dramatically, as there is a connection between lethal methods and bad experiences (as supported by our data). Also, if we do not take action in decreasing deer accidents, the acceptance of lethal methods may become majority consensus and residents may not accept any other form of management plan. In any case, action must be taken by government officials with the aid of residents and wildlife professionals before an event as severe as human death occurs. Hopefully, residents will take this information and press government agencies such as Berkeley Animal Control to take action.

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