Evaluating the recently imposed English compulsory microchipping policy. Evidence from an English Local Authority.

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Abstract

This is the first empirical study examining the effectiveness of the newly imposed English compulsory microchipping policy. A dataset of 2,974 records was retrieved from an English local authority's website. Records were from the period 2010-2018 and were analysed based on the three periods of the policy timeline: initial period includes data recorded prior to the intent of imposing the microchipping policy (April 1, 2010 - February 2, 2013); second period includes data recorded between the announcement of the intent and the date of the policy coming into effect (February 3, 2013 - April 5, 2016); and the final period includes data recorded after the policy came into effect (April 6, 2016 – July 4, 2018). A preliminary binary univariable logistic regression model analyzed the initial period which revealed that microchipping was an effective means of traceability providing evidence supporting the imposition of the policy. Thereafter, a multinomial logistic regression model was employed for the complete dataset and all policy periods. It revealed that both the period after the announcement of intent to impose the policy and the period after the policy came into effect have had a significant effect on the return of stray dogs, with the latter of greater magnitude. In particular for Staffordshire bull terriers and its crosses, which is the leading breed in animal welfare organization and local authority kennels, this study identifies the need for further research. Overall, these findings are encouraging in terms of the success of the policy however, more insights are required on keeping microchip details up-to-date and on the link of deprived areas, youth and the ownership of Staffordshire bull terriers. Although the findings of this study may not be generalized to all English local authorities, its conclusions could be used as a benchmark and starting point for further investigation.

Keywords: Multinomial logistic regression; stray dogs; microchipping; local authorities; Staffordshire bull terriers

1. Introduction

In April 2012, the United Kingdom's department of Environment Food and Rural Affairs (Defra) conducted a public consultation, which was open to both individual members of the public and organizations, on a set of measures aiming to promote more responsible dog ownership (Defra, 2012). One of the measures proposed was the imposition of compulsory microchipping for all dogs (Defra, 2012). In February 2013, the results of the consultation revealed that 96% of the respondents were in favor of the measure with the view that it would improve owner accountability and dog-owner re-unification in the case of lost dogs (Defra, 2013). These consultation results along with stakeholder views were formulated into the Microchipping of dogs in England Regulation 2015 which also determined April 6, 2016 as the date compulsory microchipping for all dogs came into effect (Defra, 2013). According to Defra, 60% of all owned dogs had already been microchipped in 2013 (Defra, 2013). In 2016, Defra reported that 86% of dog owners in the UK had microchipped their dogs right before the law came into effect, an estimated 7.34 million dogs (Defra, 2016) from approximately 8.5 million owned dogs (Pet Food Manufacturer's Association, 2017); with the statistic rising up to 95% a year after the policy came into effect (Woodmansey, 2017). Dogs Trust (2017) annual report also noted an increase in the percentage of the total number of microchipped stray dogs from 17,789 in the 2014-2015 period to 16,447(29% of all strays) in the 2015-2016 period. The imposition of the policy led to a further increase in the number of total stray dogs that already had been microchipped to 18,430 (34%) in the 2016-2017 period (Dogs Trust, 2017).

In the first annual stray report after the implementation of the policy, Dogs Trust reported an overall 18% decrease of stray dog handling, with local authorities handling 66,277 stray dogs in the 2016-2017 period compared to 81,050 dogs in the 2015-2016 period (Dogs Trust, 2017). An overall 1% decrease in the number of dogs that were euthanized was

also reported between the two periods, totalling to 2,239 dogs (3% of total strays). The majority of these dogs were reported of being euthanized for reasons related to health and behavior or under the Dangerous Dogs Act (Dogs Trust, 2017). Only 226 dogs had a confirmed report of being euthanized due to being unclaimed or having no rescue available (Dogs Trust, 2017).

One extremely emotive and current issue is the management of Staffordshire bull terriers (SBT). It is common knowledge that SBT are the leading breed in most UK animal welfare organization and local authority kennels. Battersea Dogs and Cats Home (2016), one of UK's largest animal welfare organization, reported SBT as the leading breed for 2016. However, SBT have also been characterized as 'Status Dogs', a '*type of dog used by individuals to intimidate and harass members of the public'* (Defra, 2010, p.4) and according to Hughes et al. (2011) may be popular in youth peer groups and gangs in particular in deprived areas. Recently, People for the Ethical Treatment of Animals (PETA) backed the call to include SBT to the Dangerous Dogs Act, banning the breed as an aggressive and dangerous one (RSPCA, 2018a). In a Defra enquiry about dangerous dogs and Breed Specific Legislation (BSL) the Royal Society for the Prevention of Cruelty to Animals (RSPCA) provided written evidence against BSL calling it ineffective (RSPCA, 2018b). Furthermore, it supported that breed is not a suitable criterion for measuring dog aggression and that there is paucity in the scientific research to support BSL (RSPCA, 2018b). After the submission of an e-petition, the House of Commons debated and concluded that SBT would not be considered for inclusion (House of Commons, 2018).

The main objective of the present study is to identify whether the likelihood of stray dogs being reunited with their owners has increased due to the imposition of the compulsory microchipping policy, with a special reference to SBT. As a secondary objective this study will provide evidence that microchipping is an effective means of traceability.

2. Material and Methods

2.1. Data sources

Under the Clean Neighbourhoods and Environment Act 2005, local authorities have the sole responsibility of stray dogs (Ashfield District Council, n.d.). Furthermore, all stray dogs found by the public must either be returned to their owners or to the local authority in which they are found (Swale Borough Council, 2017). Stray dogs are held at local authorities for seven days and if after this period they are not reunited with their owners, ownership is transferred to the local authorities (Swale Borough Council, 2017). Thereafter, the Clean Neighbourhoods and Environment Act (2005) allows the local authorities to either sell or transfer the dog to individuals or animal welfare organizations that can provide the appropriate care, or resort to euthanasia.

The dataset used for this study includes records of stray dogs handled by Swale Borough Council, a local authority in the South East of England. This local authority was selected for two reasons: firstly, for the availability of stray dog data and secondly for the socio-economic demographics of the Borough. This Borough has four towns and 37 civil parishes. Swale is within the most deprived 35% of local authorities in England (Swale Borough Council, 2010a) with a reported most deprived ranking of 116th out of 353 English local authorities in 2007 (Swale Borough Council, 2010b). In more recent publications, Swale was reported having higher than the English average deprivation in 2016 (KCC, 2016).

In terms of data availability, this local authority was selected as it publishes, on their website, records on all stray dogs they handle, with their register being updated daily making this dataset as accurate as possible. This local authority exhibits continuous high-quality animal service, and this is evident by its status as a holder of a Stray Dog Gold Footprint Award awarded by the RSPCA for nine consecutive years (Swale Borough Council, 2018). Since 2015, this local authority employs two animal control officers, one full-time and one part-time, who carry out duties of Dog Warden and other officers who are trained to handle dogs (Swale Borough Council, 2016; Swale Borough Council, 2017). These officers enter stray dog data onto the website and provide all dog details, including breed, sex, coat color and age. In addition to their council website, they also maintain a social

media lost and found group page, which was established in 2015, where they upload photographs and information of dogs in their care as well as allow owners to post lost dogs photographs.

Data from their website was collected in three batches. The first batch of records was retrieved on April 16, 2012 and included information of dogs handled between April 1, 2010 and April 15, 2012. The second batch of records was retrieved on May 29, 2013 and included information of dogs handled between April 16, 2012 and May 29, 2013. The final batch of records was retrieved on July 4, 2018 and included information of dogs handled between May 24, 2014 and July 4, 2018. Data between May 30, 2013 and May 23, 2014 are missing from the dataset. This is due to the council updating their website and changing the design layout which resulted in making those data unavailable to the public. Overall, the complete dataset consists of 3,246 records of stray dogs. Of these, 2,974 were complete without any missing values.

In all batches of data, the details recorded include: breed, sex, age, coat color and fate of the dog. Only in the first batch of data (April 1, 2010 – April 15, 2012) the local authority also reported whether the dog had a means of traceability (i.e. microchip, or another means such as a collar or a personal ID tag). Of the 873 dogs recorded during that period, 557 had the means of traceability complete. Means of traceability was no longer recorded in the second and third batch.

In terms of breed, the leading breed was SBT and its crosses. From the overall 3,133 dogs that had complete breed information, 914 (29.2%) were SBT or crosses of that breed. The second and third leading breeds were Jack Russell terriers (328 dogs, 10.5%) and Lurchers (196, 6.3%) respectively. During the examined period, Swale Borough Council handled dogs from at least 62 different breeds. Given the aim of the study to examine SBT in particular, it was decided to create the breed variable as a binary variable indicating if the dog was SBT and its crosses or not.

The sex of the dogs was given for 2,932 dogs and indicates that the local authority handled a somewhat balanced number between female and male dogs, with 56% of the handled dogs being male. In terms of the age of the dogs, this was recorded according to the

categories of puppy, young, young adult, adult and senior. From the overall 3,246 records of stray dogs, a total of 2,512 had their age recorded. However, when investigating the data it appears that 93.6% of the dogs were recorded as being adults.

The coat color of the dogs was given by the local authority as part of the dogs' description title. These did not appear to be standardized and therefore, the collation of these was done using existing literature as guidance. In particular, Posage et al. (1998) indicated that fair-color coated dogs were more desirable and Diesel at al. (2007) revealed that fair-color coated dogs had a faster rate of adoption compared to black-coated dogs. Given the focus on fair and black coats, it was decided to collate coat color based primarily on these two groups. Hence, coat color was created as a categorical variable including fair (white, cream, beige, etc.), black, black and tan, black and white and all other coat-colors. Of the overall 3,246 records, 3,057 had the coat color completed, of which 43.2% were dogs allocated into the 'other' category.

To accommodate the main research objective a categorical variable depicting the periods associated with the compulsory microchipping policy timeline was created (Table 1). The initial period included records of dogs handled prior to the intention to impose the policy – hence including data recorded before February 3, 2013; the second period included records of dogs handled after the date of announcement of the intent to impose the policy but before the policy came into effect- hence including data recorded between February 3, 2013 and April 5, 2016); and the final period included records of dogs handled after the policy came into effect– hence including data recorded from April 6, 2016 onwards.

Table 1

2.2 Binary univariable logistic regression analysis examining the effectiveness of microchipping as a means of traceability

The availability of data on the means of traceability between April 1, 2010 and April 15, 2012 allows the preliminary examination of the effectiveness of microchipping as a method

of re-uniting dogs with their owners. It is hypothesized that the analysis would indicate microchipping as an effective method. The fate of the dogs was constructed as a binary variable depicting whether the dogs were taken to kennels or re-united with owners. This construction allowed the employment of the binary logistic regression model. This model was employed to examine whether a presence of a means of traceability and in particular that of microchipping is a significant factor in dog-owner unification. The analysis was conducted using the statistical package Stata 15 and the results are reported using the odds ratio (OR).

2.3 Multinomial logistic regression analysis examining increased likelihood of stray dogs being re-united with their owners

The availability of data associated with the compulsory microchipping policy timeline allows the examination of the effectiveness of the imposition of the policy. The hypothesis is that the imposition of the policy has had a significant positive effect on the local authority's return rates. For this analysis, the fate of the dogs was constructed as an unordered categorical variable using the information of outcomes given by the local authority. These include whether the dog was returned by the council, returned by the public or the finder, retained by the finder, claimed by the owner, taken to kennels or euthanized. Hence, in this case the multinomial logistic regression model was employed. To determine which variables would be included in the final model, the Wald test was conducted for each independent variable. Those that were not found to be significant at the P-value <0.20 were not included in the final model. Finally, two-way interaction terms were added and inspected for significance ($P<0.05$). The Independence of Irrelevant Alternatives (IIA) assumption was also tested with the Hausman test. This is a diagnostic test developed for the multinomial logistic regression model that tests for functional misspecification and omitted variables (McFadden, 1987). The IIA property suggests that the alternatives are distinct (Hausman and McFadden, 1984); which in this study the alternatives are the fate of the dogs. The analysis and tests were conducted using the statistical package Stata 15 and the model results are reported using the multinomial odds ratios (OR).

3. Results

3.1 Descriptive statistics

Overall, during the examined period (April 10, 2010-July 4, 2018), Swale Borough Council provided a complete dataset for 2,974 of the dogs they handled. Of those, 888 dogs were taken into kennels and not reunited with their owners or retained by the finder. The rate of kennel intake appears to be influenced by the timeline of the imposition of the compulsory microchipping policy. The rate of kennel intake between April 10, 2010 and February 2, 2013, the period when there was no intent to impose such a policy, appears to be 37.3% (433/1161). Once the intent to impose such a policy was announced and until the day before the law came into effect, dates between February 3, 2013 and April 5, 2016, the rate of kennel intake appears to have decreased to 26.9% (238/883). Finally, between the first day the policy came into effect, April 6, 2016, and July 4, 2018, Swale Borough Council experienced a further decrease of the rate of kennel intake to 23.3% (217/930).

3.2. Binary univariable logistic regression analysis examining the effectiveness of microchipping as a means of traceability

An indication of the effectiveness of microchipping as a means of traceability is presented in Table 2. Approximately 16.9% of the dogs that had a means of traceability recorded on the register were reported as having a microchip, the rest had an alternative means of traceability such as a collar or a personal ID tag. From these dogs, only 24.5% remained in the kennel after the seven-day statutory period had ended. According to the results of the univariable binary logistic regression model, microchipping was an effective means of traceability (OR 3.83, 95% CI: 2.31-6.35, P-value <0.001).

Table 2

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232 3.3. Multinomial logistic regression analysis examining increased likelihood of stray dogs
233 being re-united with their owners
234 The Wald test of the independent variables revealed that sex (P-value=0.84) was not
235 statistically significant. In addition, two categories of age ('young', P-value= 0.59; 'young
236 adult', P-value=0.94) were not found to be statistically significant but the category of
237 'adult' (P-value<0.001) and 'senior' (P-value=0.03) were found to be statistically
238 significant. Taking into account that 93.6% of the dogs were categorized as adult, it was
239 decided to not include this variable in the final model. The Wald test revealed all categories
240 of coat color (black and tan, P-value=0.39; black, P-value=0.27; black and white, P-
241 value=0.18) to not be statistically significant. Only the coat color category of 'other' was
242 found to be statistically significant (P-value<0.001). Given this variable does not have a
243 logical underpinning it was decided to not be included in the model. Breed was also not
244 found to be statistically significant (P-value=0.23) however the two-way interaction
245 between breed and policy timeline was overall found to be statistically significant (second
246 period, P-value=0.05; final period, P-value=0.25) and therefore, was retained into the
247 final model. Finally, the Hausman test revealed that the IIA assumption was not violated,
248 indicating that the model is well specified.
249 For this multinomial logistic regression model, the dependent variable of the fate of the
250 dogs was constructed based on the outcomes reported by the local authority. Of particular
251 interest is the return rates from the council as they own the microchip scanners and
252 therefore would be the return rates most affected by the policy. The results of the
253 investigation on the effectiveness of the compulsory microchipping policy are given in
254 Table 3.
255 ----------
256 Table 3
257 ----------
258 The chosen reference category was 'taken to kennels' therefore, the interpretation of all
259 outcomes is undertaken by comparing to the likelihood of being taken into kennels after
260 the seven-day statutory period. The results of the multinomial logistic regression reveal

that when comparing the second period of the policy timeline to the initial period of the policy timeline dogs were more likely to be returned to owners by the council (OR 1.90, 95% CI: 1.34-2.69, P-value<0.001), than being taken to kennels. The comparison also shows that other means of return such as to be returned by the public or the dog's finder (OR 1.44, 95% CI: 1.10-1.90, P-value =0.008) and to be claimed by the owners (OR 1.44, 95% CI: 1.06-1.94, P-value = 0.019) were also improved.

When comparing the final period of the policy timeline to the initial period of the policy timeline, the findings reveal that dogs were more likely to be returned by the council (OR 2.69, 95% CI: 1.94-3.72, P-value <0.001) than to be taken into kennels. In addition, the analysis also revealed that the likelihood to be returned by the public or the dog's finder (OR 1.92, 95% CI: 0.48-2.48, P-value <0.001) was also increased. However, the results reveal that dogs were less likely to be claimed by the owner (OR 0.59, 95% CI: 0.42-0.85, P-value=0.004).

When examining the fate of the most popular breed handled by the local authority, the findings reveal that when comparing the initial period of the policy timeline to the final period of the policy timeline SBT and its crosses were more likely to be taken to kennels than to be returned by the public or the dog's finder (OR 0.48, 95% CI: 0.29-0.80, P-value=0.004). Finally, the analysis did not reveal any significance between SBT and being euthanized.

4. Discussion

When Defra published its Impact Assessment on the compulsory microchipping of dogs in England in 2014, their evidence-based investigation relied upon evidence from other countries. They cited the results of Sweden's compulsory microchipping policy and of a US based study (Defra, 2014). According to Tasker (2008), after the enforcement of the Swedish compulsory microchipping policy, 90% of all stray dogs were re-united with their owners. Similarly, Lord et al. (2009) reported that microchipping and registering on a database increased the likelihood of reunification.

Additional international literature includes Dingman et al. (2014) that had found that microchipped dogs were by up to 21 times more likely to be returned to their owners than those that had not been microchipped. The results of the present study provide empirical evidence that microchipping also contributed to the increase in likelihood of stray dogs being reunited with their owners in England. From the preliminary examined data, microchipping appeared to be an effective means of traceability. Before the compulsory microchipping policy, every dog in the UK through The Control of Dogs Order (1992) was obliged to wear a collar with owners' address and phone number inscribed on it or having this information on an ID tag attached to it. The results of this binary univariable logistic regression did not find collar and ID tag to be statistically significant. This could potentially be an indication that this obligation is not being followed by dog-owners. Hence, even if in retrospect, these results agree with the findings of the international literature and further justify the imposition of compulsory microchipping in England.

In terms of the effectiveness of the policy itself, the multinomial logistic regression model revealed strong and positive results. Both the second and third periods of the policy timeline have had a significant effect on the return of stray dogs. The anticipation of the policy led to an increase of dogs being microchipped. Defra reported that between 2012, when the government consultation was carried out, and April 6, 2016, the day the policy came into effect, the number of microchipped dogs increased by 25% (Defra, 2016). The year after the policy came into effect saw an additional 9% increase, reaching 95% of all UK dogs being microchipped (Woodmansey, 2017).

When comparing the multinomial regression model results between the two latter periods, the likelihood to be returned by the council compared to being taken to kennels is of greater magnitude after the policy came into effect. This could be associated with the higher percentage of dogs being microchipped. The same result is evident when comparing the likelihood to be returned by the public or the finder compared to being taken to kennels. As the public do not have access to scanners, this could potentially be attributed to the local authority's presence on social media. Their establishment of social media presence somewhat coincides with the compulsory microchipping policy timeline. Since

the beginning of 2015, Swale Borough Council established a social media presence allowing citizens of their Borough to upload pictures and interact with one another facilitating the online notification and re-unification of lost dogs.

An additional interesting finding is that the likelihood of being claimed by the owner, even though was higher in the second period of the policy timeline compared to the initial period, has been revealed that during the final period the likelihood reversed making it more likely to be taken to kennel rather than being claimed. This could potentially be evidence aligning with the 25% of dogs that Dog's Trust (2017) has reported on of their owners not wanting the dog any longer. In addition, it could potentially be associated with the fact that Swale Borough Council is within the most deprived 35% of local authorities in England (Swale Borough Council, 2010a). According to Swale Borough Council's stray dog policy (2017) owners can claim back their dogs once they have paid the associated fees. Therefore, changes in the affordability of retrieving a lost dog is an area that needs further research.

In terms of SBT and its crosses, our dataset also revealed SBT and its crosses as the leading breed handled by the local authority during the entire period of investigation (2010-2018), accounting for 29.2%. The results of the multinomial regression model provide initial evidence that this breed is not correlated to aggression as there was no significance of the breed being euthanized. Swale Borough Council has a policy to only euthanize dogs under the situations of ill-health, aggression or under the Dangerous Dogs Act (Animal Control Officer, personal communication, June 10th, 2013). In the present analysis being euthanized was not significant indicating that SBT are not more likely to be euthanized than taken to kennels. This empirically suggests that SBT handled by Swale Borough Council were not deemed aggressive.

The results of the multinomial regression, therefore, provide evidence against a BSL on SBT but also provide evidence that SBT contribute to the stray dog population problem due to it representing the leading breed. According to the multinomial regression model results, microchipping policy has had a positive effect on SBT low return rates; even though they are only significant at the 10% level of significance in the instance of being returned by the council but significant at the 1% level of significance in the instance of

being returned by the public or finders. The imposition of the law appears to have reduced the likelihood of the dogs to be taken into kennels compared to the previous periods. Despite this, SBT are still more likely to be taken to kennels than to be reunited with their owners. As previously mentioned, Swale Borough Council is within the most deprived 35% of local authorities in England (Swale Borough Council, 2010a) and perhaps there is a change in the affordability of retrieving an STB dog. In addition, KCC (2016) has reported that young people have been particularly affected due to living in a poor environment with high crime rates and low incomes. Pairing this with Hughes et al (2011) findings that SBT are most popular with youth gangs, the present study raises the need for more research into this breed's contribution to the overall stray dog population and to the link of deprived areas, youth and SBT ownership.

An additional issue raised by Rohlf et al. (2010) is that even the most dedicated dog owners may fail to comply with some responsibilities. One of the most cited criticisms of the compulsory microchipping policy is the failure to keep owner details up-to-date (Lord et al., 2007; Lancaster et al., 2015; Prior, 2018). Dogs Trust (2017) latest stray survey report revealed that 69% of all microchipped dogs were not reunited with their owners due to incorrect owner information records. However, within the international literature, a study by Zak et al. (2018) revealed that when comparing the intake of periods before and after the implementation of compulsory microchipping in the Czech Republic both the number and the accuracy of details of microchipped dogs had increased. Unfortunately, our dataset was unable to investigate the accuracy of microchip details. More research is needed to compare rates of accurate details before and after the implementation of the policy to conclude on whether the policy has instilled the importance of the accuracy of microchipping details.

An additional potential limitation can be found in the dataset. Data between May 30, 2013 and May 23, 2014 have not been included due to their unavailability. However, the omission of this year of data is not expected to have had a significant impact on the quality of the data and the analysis. This is due to this data being in the second period of policy timeline which was the transitional period between the intent to impose the policy and the

actual imposition of the policy. Overall the dataset for that period includes two years' worth of data which scopes both close to the announcement of intent and close to the day the policy came into effect. Furthermore, the recording of the age and coat color of the dogs did not appear to be in a standardized manner. Grouping all dogs as adults did not allow the use of these data into the final model and perhaps some useful information was omitted. This is also true for coat color; a more standardized approach in recording coat color could have potentially provided some useful information.

A final limitation of the present study is that the results are only associated with one particular local authority. This implies that the results cannot be generalized to all English local authorities. More data need to be collected from other English local authorities to be able to provide a complete analysis. Data paucity has prohibited this approach at present. However, despite an objection that the dataset is potentially not representative, conclusions could be drawn and used as a benchmark and a starting point for further investigation.

5. Conclusion

This is the first empirical study examining the effectiveness of the newly imposed English compulsory microchipping policy. Data from Swale Borough Council between 2010 and 2018 have revealed that the policy has significantly improvement the rates of return of stray dogs to their owners by the council. It has also revealed improved rate of return by the public or the finder. In relation to the leading breed found in animal welfare organizations and local authority kennels, SBT, the analysis revealed that they were less likely to be taken to kennels after the imposition of the law. This indicates that the law has also improved the fate of SBT, however, more research is needed for clearer insights of the link of deprived areas, youth and ownership of this breed.

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Tables

Table 1: The fate of the dogs handled by the local authority organized by the policy timeline between April 1, 2010 and July 4, 2018 (percentage given in parenthesis).

	Prior to the intention to enact	Between intention to enact and date policy came into effect	After policy came into effect
	April 1, 2010 - February 2, 2013	February 3, 2013 -April 5, 2016	April 6, 2016 - July 4, 2018
Taken to Kennels	433 (37.3%)	238(26.9%)	217(23.3%)
Returned by Public or finder	333(28.7%)	306(34.6%)	405(43.5%)
Returned by Council	133(11.4%)	139(15.7%)	212(22.8%)
Retained by Finder	17(1.5%)	14(1.6%)	18(1.9%)
Claimed	231(19.9%)	180(20.4%)	74(7.9%)
Euthanized	14(1.2%)	6(0.7%)	4(0.4%)
Total number of dogs	1161	883	930
N of SBT	405 (34.88%)	258 (28.87%)	221 (23.18%)

Table 2: Binary univariable logistic regression model: Evidence on the effectiveness of microchipping as a means of traceability.

	Returned to owner			
	Odds Ratios	P- value	95% Conf. Interval	
Dog identification:				
No identification	1.00			
Microchip	3.83	<0.001	2.31	6.35
Collar or personal ID tag	0.87	0.78	0.32	2.32
Constant	0.80	0.02	0.67	0.97
Observations	557			

Table 3: Multinomial logistic regression model: The effect of the compulsory microchipping policy on dogs handled by an English local authority between April 1, 2010 and July 4, 2018, with the inclusion of the interaction between breed and policy timeline

	Returned by Council				Returned by Public or Finder				Retained by Finder				Claimed by Owner				Euthanized			
	Odds Ratios	P-value	95% Conf. Interval		Odds Ratios	P-value	95% Conf. Interval		Odds Ratios	P-value	95% Conf. Interval		Odds Ratios	P-value	95% Conf. Interval		Odds Ratios	P-value	95% Conf. Interval	
Policy timeline:																				
Initial period	1.00				1.00				1.00				1.00				1.00			
Second period	1.90	<0.001	1.34	2.69	1.44	0.008	1.10	1.90	1.16	0.73	0.50	2.67	1.44	0.02	1.06	1.94	1.30	0.70	0.34	4.90
Final period	2.69	<0.001	1.94	3.72	1.92	<0.001	0.48	2.48	1.61	0.21	0.75	3.43	0.59	0.004	0.42	0.85	0.90	0.89	0.21	3.83
SBT	1.20	0.42	0.77	1.87	1.14	0.51	0.77	168	0.69	0.56	0.19	2.46	0.66	0.25	0.33	1.33	1.14	0.91	0.12	11.23
SBT' fate based on policy timeline:																				
Initial period	0.60	0.09	0.33	1.10	0.48	0.004	0.29	0.80	0.44	0.37	0.07	2.65	0.99	0.99	0.46	2.16	2.21	0.54	0.17	28.09
Second period	0.55	0.07	0.29	1.05	0.73	0.24	0.43	1.24	1.11	0.91	0.19	6.37	0.85	0.69	0.37	1.92	0.83	.090	0.05	14.52
Final period	1.00				1.00				1.00				1.00				1.00			
Constant	0.35	<0.001	0.27	0.44	0.94	0.53	0.79	1.13	0.05	<0.001	0.03	0.09	0.62	<0.001	0.51	0.76	0.02	<0.001	0.01	0.05
Observations	2,974				2,974				2,974				2,974				2,974			