UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF
CHEMICAL SAFETY
AND POLLUTION PREVENTION

Memorandum

SUBJECT: Alternatives Assessment for Tetrachlorvinphos (TCVP) (PC Code: 083702) Impregnated Flea and Tick Collars on Dogs and Cats

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Product Review Panel Date: 8/2/2017

SUMMARY:

BEAD has determined that deltamethrin and flumethrin + imidacloprid are the only active ingredient alternatives to tetrachlorovinphos (TCVP) available for control of arthropod pests of pets in insecticide impregnated pet collar formulations. However, numerous other insecticide formulations (ie. EPA regulated shampoos, sprays, dusts, dips, spot-ons, and FDA regulated

oral treatments) are available for control of fleas and ticks on pets. The most likely alternative formulation to pet collars are spot-on products. Both collars and spot-on formulations are readily available, should be considered as interchangeable, and control the same pest spectrum as TCVP-based pet collars. However, the purchase decision will be influenced by socio-economic factors influencing both the buyer's choice of product formulation and also the availability of alternatives in the market place. Etofenprox based spot-ons were identified as the most likely alternative to TCVP for both cats and dogs. No increased cost or socio-economic impact would be expected from the use of etofenprox spot-ons. In contrast, increased costs and socio-economic impacts could result from the use of other spot-on formulations and pet collars.

BACKGROUND

Pesticide impregnated pet collars have been identified as a risk driver for the TCVP occupational and residential exposure assessment. BEAD was asked by PRD to determine TCVP pet collar use patterns, identify alternative insecticides used in pet collars, and provide an overview of the pet flea and tick control market. Non-agricultural Market Data (NAMD) was used to evaluate buyer preference for other pesticide formulations used for pest control on pets (i.e. spot-on, veterinary medication, dust, spray, etc.) to determine their suitability as alternatives to TCVP pet collars. NAMD data was further evaluated to determine the impact of geographic location and family income on both choice of pesticide formulation and site of purchase (i.e. veterinary, grocery, pet supply, etc.). After considering these factors, BEAD determined the most likely alternative products to TCVP pet collars based on similar pests controlled, length of pest control, and cost. Finally, based on these data assessments and identification of the most likely TCVP alternative product, BEAD was asked to provide a Socio-Economic Equity Assessment to characterize the impacts of cancelling TCVP collar products on low income families.

SCOPE AND LIMITATIONS

This assessment is based on non-agricultural market data covering the period 2009 through 2011 (NAMD 2009-11). However, available market data are limited to use and usage data for TCVP alone. Market data are not available which considers TCVP use and usage on cats and dogs separately.

Alternative insecticide/acaricide active ingredients to TCVP were identified from the EPA registration database, from various state recommendations for pest control on pets, and marketing from various online and brick and mortar suppliers. As all registered products are required to have data on file with Agency that support the efficacy claims on the label, all identified insecticide/acaricide products were considered as potential alternatives to TCVP.

This analysis is inclusive for the United States with regional analysis where available but does not attempt to account for differences in pest occurrence and/or abundance or the varying seasonal use pattern of TCVP. Data analysis is primarily limited to insecticide/acaricide products which target the same pests as TCVP and which are applied in impregnated collars.

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However, other control methods are discussed where they may be viable alternatives to impregnated collars.

CAT AND DOG PEST CONTROL DEMOGRAPHICS FOR THE UNITED STATES

As of 2015, there were approximately 117 million occupied households in the United States (AHS, 2015). A survey conducted in 2012 by the American Veterinary Medical Association (AVMA, 2012) determined that 30.4% of U.S. households own 1 or more cats (mean of 2.1 cats per household based on a total population of 74.1 million cats). This is equivalent to cat ownership by 35.6 million households in the United States. In addition, 50.6% of cat households have more than 1 cat (approximately 18 million households). Dogs were owned by 36.5% of households or 42.7 million households. Total dog population for the United States was estimated at 70 million with 39.2% of households owning more than one dog (mean of 1.6 per household). Among dog-owning households 36.4% also owned cats and 43.7% of cat-owning households also owned dogs.

The 2012 AVMA survey shows that 44.9% of households which own cats do not take their cat for a yearly veterinary visit (16 million households) (AVMA, 2012). In comparison, only 18.7% of dogs did not have a yearly veterinary visit (8 million households) (AVMA, 2012). These percentages represent the number of households (24 million) where cats and dogs would not have access to veterinary-supplied flea and tick control products, either Agency or FDA registered.

Of the other 55.1% of households which owned cats and visited a veterinarian (19.6 million households), the mean number of veterinary visits per year is 1.6 per household and 0.7 times per cat (AVMA, 2012). However, survey results indicate that only 11.4% of cat owning households purchased veterinary supplied flea or tick control products during the most recent visit. Based on 1.6 yearly veterinary visits, this represents veterinary sales of flea and tick products to 3.6 million cat owning households. In comparison, of the 81.3% of households with dogs which visited a veterinarian (34.7 million households), the mean number of visits was 2.6 times per household per year and 1.6 times per dog (AVMA, 2012). Survey results show that 17.7% of dog owning households purchased veterinary supplied flea or tick control products during the most recent visit. Based on an average of 2.6 household visits per year, this would represent veterinary sales of flea and tick control products to 16 million households. However, these numbers are probably conservative due to the percentage of households which own both cats and dogs. Nevertheless, these numbers do indicate a sizable number of households that are dependent upon the retail market for flea and tick control products, 90% for cats and 62.5% for dogs.

Veterinary visits by cat owners who reported veterinary visitations were noted to vary only slightly in relation to household income (1.6 visits for incomes over $50,000 as compared to 1.3 visits for incomes under $25,000) (AVMA, 2012). In contrast, veterinary visits by dog-owners varied directly in relation to income (2.2 visits for incomes over $50,000 as compared to 1.2 visits for incomes under $25,000) (AVMA, 2012). Nevertheless, these data suggest that income is probably not a limiting factor in the availability of veterinary supplied pest control products.

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PET INSECTICIDE MARKET

Sales

The consumer market for all pesticide formulations used on pets was estimated at $1,217.5 million in manufacturer sales and $2,099.9 million in retail sales in 2011 (Tables 1 and 2) (NAMD, 2010 and 2012). Insecticide sales data indicates that pet products account for 46% of the consumer insecticide market (Table 1).

Table 1. Estimated Insecticide Sales to the U.S. Consumer Market, 2009 and 2011.

Insecticides	$ Million	
	2009	2011
Pet	1,042.1	1,217.5
Outdoor	554.9	582.4
Household	544.3	494.4
Insect repellents	325.6	347.9
Total	2,466.9	2,642.2

Source: NAMD 2010 and 2012

Owners of dogs are significantly more likely to purchase pet insecticides than cat owners with 77% of dog owners and 54% of cat owners reporting purchasing pet insecticides in 2011 (NAMD, 2012). Sales data indicates 68.1% and 31.8% sales for fleas and ticks, respectively (NAMD, 2006). For cats, fleas represent 71% of sales and ticks 29% of sales. For dogs, fleas represent 66.9% of sales and ticks 33.1% of sales.

In 2009 and 2011, veterinary clinics dominated the retail sales market for flea and tick pesticides with greater than 40% of total sales (Table 2) (NAMD, 2010 and 2012). This domination appears to reflect the increased cost of veterinary prescribed products. Historically, veterinary sales have fluctuated yearly with the development of new prescription restricted products and movement of previously prescription restricted products to the over-the-counter (OTC) sales market (NAMD, 2001, 2004, and 2006). Since the initial 367% increase in sales for flea and/or tick control products from 1997-2000 (fueled by the rapid acceptance of veterinary supplied spot-on flea and tick products), market growth for flea and/or tick control products has slowed considerably. Overall, data indicate that the flea and tick pesticide market is stable in relation to retail distribution outlet.

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Table 2. Retail Sales of Flea and Tick Control Products (All Formulations) by Distribution Outlet, 2009 and 2011.

Retail Outlet	2009		2011	
	Sales ($ million)	% Sales	Sales ($ million)	% Sales
Veterinarian [a]	776.5	41.0	907.6	43.2
Discount/mass merchandise	469.7	24.8	549.0	26.1
Farm Supply Centers	47.3	2.5	55.3	2.6
Pet Stores	246.2	13.0	287.8	13.7
Mail Order/Internet	236.7	12.5	276.6	13.2
All Other [b]	117.5	6.2	23.6	1.1
Total	1,893.9		2,099.9	

[a] Includes veterinary supplied spot-on and oral products
[b] Includes farm supply stores, hardware stores, lawn and garden centers, and other retail outlets
Source: NAMD, 2010 and 2012.

Liquids (shampoos, dips, and spot-ons) account for the greatest percent of marketers' sales of pet insecticide products (Table 3) (NAMD, 2010 and 2012). However, while liquid sales have remained constant in relation to other products, this is largely the result of increased sales of spot-on products which counterbalance the decreased sales for other liquid formulations (shampoos and dips). Tablet sales appear to be increasing largely at the expense of collars and powders. It should also be noted that tablets are primarily only available from veterinary clinics or with a veterinary prescription. In contrast, pet collars are now primarily sold over the counter (OTC). Furthermore, Tables 2 and 3 only represent income (retail and marketers', respectively) associated with the different pest insecticide formulations and are not indicative of actual use pattern and buyer preference for particular formulations.

Table 3. Marketers' Sales of Flea and Tick Pesticides by Formulation, 2009 and 2011.

Product Form	2009		2011	
	Sales ($ million)	% Sales	Sales ($ million)	% Sales
Liquids [a]	792.6	76.0	949.7	78.0
Tablets [b]	108.0	10.0	182.6	15.0
Collars	79.6	8.0	60.9	5.0
Powders	29.5	3.0	12.2	1.0
All other [c]	32.4	3.0	12.2	1.0
Total	1,0421		1,217.5	

[a] Shampoos, dips, and topical spot-ons
[b] Veterinary supplied oral treatments
[c] Primarily aerosols, foggers, and soaps
Source: NAMD, 2010 and 2012

Usage

Pesticide usage on pets and public preference for different formulations will vary by regional and socioeconomic factors (Tables 4-8). Flea and tick control products for companion animals (dogs and cats) can be broken down into seven categories which pertain to insecticides/acaricide or veterinary supplied products. These include: collars, shampoos, powders/dusts, on-animal sprays, dips, liquid rub-in/spot-on treatments, and veterinary medication (including oral, topical, and injectable treatments). Due to households having multiple pets with different formulations

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used for each pet or the use of more than one formulation per year on a single pet, the usage percentages in Tables 4-8 may exceed 100%.

Liquid rub-in/spot-on products are the most commonly purchased form of pesticides applied to pets in the United States and has shown continued increased usage since 2005. In 2011, 50.3% of respondents reported spot-on use, an increase over the 46.3% usage reported in 2009 (Table 4) (NAMD, 2012). Veterinary medicines, shampoos, and collars were the other commonly purchased insecticide formulations with little difference in purchase preference (26.6, 25.2, and 25.9% respectively in 2011). However, in contrast to the increased usage of spot-on products, usage of veterinary medicines, shampoos, and collars were noted to decrease between 2009 and 2011. Furthermore, data indicates that sprays, dusts, powders, and dips have negligible use when compared to the other formulations. Additionally, some pet owners may use more than one product formulation (i.e. spot-on, shampoo, etc.), thus the percentages will not add up due to use of multiple formulations.

Table 4. National Formulation Preference for Pesticides on Pets in 2009 and 2011.

Formulation	2009 Purchase [a] (% Formulation Preference)	2011 Purchase [a] (% Formulation Preference)
Spot-on	46.3	50.3
Veterinary medicine	30.7	26.6
Shampoo	28.3	25.2
Collar	30.9	25.9
Spray	10.4	7.3
Powder/Dust	6.3	5.8
Dip	6.9	6.0

[a] Column total may not add to 100 due to multiple survey responses (i.e. pet owners may purchase more than one formulation)
Source: NAMD 2010 and 2012

As shown in Table 5, spot-on formulations are the preferred purchase choice in all regions of the United States. Veterinary medicines and sprays have much greater usage in the South and Northeast. The use of shampoos, dusts and collars are consistent across all survey regions. Although national purchase of shampoo formulations is equivalent to purchase of both veterinary medicine and collars, the relatively high reported use of shampoos may be the result of usage in conjunction with other flea control products or use during periods of reduced pest activity as a replacement for other flea control products. Based on available formulation data, BEAD does not anticipate any impact of geographic region on pet insecticide usage for the key alternative formulations for TCVP pet collars.

Table 5. Pet Pesticide Formulation Preference by Geographic Region in 2011.

Formulation	Geographic Region [a]			
	Northeast	Mid-west	South	West
	(% Formulation Preference)			
Spot-on	51.7	51.2	48.0	52.3
Veterinary medicine	29.7	19.9	31.9	20.9
Shampoo	22.1	24.7	27.9	23.5
Collar	26.2	25.9	27.5	22.2
Spray	11.0	6.6	8.1	3.3
Powder/Dust	5.5	5.4	6.0	5.9
Dip	6.2	2.4	9.1	3.9

[a] Column totals may not add to 100 due to multiple survey responses (i.e. pet owners may purchase more than one formulation)
Source: NAMD 2012

Table 6 illustrates important differences in choice of pesticide formulation for control of fleas and ticks on pets based on type of housing. Spot-on formulations are the primary formulation purchase for single and multi-family housing and mobile homes/trailer residents with minimum difference in percent usage (< 5%). Mobile home residents use more veterinary medicine, shampoo, pet collars, sprays, and powder/dust than single or multi-family residences. In contrast, pesticide dips are used more in multi-family housing as compared to single family housing and mobile home/trailers. Insecticidal pet collar use is 7% to 9% less for multi-family houses and single family houses, respectively, in comparison to mobile home/trailer residents. Housing type may slightly impact choice of pesticide formulation for use on domestic pets.

Table 6. Pet Pesticide Formulation Preference by Housing Type in 2011.

Formulation	Housing Type [a]		
	Single Family House	Multi-Family House	Mobile Home/Trailer
	(% Formulation Preference)		
Spot-on	51.1	47.0	46.8
Veterinary medicine	25.7	27.0	38.3
Shampoo	24.4	25.0	36.2
Collar	25.0	27.0	34.0
Spray	7.5	6.0	8.5
Powder/Dust	5.5	6.0	8.5
Dip	4.9	12.0	8.5

[a] Column totals may not add to 100 due to multiple survey responses (i.e. pet owners may purchase more than one formulation)
Source: NAMD 2012

There is little difference in choice of pet insecticide formulation based on population density (Table 7). The only observable trend for 2011 data is an increase in use of shampoos for suburban and rural residents. Data indicate no important impact of population density on choice of pesticide formulation.

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Table 7. Pet Pesticide Formulation Preference by Population Density in 2011.

Formulation	Population Density [a]		
	Urban	Suburban	Rural
	(% Formulation Preference)		
Spot-on	49.6	51.8	51.6
Veterinary medicine	25.7	31.3	22.6
Shampoo	24.9	25.3	27.4
Collar	25.7	25.9	27.4
Spray	6.7	8.4	9.7
Powder/Dust	5.6	7.2	3.2
Dip	6.6	4.2	6.5

[a] Column totals may not add to 100 due to multiple survey responses (i.e. pet owners may purchase more than one formulation)
Source: NAMD 2012

Table 8 shows the impact of family income on pet insecticide purchase in 2011 in terms of $1,000 dollars (k). There is little correlation in family income and choice of pet insecticide formulation. Nevertheless, families of all income levels prefer to purchase spot-on products over veterinary medicine (tablets), shampoo, and pet collars. Similarly, with the exception of incomes under $25k and incomes between $75k to <$100k, veterinary medicines are the second most preferred pet insecticide formulation. Pet collars are the third most preferred formulation for families for all income levels with the exception of $25k to <$50k where shampoo is the third preferred formulation. There is less preference for sprays, powders/dusts, and dips when compared to the other formulations.

Table 8. Pet Pesticide Formulation Preference by Family Income in 2011.

Formulation	Family Income [a]				
	< 25k	$25k to <$50k	$50k to <$75k	$75k to <$100k	$100k or more
	(% Formulation Preference)				
Spot-on	48.1	51.2	46.7	49.5	57.0
Veterinary medicine	20.8	30.0	32.8	20.7	28.1
Shampoo	33.9	28.1	21.9	16.2	18.4
Collar	29.5	24.0	24.1	24.3	27.2
Spray	6.6	9.2	4.4	7.2	8.8
Powder/Dust	3.8	6.5	8.8	3.6	6.1
Dip	6.0	5.5	6.6	3.6	8.8

[a] Column totals may not add to 100 due to multiple survey responses (i.e. pet owners may purchase more than one formulation)
Source: NAMD 2012

PESTICIDE PURCHASE SITE

Data in Table 9 indicate that combined, veterinary clinics, discount/merchandise stores, online pet products suppliers, pet stores, and pet supply stores account for the majority of pesticide purchases for use on pets in the United States (~87%). No other site exceeds 5% of purchases of pet insecticides.

Table 9. National Pesticide Purchase Site Preference in 2011.

Purchase Site	Reported Purchase [a] (% Site Preference)
Veterinarian	35.1
Discount/Mass Merchandise Store (e.g. Walmart, K-Mart)	28.9
Lawn/Garden Center	1.4
Supermarket/Grocery Store	4.5
Home Improvement Center (e.g. Home Depot, Lowes)	1.2
Hardware Store (e.g. True Value)	0.7
Farm Supply Store	3.7
Mail order/Catalog	1.2
On-line Pet Products Supplier	9.4
Pet Store	7.6
Pet Supply Store	6.0
Internet/World Wide Web	3.5
Warehouse/Wholesale Club	1.0

[a] Column totals may not add to 100 due to multiple survey responses (i.e. pet owners may purchase from multiple sites)
Source: NAMD 2012

Table 10 indicates that veterinary clinics are the primary site of pesticide purchase in all regions. However, while discount/mass merchandise stores in the southern and western United States are equally as important as veterinary clinics in terms of purchase site, veterinary clinics are more important in the other regions. Pet store purchases of pesticides exceed 5% in all regions but are greatest in the North-East and West regions. Pet supply stores are more important as a purchase site for pesticides in the West than the other regions. Pesticide purchases from supermarket/grocery stores, although minor for all regions, are lowest in the South. In addition, acceptance of digital pesticide purchases (internet + online) is lowest in the Mid-West when compared to the other regions. In contrast, pet owners in the Mid-West are more reliant on farm supply stores for pesticide purchase than are pet owners in the other regions. Pesticide purchases from all other sites account for less than 5% per region. Overall, geographic data indicates that purchase site preference does have a slight regional component but is probably insignificant for the major purchase sites (veterinarian clinic, discount/mass merchandise stores, and pet store/pet super stores).

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Table 10. Pesticide Purchase Site Preference for Pet Products by Geographic Region in 2011.

Purchase Site	Geographic Region [a]			
	North-East	Mid-West	South	West
	(% Site Preference)			
Veterinarian	33.6	36.5	38.6	28.1
Discount/Mass Merchandise Store (e.g. Walmart)	21.7	27.7	34.4	26.7
Lawn/Garden Center	2.1	0.6	1.4	1.4
Supermarket/Grocery Store	7.7	5.0	2.8	4.1
Home Improvement Center (e.g. Home Depot)	1.4	1.3	0.3	2.7
Hardware Store (e.g. True Value)	0.7	0.0	0.7	1.4
Farm Supply Store	2.8	9.4	2.4	0.7
Mail order/Catalog	1.4	1.9	1.0	0.7
On-line Pet Products Supplier	11.9	5.0	10.8	8.9
Pet Store	10.5	5.0	5.9	11.0
Pet Supply Store	6.3	5.7	3.8	10.3
Internet/World Wide Web	4.9	3.8	2.8	3.4
Warehouse/Wholesale Club	0.7	0.0	1.0	2.1

[a] Column totals may not add to 100 due to multiple survey responses (i.e. pet owners may purchase from multiple sites)
Source: NAMD 2012

Table 11 indicates that veterinary clinics are equally important purchase sites for flea and tick pesticides regardless of housing type. In contrast, mobile home/trailer residents are more likely to purchase pet insecticides from a discount/mass merchandise store than residents of single or multi-family housing. Furthermore, discount/mass merchandise stores represent the primary purchase site for mobile home/trailer residents. Multi-family and mobile home/trailer residents are more likely to purchase pet insecticides at supermarket/grocery stores than are residents of single family housing. Pet insecticide purchase at pet stores and pet supply stores is more important for multi-family housing in comparison to single family and mobile home/trailer housing. Regardless, pet stores and pet supply stores are the third greatest supplier of pet insecticides regardless of housing type. Online and internet sites also account for almost 10% of pet insecticides purchased regardless of housing type. Pet insecticide purchase at all other sites are minimal (less than 5%). Overall, data indicates that product availability at discount/mass merchandise stores is an important consideration for residents of mobile homes/trailers.

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Table 11. Pesticide Purchase Site Preference for Pet Products by Housing Type in 2011.

Purchase Site	Housing Type [a]		
	Single Family	Multi-Family	Mobile home/trailer
	(% Site Preference)		
Veterinarian	35.3	36.0	30.4
Discount/Mass Merchandise Store (e.g. Walmart)	29.0	22.0	43.5
Lawn/Garden Center	1.2	3.0	0.0
Supermarket/Grocery Store	3.9	7.0	6.5
Home Improvement Center (e.g. Home Depot)	0.8	3.0	2.2
Hardware Store (e.g. True Value)	0.8	0.0	0.0
Farm Supply Store	4.4	1.0	0.0
Mail order/Catalog	1.5	0.0	0.0
On-line Pet Products Supplier	9.7	7.0	10.9
Pet Store	6.9	11.0	8.7
Pet Supply Store	6.1	6.0	4.3
Internet/World Wide Web	3.7	2.0	4.3
Warehouse/Wholesale Club	1.0	1.0	0.0

[a] Column totals may not add to 100 due to multiple survey responses (i.e. pet owners may purchase from multiple sites)
Source: NAMD 2012

Veterinary clinics are the preferred site for pesticide purchase for urban and suburban residents, although a substantial portion of suburban purchases are also made from discount/mass merchandise stores (Table 12). In comparison, rural pet insecticide purchases are more likely to be from discount/mass merchandise stores. While pet stores/pet supply stores are the third most important purchase site for urban and suburban populations, rural populations are more likely to order pet products online. As noted for housing type, availability of various formulations of pet insecticides at discount/mass merchandise stores will strongly influence purchase decisions by rural pet owners.

Table 12. Pesticide Purchase Site Preference for Pet Products by Population Density in 2011.

Purchase site	Population Density [a]		
	Urban	Suburban	Rural
	(% Site Preference)		
Veterinarian	33.9	41.4	27.6
Discount/Mass Merchandise Store (e.g. Walmart)	24.6	35.8	48.3
Lawn/Garden Center	1.6	1.2	0.0
Supermarket/Grocery Store	5.2	2.5	3.4
Home Improvement Center (e.g. Home Depot)	1.6	0.0	1.7
Hardware Store (e.g. True Value)	0.8	0.6	0.0
Farm Supply Store	3.3	4.3	5.2
Mail order/Catalog	1.2	1.2	1.7
On-line Pet Products Supplier	10.1	4.3	17.2
Pet Store	8.7	6.8	0.0
Pet Supply Store	7.6	3.1	0.0
Internet/World Wide Web	3.7	2.5	5.2
Warehouse/Wholesale Club	1.2	0.6	0.0

[a] Column totals may not add to 100 due to multiple survey responses (i.e. pet owners may purchase from multiple sites)
Source: NAMD 2012

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Family income (Table 13) has a direct bearing on site of pesticide purchase for control of pests on pets. Purchases from veterinary clinics decreases as income decreases below $100k with a marked decrease as income fall below $25k. Most telling is that discount/mass merchandise stores are the primary site for pet insecticide purchase for incomes less than $25k (approximately 34% increase over that for veterinary clinics). For an income of $25k to $50k, little difference in preference is shown for purchase at either veterinary clinics or discount/mass merchandise stores. As incomes increase above $50k, purchasers are more likely to purchase at veterinary clinics over discount/mass merchandise stores. Overall, pet insecticide purchase decisions for families with less than $25K income will be more dependent upon the formulations and products available at discount/mass merchandise stores.

Table 13. Pesticide Purchase Site Preference for Pet Products by Family Income in 2011.

Purchase Site	Family Income [a]				
	Under $25k	$25k to <$50k	$50k to $75k	$75k to <$100k	$100k or more
	(% Site Preference)				
Veterinarian	29.1	35.3	34.6	32.1	48.1
Discount/Mass Merchandise Store (e.g. Walmart)	39.1	31.9	27.1	22.9	14.8
Lawn/Garden Center	0.6	2.4	0.0	0.9	2.8
Supermarket/Grocery Store	4.5	4.3	4.5	4.6	4.6
Home Improvement Center (e.g. Home Depot)	1.7	0.5	0.0	0.9	3.7
Hardware Store (e.g. True Value)	0.6	1.0	0.8	0.0	0.9
Farm Supply Store	3.9	4.3	2.3	6.4	0.9
Mail order/Catalog	1.7	1.4	0.8	0.9	0.9
On-line Pet Products Supplier	5.6	10.1	11.3	11.0	10.2
Pet Store	5.6	6.8	10.5	12.8	3.7
Pet Supply Store	7.8	3.9	7.5	3.7	7.4
Internet/World Wide Web	2.8	2.9	4.5	4.6	3.7
Warehouse/Wholesale Club	0.6	1.4	0.0	0.9	1.9

[a] Column totals may not add to 100 due to multiple survey responses (i.e. pet owners may purchase from multiple sites)

Source: NAMD 2012

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ALTERNATIVE INSECTICIDES

To obtain adequate levels of flea and tick control, insecticide recommendations include treatment of the animal and environment (house and yard), generally using multiple insecticides. Flea collars remain a viable product for use on both dogs and cats as part of a comprehensive control program for fleas and ticks. Nevertheless, as shown in Table 4, veterinary medicines, shampoos, and collars are equally used products. However, as collars, veterinary medicines, and liquid rub-in/spot-ons provide control of both fleas and ticks for extended periods, shampoos only provide immediate relief for fleas and ticks with no residual control. Furthermore, although shampoos are available with residual activity against flea eggs, their inability to control ticks precludes them as full replacements for TCVP collars. In addition, as noted previously, shampoos may also be used in conjunction with other pest control formulations which may bias their importance in survey data. Therefore, for the scope of this analysis, shampoos are not considered to be a viable alternative to TCVP impregnated collars and this analysis will only examine pet collars, veterinary medicines, and liquid rub-ins/spot-ons as alternatives to TCVP pet collars.

Pet Collars:

BEAD has identified 5 insecticide combinations which are formulated as an impregnated flea/tick control collar for dogs and 4 which are formulated for use on cats (Table 14). In addition, there is one collar which is specifically for tick control on dogs.

Two of the available pet collar formulations for dogs and cats contain TCVP. In the absence of reformulation of these collars with an alternative active ingredient, the available collar formulations are reduced to 4 for dogs and 2 for cats in the absence of TCVP.

Absence of TCVP-based products for flea and tick control on dogs would limit pet collar availability for dogs to products containing amitraz (tick control only), deltamethrin, flumethrin+imidacloprid, and geraniol+peppermint oil+almond oil. Cat collars would be limited to flumethrin+imidacloprid and geraniol+peppermint oil+almond oil (Table 14). It must be noted that all of these products with the exception of geraniol+peppermint oil+almond provide control of the target pests whereas geraniol+peppermint oil+almond oil only repels the target pests. In addition, geraniol+peppermint oil+almond oil based products have activity against target pests which is substantially less than TCVP based products and the other identified alternatives. As such geraniol+peppermint oil+almond oil based pet collars are not considered an alternative to TCVP pet collars. All of the other products provide equivalent periods of pesticidal activity when compared to TCVP based products and would be viable alternatives.

Absence of tetrachlorvinphos+methoprene collars for dogs and cats would limit the ability to break the life cycle of fleas due to methoprene stopping hatch of flea eggs. However, the remaining available products could potentially be formulated to include methoprene.

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Table 14. Insecticides Used in Impregnated Flea and/or Tick Collars for Pets (2017).

Pet	Products [a]	Active Ingredients (% AI)	Labeled Pests			Treatment Interval
			Flea		Tick	
			Adult	Egg	Adult /Immature	
Dog	Preventic Amitraz Tick Collar	amitraz (9.0%)			x	3 months
	DogMD	deltamethrin (4.0%)	x		x	6 months
	PetArmor		x		x	6 months
	PetLock Collar		x		x	6 months
	Scalibor		x		x	6 months
	Seresto	flumethrin (4.5%) + imidacloprid (10.0%)	x		x	8 months
	Easy Defense	Geraniol, peppermint oil, almond oil	x		x	4 months
	Adams Flea and Tick Control Collar	tetrachlorvinphos (14.55%)	x		x	7 months
	Hartz UltraGuard		x		x	7 months
	Zodiac		x		x	7 months
	Adams Flea and Tick Control Collar	tetrachlorvinphos (14.55%) + (S)-methoprene (1.02%)	x	x	x	7 months
	Hartz UltaGuard Plus		x	x	x	7 months
Cat	Seresto	flumethrin (4.5%) + imidacloprid (10.0%)	x		x	8 months
	Easy Defense	Geraniol, Peppermint Oil, Almond Oil	x		x	4 months
	Hartz 2-in-1	tetrachlorvinphos (14.55%)	x		x	7 months
	Zodiac Breakaway		x		x	7 months
	Adams Plus	tetrachlorvinphos (14.55%) + (S)-methoprene (1.02%)	x	x	x	7 months
	Bio Spot Active Care		x	x	x	7 months
	Hartz Ultra Guard Plus		x	x	x	7 months

Source: 1-800-PetMeds®, Petco®, PetSmart®, Walmart®
[a] All products are trademarked (®)

Spot-ons:

Spot-ons are the primary non-collar alternative to TCVP-based pet collars. However, as shown in Table 15, imidacloprid and indoxacarb as single active ingredients are only effective for fleas on dogs. Similarly for cats, imidacloprid and methoprene are only effective for flea control. These products are appropriate alternatives to TCVP-based pet collars where fleas are the only target pest. As such, these single active ingredient products cannot be considered as full replacements for TCVP based collars which also provide tick control. All other multiple active ingredient spot-on products can be considered as alternatives to TCVP pet collars based on activity against the complete pest spectrum (fleas and ticks) targeted for control with TCVP.

As noted previously, among dog-owning households 40.7% also owned cats and 46.4% of cat-owning households also owned dogs. As permethrin based spot-ons should not be used in households with both dogs and cats present, use of this product would be further restricted for 40 to 50% of pet insecticide purchasers. Similarly, as Revolution® (selamectin), Advantage Multi® (imidacloprid + moxidectin), and Bravecto® (fluralaner) are veterinary products, only those pets which see a veterinarian and where owners purchase pest control products from a veterinarian would have access to these materials. This would potentially limit these products

as alternatives to TCVP for a large proportion of the pet population. Therefore, veterinary spot-on products cannot be considered as viable TCVP alternatives.

Table 15. Spot-On Products Used for Flea and Tick Control on Dogs and Cats (2017).

Pet	Products [a]	Active Ingredients (%AI)	Labeled Pests		Treatment Interval
			Flea	Tick	
Dog	Natural Care +	clove, thyme, and cinnamon oils	x	x	1 month
	Sentry Pro XFT	cyphenothrin (20.0%) + pyriproxyfen (2.0%)	x	x	1 month
	Sentry Pro Toy	etofenprox (55.0%) + pyriproxyfen (2.2%)	x	x	1 month
	Hartz UltraGuard	etofenprox (55.0%) + piperonyl butoxide (10%.0%) + N-octyl bicycloheptene dicarboximide (1.0%)	x	x	1 month
	Hartz UltraGuard Pro	etofenprox (55.0%) + piperonyl butoxide (10.0%) + n-octylbicycloheptene dicarboximide (1.0%) + pyriproxyfen (0.5%)+ (S)-methoprene (0.25%)	x	x	1 month
	PetArmor (Generic Frontline)	fipronil (9.7%)	x	x	1 month
	Parastar		x	x	1 month
	DogMD - fipronil		x	x	1 month
	Parastar Plus	fipronil (9.8%) + cyphenothin (5.2%)	x	x	1 month
	Frontline Plus	fipronil (9.8%) + (s)-methoprene (8.8%)	x	x	1 month
	Flea5X Plus (Generic Frontline)		x	x	1 month
	Sentry Fiproguard Plus		x	x	1 month
	DogMD Plus		x	x	1 month
	Pet Armour Plus		x	x	1 month
	ZoGuard Plus		x	x	1 month
	Certifect	fipronil (9.8%) + (s)-methoprene (8.8%) + amitraz (22.1%)	x	x	1 month
	Easy Defense	Geraniol, perpermint oil, almond oil	x	x	1 month
	Advantage Multi [b]	imidacloprid + moxidectin	x		1 month
	Bayer Defense Care	imidacloprid (8.8%) + permethrin (44.0%)	x	x	1 month
	Dog MD Advanced 2	imidacloprid (9.1%) + pyriproxifen (0.46%)	x		1 month
	Advantage II		x		1 month
	PetLock Max	imidacloprid (8.8%) + permethrin (44.0%) + pyriproxifen (0.44%)	x	x	1 month
	Advecta 3		x	x	1 month
	K9 Advantix II		x	x	1 month
	Activyl	indoxicarb (19.53%)	x		1 month
	Activyl Tick Plus	indoxicarb (13.01%) + permethrin (42.50%)	x	x	1 month
	Frontline Tritak	fipronil (9.8%) + cyphenthrin (5.2%) + (s)-methoprene (8.8%)	x	x	1 month
	DogMD Maximum Defense	permethrin (45.0%) + pyriproxyfen (1.9%)	x	x	1 month
	Sentry		x	x	1 month
	Revolution [b]	selamectin	x	x	1 month

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Pet	Products [a]	Active Ingredients (%AI)	Labeled Pests		Treatment Interval
			Flea	Tick	
Cat	Catego	dinetofuran (22.0%) + fipronil (8.92%) + pyriproxyfen (3.0%)	x	x	1 month
	PurrScriptions	etofenprox (55.0%)	x	x	1 month
	Hartz UltraGuard Pro	etofenprox (40.0%) + (S)-methoprene (3.6%)	x	x	1 month
	Bio Spot Spot On Flea and tick		x	x	1 month
	Adams Flea & Tick Spot On		x	x	1 month
	Bio Spot Active Care		x	x	1 month
	Hartz UltraGuard Plus		x	x	1 month
	PurrScriptions Plus	etofenprox (55.0%) + pyriproxyfen (2.2%)	x	x	1 month
	Parastar	fipronil (9.7%)	x	x	1 month
	EasySpot		x	x	1 month
	PetArmor (Generic Frontline)		x	x	1 month
	CatMD-fipronil		x	x	1 month
	Sentry Fiproguard		x	x	1 month
	Parastar Plus	fipronil (9.8%) + cyphenothin (5.2%)	x	x	1 month
	Frontline Tritak	fipronil (9.8%) + etofenprox (15.0%) + (s)-methoprene (11.8%)	x	x	1 month
	Flea5X Plus (Generic Frontline)	fipronil (9.8%) + (s)-methoprene (8.8%)	x	x	1 month
	Frontline Plus	fipronil (9.8%) + (s)-methoprene (11.8%)	x	x	1 month
	CatMD Plus		x	x	1 month
	PetLock Plus		x	x	1 month
	Pet Armor Plus		x	x	1 month
	Bravecto [b]	fluralaner	x	x	3 months
	Easy Defense	Geraniol, Pepermint Oil, Almond Oil	x	x	1 month
	Defense Care	imidacloprid (5.1%)	x		1 month
	Advantage Multi [b]	imidacloprid + moxidectin	x		1 month
	Advantage II	imidacloprid (9.1%) + pyriproxifen (0.46%)	x		1 month
	CatMD Advanced2		x		1 month
	PetLock II		x		1 month
	K9 Advantix II	imidacloprid (8.8%) + permethrin (44.0%) + pyriproxifen (0.44%)	x	x	1 month
	Activyl	indoxicarb (19.53%)	x		1 month
	PurrScriptions Indoor	peppermint, clove, and lemongrass oils	x	x	1 month
	Sentry Natural Defense		x	x	1 month
	Hartz UltraGuard (One Spot)	(S)-methoprene (2.9%)	X (eggs)		1 month
	Revolution [b]	selamectin	x	x	1 month
	Cheristin	spinetoram (11.2%)	x		1 month

Source: 1-800-PetMeds®, Petco®, PetSmart®, Walmart®

[a] All products are trademarked (®)

[b] Veterinary product

Veterinary Medicines (Pills, Tablets, and Chews):

There are currently 11 veterinary products (pills, tablets, and chews) across 8 formulations which could be considered as alternatives to TCVP flea and tick collars on dogs (Table 16). For cats, there are only 5 veterinary products and 2 formulations available. However, while all products are effective against fleas, only products containing afoxolaner and sarolaner have additional activity against ticks and could be considered full replacement to TCVP collars. All formulations except imidacloprid and nitenpyram require a prescription for purchase. Only those pets which see a veterinarian would have access to these materials. As noted earlier, only approximately 85% of dogs and 65% of cats are examined by a veterinarian on a yearly basis. In addition, taking into account the lack of tick control for most veterinary products, these products would only be acceptable replacements for TCVP collars in situations where fleas are the only target pest. Overall, veterinary medicines cannot be considered as viable alternatives to TCVP pet collars.

Table 16. Veterinary Medicines Used for Flea and Tick Control on Dogs and Cats (2017).

Pet	Products [a]	Active Ingredient	Flea	Tick	Treatment Interval
Dog	NexGard [b]	afoxolaner	x	x	1 month
	Advantus	imidacloprid	x		1 day
	Sentinel [b]	milbemycin oxime	x (eggs)		1 month
	Sentinel Spectrum [b]	milbemycin oxime + lufenuron + praziquantel	x		1 month
	Capstar	nitenpyram	x		1 day
	Sentry Capguard		x		1 day
	Dog MD QuickTabs		x		1 day
	Pet Armour FastCaps		x		1 day
	Simparica [b]	sarolaner	x	x	1 month
	Comfortis	spinosad	x		1 month
	Trifexis	spinosad + milbemycin oxime	x		1 month
Cat	Sentry Capguard	nitenpyram	x		1 day
	Capstar		x		1 day
	Dog&Cat MD QuickTabs		x		1 day
	PetArmour FastCaps		x		1 day
	Comfortis [b]	spinosad	x		1 month

Source: 1-800-PetMeds®, Petco®, PetSmart®, Walmart®
[a] All products are trademarked (®)
[b] Veterinary product

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Price Comparison for Pet Collars and Spot-ons:

Tables 17 and 18 provide a comparison of pricing for collars and spot-ons for flea and tick control on dogs and cats, respectively. Due to the extended control provided by these product types when compared to shampoos, these are the most likely alternatives to TCVP collars. Product price information was obtained online from various discount/mass merchandise stores and pet super stores including; 1-800-PetMeds, Petsmart, Petco, and Walmart. Walmart pricing was limited to products with in-store pickup as online sales information indicate that many products are actually supplied by third party vendors. Product price is provided for both initial purchase and monthly. Initial purchase price was obtained for the lowest quantity of product available for purchase (ie. some spot-ons are packed as either 3, 6, or more single applicators). While better pricing can usually be expected by buying a larger volume at one time, this assessment attempts to minimize initial outlay which would likely be the more economically viable option for purchasers with low incomes. It must be noted that all stores did not carry the same products and some products were limited to one store only. In addition, these prices do not reflect pricing at veterinarian clinics or retail stores which tend to be higher. However, the stores sampled for price information do represent a readily available source for pet insecticides for all socio-economic groups considered in this analysis.

As shown in Tables 17 and 18, alternative flea and tick controls based on etofenprox are comparable in price or less expensive than TCVP based pet collars for both dogs and cats. The most likely alternatives to TCVP pet collars would be Hartz UltraGuard® for dogs and PurrrScriptions® for cats. Initial cost for Hartz UltraGuard® for dogs would $1.85 less than TCVP collars and monthly cost would only increase by $0.66. Similarly, initial cost for PurrrScriptions® for cats would be $2.11 less than TCVP collars and monthly cost would only increase by $0.45.

In contrast, other products used in both collars and spot-on insecticides for dogs would be $1.74 (Easy Defense®) to $24.04 (Certifect®) per month more expensive than TCVP pet collars for dogs. For cats, other collar and spot-on products would be $0.54 (Hartz UltraGuard One Spot®) to $18.10 (FrontLine Tritak®) per month more expensive than TCVP collars. Overall, only the etofenprox products are equivalent in price and control the same pest spectrum as TCVP.

Table 17. Current Pricing for Representative Alternative Flea Collars and Spot-Ons for Dogs.

Products [a]	Active Ingredients (% AI)	Product Type	Treatment Interval	Initial Cost ($)	Units per package	Change in Initial Cost Relative to TCVP ($)	Cost per Month ($)	Change in Monthly Cost relative to TCVP ($)
TCVP Tick And Adult Flea (Only) Control (Dog)								
Adams Flea and Tick Control Collar	tetrachlorvinphos (14.55%)	collar	7 months	4.92	1		0.70	
Hartz UltraGuard		collar	7 months	3.43	1		0.49	
Zodiac		collar	7 months	7.49	1		1.07	

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Products [a]	Active Ingredients (% AI)	Product Type	Treatment Interval	Initial Cost ($)	Units per package	Change in Initial Cost Relative to TCVP ($)	Cost per Month ($)	Change in Monthly Cost relative to TCVP ($)
Preventic Amitraz Tick Collar [c]	amitraz (9.0%)	collar	3 months	16.90	1	11.62	5.63	4.88
DogMD	deltamethrin (4.0%)	collar	6 months	59.99	1	54.71	5.00	4.24
PetArmor Plus		collar	6 months	39.46	1	34.18	6.58	5.82
PetLock Collar		collar	6 months	41.19	1	35.91	6.87	6.11
Scalibor		collar	6 months	33.99	1	28.71	5.67	4.91
Easy Defense	Geraniol, perpermint oil, almond oil	collar	4 months	9.99	1	4.71	2.50	1.74
TCVP Tick And Adult/Immature/Egg Flea Control (Dog)								
Adams Flea and Tick Control Collar	tetrachlorvinphos (14.55%) + (S)-methoprene (1.02%)	collar	7 months	6.39	1		0.91	
Hartz UltaGuard Plus		collar	7 months	7.03	1		1.00	
Seresto	flumethrin (4.5%) + imidacloprid (10.0%)	collar	8 months	54.99	1	48.28	6.87	5.92
Natural Care +	clove, thyme, and cinnamon oils	topical	1 month	11.95	4	5.24	2.99	2.03
Sentry Pro XFT	cyphenothrin (20.0%) + pyriproxyfen (2.0%)	topical	1 month	11.99	3	5.28	4.00	3.04
Sentry Pro Toy	etofenprox (55.0%) + pyriproxyfen (2.2%)	topical	1 month	12.99	3	6.28	4.33	3.37
Hartz UltraGuard	etofenprox (55.0%) + piperonyl butoxide (10%.0%) + N-octyl bicycloheptene dicarboximide 1.0%)	topical	1 month	4.86	3	-1.85	1.62	0.66
Hartz UltraGuard Pro	etofenprox (55.0%) + piperonyl butoxide (10.0%) + n-octylbicycloheptene dicarboximide (1.0%) + pyriproxyfen (0.5%)+ (S)-methoprene (0.25%)	topical	1 month	11.83	3	5.12	3.94	2.98
PetArmor (Generic Frontline)	fipronil (9.7%)	topical	1 month	19.76	3	13.05	6.59	5.63
Parastar		topical	1 month	30.59	3	23.88	10.20	9.24
DogMD - fipronil		topical	1 month	24.99	3	18.28	8.33	7.37

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Products [a]	Active Ingredients (% AI)	Product Type	Treatment Interval	Initial Cost ($)	Units per package	Change in Initial Cost Relative to TCVP ($)	Cost per Month ($)	Change in Monthly Cost relative to TCVP ($)
Parastar Plus	fipronil (9.8%) + cyphenothin (5.2%)	topical	1 month	38.62	3	31.91	12.87	11.91
Frontline Plus	fipronil (9.8%) + (s)-methoprene (8.8%)	topical	1 month	32.00	3	25.29	11.41	10.45
Flea5X Plus (Generic Frontline)		topical	1 month	27.62	3	20.91	9.21	8.25
Sentry Fiproguard Plus		topical	1 month	86.99	6	80.28	14.50	13.54
DogMD Plus		topical	1 month	52.99	6	46.28	8.83	7.87
Pet Armour Plus		topical	1 month	27.54	3	20.83	9.18	8.22
ZoGuard Plus		topical	1 month	25.97	3	19.26	8.66	7.70
Certifect	fipronil (9.8%) + (s)-methoprene (8.8%) + amitraz (22.1%)	topical	1 month	74.99	3	68.28	25.00	24.04
Easy Defense	Geraniol, perpermint oil, almond oil	topical	1 month	19.99	3	13.28	6.66	5.70
Advantage Multi [b]	imidacloprid + moxidectin	topical	1 month	81.99	6	75.28	13.67	12.71
Bayer Defense Care	imidacloprid (8.8%) + permethrin (44.0%)	topical	1 month	40.99	3	34.28	13.66	12.70
Dog MD Advanced 2	imidacloprid (9.1%) + pyriproxifen (0.46%)	topical	1 month	46.99	4	40.28	11.75	10.79
Advantage II		topical	1 month	37.28	4	30.57	9.32	8.36
PetLock Max	imidacloprid (8.8%) + permethrin (44.0%) + pyriproxifen (0.44%)	topical	1 month	39.99	4	33.28	10.00	9.04
Advecta 3		topical	1 month	32.64	4	25.93	8.16	7.20
K9 Advantix II		topical	1 month	43.25	4	36.54	10.81	9.85
Activyl	indoxicarb (19.53%)	topical	1 month	78.87	6	72.16	20.98	20.02
Activyl Tick Plus	indoxicarb (13.01%) + permethrin (42.50%)	topical	1 month	72.24	6	65.53	12.04	11.08
Frontline Tritak	fipronil (9.8%) + cyphenthrin (5.2%) + (s)-methoprene (8.8%)	topical	1 month	47.69	3	40.98	15.90	14.94
DogMD Maximum Defense	permethrin (45.0%) + pyriproxyfen (1.9%)	topical	1 month	9.99	3	3.28	3.33	2.37
Sentry		topical	1 month	9.72	3	3.01	3.24	2.28
Revolution [b]	selamectin	topical	1 month	43.19	3	36.48	14.40	13.44

Source: 1-800-PetMeds®, Petco®, PetSmart®, Walmart®

[a] All products are trademarked (®)

[b] Veterinary prescription required for purchase

[c] Tick control only

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Table 18. Current Pricing for Representative Alternative Flea Collars and Spot-ons on Cats.

Products [a]	Active Ingredients (% AI)	Product Type	Treatment Interval	Initial Cost ($)	Units per package	Change in Initial Cost Relative to TCVP ($)	Cost per Month ($)	Change in Monthly Cost relative to TCVP ($)
TCVP Tick And Adult Flea (Only) Control On Cats								
Hartz 2-in-1	tetrachlorvinphos (14.55%)	collar	7 months	2.94	1		0.42	
Zodiac Breakaway		collar	7 months	9.22	1		1.32	
PurrScriptions	etofenprox (55.0%)	topical	1 month	3.97	3	-2.11	1.32	0.45
Parastar	fipronil (9.7%)	topical	1 month	30.59	3	24.51	10.20	9.33
EasySpot		topical	1 month	30.59	3	24.51	10.20	9.33
PetArmor (Generic Frontline)		topical	1 month	23.79	3	17.71	7.93	7.06
CatMD-fipronil		topical	1 month	24.99	3	18.91	8.33	7.46
Sentry Fiproguard		topical	1 month	23.99	3	17.91	8.00	7.13
Bravecto [b]	fluralaner	topical	3 months	45.81	1	39.73	15.27	14.40
Easy Defense	Geraniol, Pepermint Oil, Almond Oil	topical	1 month	19.99	3	13.91	6.66	5.79
Defense Care	imidacloprid (5.1%)	topical	1 month	39.99	3	33.91	13.33	12.46
PurrScriptions Indoor	peppermint, clove, and lemongrass oils	topical	1 month	14.99	3	8.91	5.00	4.13
Sentry Natural Defense		topical	1 month	8.99	4	2.91	2.25	1.38
TCVP Tick And Flea (Adult/Immature/Egg) Control On Cats								
Adams Plus	tetrachlorvinphos (14.55%), (S)-methoprene (1.02%)	collar	7 months	9.59	1		1.37	
Bio Spot Active Care		collar	7 months	7.69	1		1.06	
Hartz Ultra Guard Plus		collar	7 months	7.43	1		1.06	
Seresto	flumethrin (4.5%) + imidacloprid (10.0%)	collar	8 months	54.66	1	46.42	6.83	5.67
Easy Defense	Geraniol, Pepermint Oil, Almond Oil	collar	4 months	9.99	1	1.75	2.50	1.34
Catego	dinetofuran (22.0%) + fipronil (8.92%) + pyriproxyfen (3.0%)	topical	1 month	39.99	3	31.75	13.33	12.17
Hartz UltraGuard Pro	etofenprox (40.0%) + (S)-methoprene (3.6%)	topical	1 month	12.97	3	4.73	4.32	3.16
Adams Flea & Tick Spot On		topical	1 month	18.69	3	10.45	6.23	5.07

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Products [a]	Active Ingredients (% AI)	Product Type	Treatment Interval	Initial Cost ($)	Units per package	Change in Initial Cost Relative to TCVP ($)	Cost per Month ($)	Change in Monthly Cost relative to TCVP ($)
Bio Spot Active Care		topical	1 month	18.99	4	10.75	6.33	5.17
Hartz UltraGuard Plus		topical	1 month	13.60	3	5.36	4.53	3.37
PurrScriptions Plus	etofenprox (55.0%) + pyriproxyfen (2.2%)	topical	1 month	11.69	3	3.45	3.90	2.73
Frontline Tritak	fipronil (9.8%) + etofenprox (15.0%) + (s)-methoprene (11.8%)	topical	1 month	57.79	3	49.55	19.26	18.10
Flea5X Plus (Generic Frontline)	fipronil (9.8%) + (s)-methoprene (8.8%)	topical	1 month	27.62	3	19.38	9.21	8.04
Frontline Plus	fipronil (9.8%) + (s)-methoprene (11.8%)	topical	1 month	34.12	3	25.88	11.37	10.21
CatMD Plus		topical	1 month	44.99	3	36.75	15.00	13.83
PetLock Plus		topical	1 month	31.99	3	23.75	10.66	9.50
Pet Armor Plus		topical	1 month	27.54	3	19.30	9.18	8.02
Advantage Multi [b]	imidacloprid + moxidectin	topical	1 month	81.99	6	73.75	13.67	12.50
Advantage II	imidacloprid (9.1%) + pyriproxifen (0.46%)	topical	1 month	40.45	4	32.21	10.11	8.95
CatMD Advanced2		topical	1 month	46.99	4	38.75	11.75	10.59
PetLock II		topical	1 month	29.99	4	21.75	7.50	6.34
Activyl	indoxicarb (19.53%)	topical	1 month	63.74		55.50	10.62	9.46
Hartz UltraGuard (One Spot) [c]	(S)-methoprene (2.9%)	topical	1 month	5.12	3	-3.12	1.71	0.54
Revolution [b]	selamectin	topical	1 month	43.19	3	34.95	14.40	13.23
Cheristin	spinetoram (11.2%)	topical	1 month	80.99	6	72.75	13.50	12.34

Source: 1-800-PetMeds®, Petco®, PetSmart®, Walmart®

[a] All products are trademarked (®)

[b] Veterinary prescription required for purchase

[c] Flea eggs only

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Socio-Economic Equity Assessment

In order to better characterize the impacts of cancelling certain TCVP collar products, BEAD estimated the incremental changes in control costs in the context of household income and other expenditures. This analysis focuses on a household at the poverty line. This is not the worst-case scenario, as some households may be below the poverty line, but it provides insight into the impacts for dog and cat pet owners at the poverty line in the United States. Thus, the impacts of cancelling certain TCVP flea and tick collar control products may disproportionately affect low-income households.

In this analysis, EPA considers the impacts of the incremental costs estimated in the previous section on an average size, single-family household. In the United States. from 2011 to 2015, an average size family, as reported by the U.S. Census Bureau's American Community's Survey, is 3.24 persons across all income levels (U.S. Census Bureau, 2011-2015).[1] BEAD assessed the average incremental costs as a percentage of a household income at the poverty-threshold for a three-member household, which is $20,420/year or approximately $1,702 per month in 2015 (HHS, 2017).[2] Although most households face many fixed costs, housing is the only fixed cost that is more or less constant across all households. According to the U.S. Census Bureau (2015), households at or below the poverty line spend 47% or $9,597 of their annual income on housing (U.S. Census Bureau, National Housing Costs -All Occupied Units, 2015), leaving $10,823 or $902 per month for other expenses annually, including food, transportation and health care. In order to appropriately characterize the costs that a household in poverty may be facing when having to invest in enough flea and tick control products to treat for a minor or major infestation, monthly rather than annual disposable income is considered. Monthly income is appropriate in this situation since low-income households may have limited savings on which they can draw for unexpected expenses and high borrowing costs if those expenses are distributed across future periods. Further, it is unclear how frequently a flea or tick infestation may occur.

BEAD examined the impacts to households at the poverty level that used TCVP flea and tick collars that may need to find alternatives if TCVP-based flea and tick control products were no longer available. Tables 19 and 20 present the average monthly incremental change in high and low cost alternatives for households that switch from pet collars with TCVP for dogs and cats to alternative control collars and spot-ons (topical). These product costs are compared to the baseline average cost of TCVP collars for flea and tick control being used by households whose current flea and tick control methods would no longer be available under the proposed mitigation of removing TCVP pet collars. Although not examined in this analysis, the impact from having to pay for flea and tick control as a percentage of household income will be larger for households whose income is less than the poverty threshold.

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1 BEAD was unable to locate information on the household size specific to income level.

2 Note that the U.S. Department of Housing and Urban Development (HUD) uses a different poverty threshold than Department of Housing and Human Services (HHS). EPA chose to HHS's poverty threshold for two reasons. First, their data are more recent; second, EPA preferred to use the more conservative estimate (i.e., erring on the side of higher rather than lower impacts from the proposed mitigation) in this analysis.

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BEAD's analysis of the absence of TCVP pet collars provides conservative estimates of the impact. We consider the high and low incremental changes in monthly flea and tick controls costs for households at the poverty level. There are basically 2 alternatives for both dog and cat owners etofenprox + piperonyl butoxide + bicycloheptene dicarboximide and fipronil + (s)-methoprene + amitraz. Table 19 below shows that the incremental change in cost from switching from a TCVP based collar to a low cost etofenprox-based topical is $0.66 per month. The upper bound incremental change in cost for the fipronil based product is estimated to be $24 per month (Table 19). For a household at the poverty level with 1 dog, the incremental cost difference as a percent of monthly disposable income net of housing costs can range from less than 1% ($0.66 / $902) to less than 3% ($24.04 / $902) per month.

Table 19. Average Monthly Incremental Change For High And Low Cost Alternatives For Households That Switch From Pet Collars With TCVP For Dogs To Alternative Control Collars And Spot-Ons (Topical).

Products [a]	Active Ingredients (% AI)	Product Type	Treatment Interval	Initial Cost ($)	Units per package	Change in Initial Cost Relative to TCVP ($)	Cost per Month ($)	Change in Monthly Cost relative to TCVP ($)
TCVP Tick and Adult Flea (Only) Control (Dog)								
Adams Flea and Tick Control Collar	tetrachlorvinphos (14.55%)	collar	7 months	4.92	1		0.70	
Hartz UltraGuard		collar	7 months	3.43	1		0.49	
Zodiac		collar	7 months	7.49	1		1.07	
Hartz UltraGuard	etofenprox (55.0%) + piperonyl butoxide (10%.0%) + N-octyl bicycloheptene dicarboximide 1.0%)	topical	1 month	4.86	3	-1.85	1.62	0.66
Certifect	fipronil (9.8%) + (s)-methoprene (8.8%) + amitraz (22.1%)	topical	1 month	74.99	3	68.28	25.00	24.04

Source: 1-800-PetMeds®, Petco®, PetSmart®, Walmart®
[a] All products are trademarked (®)

For a household at the poverty level with 1 cat, the incremental cost difference as a percent of monthly disposable income net of housing costs can range from less than 1% ($0.45 / $902) to 2% ($18.10 / $902) per month. For cat owners at the poverty level the incremental cost differences in alternative products are illustrated below in Table 20.

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Table 20. Average Monthly Incremental Change For High And Low Cost Alternatives For A Household That Switched From Pet Collars With TCVP For Cats To Alternative Control Collars And Spot-Ons (Topical).

Products [a]	Active Ingredients (% AI)	Product Type	Treatment Interval	Initial Cost ($)	Units per package	Change in Initial Cost Relative to TCVP ($)	Cost per Month ($)	Change in Cost per Month relative to TCVP ($)
TCVP Tick and Adult Flea (only) Control on Cats								
Hartz 2-in-1	tetrachlorvinphos (14.55%)	collar	7 months	2.94	1		0.42	
Zodiac Breakaway		collar	7 months	9.22	1		1.32	
PurrScriptions	etofenprox (55.0%)	topical	1 month	3.97	3	-2.11	1.32	0.45
Frontline Tritak	fipronil (9.8%) + etofenprox (15.0%) + (s)-methoprene (11.8%)	topical	1 month	57.79	3	49.55	19.26	18.10

Source: 1-800-PetMeds®, Petco®, PetSmart®, Walmart®
[a] All products are trademarked (®)

Due to the previously discussed socio-economic factors which influence purchase decisions, it is not possible to identify the most likely collar/spot-on replacement for TCVP-based on product price alone. Nevertheless, it can be speculated that a high number of current users of TCVP-based pet collars would move to an etofenprox-based topical control alternative and realize a minimal economic impact.

CONCLUSIONS

Three market brands would be impacted by the unavailability of TCVP pet collars. These include: Zodiac, Adams, and Hartz. Pesticide formulation choice does not appear to be driven by geographic region, housing type, population density or family income. Across all socio-economic surveys, the preferred formulation for pet insecticides is spot-on products. However, site of pet insecticide purchase is strongly influenced by housing type, population density, and family income. While site of purchase is dominated by veterinary clinics and discount/mass merchandise stores, discount/mass merchandise stores are of greater importance to rural populations, mobile home residences, and as family income decreases below $25k.

The availability survey conducted by BEAD shows that there are limited alternative pet collars to replace TCVP collars. The other dominant formulations are veterinary medicines, shampoos, and collars. Veterinary medicines are not acceptable alternatives to TCVP collars as they are

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more expensive and generally only effective against fleas. Shampoos are not considered alternatives due to the temporary control achieved with their use. Spot-on formulations do provide extended control of both fleas and ticks and are the most likely alternatives to TCVP collars. Data also indicate that spot-ons have the largest market share of pet insecticide purchases and appears to be increasing at the cost to the other major formulations.

Based on price comparisons, etofenprox spot-ons are the most affordable alternative to TCVP collars. More importantly, etofenprox products were determined to be primarily sold in discount/mass merchandise stores. Due to the common occurrence of discount/mass merchandise stores throughout the United States, these etofenprox products should be readily available for all regional and socioeconomic factors. For dogs and cats, initial purchase cost for etofenprox spot-ons would be less than for TCVP collars and monthly costs would only increase by $0.66 and $0.45, respectively. Analysis of socio-economic equity also shows minimal economic impact with the change to etofenprox spot-ons.

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