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## Dogs Entering the United States from Rabies Endemic Countries, 2011–2012

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### Summary

International dog imports pose a risk because of the potential movement of disease agents, including the canine rabies virus variant which has been eliminated from the United States since 2007. U.S. regulations require a rabies vaccination certificate for dogs arriving from rabies-endemic countries, but permit the importation of dogs that have not been adequately immunized against rabies, provided that the dogs are confined under conditions that restrict their contact with humans and other animals until they have been immunized. CDC Form 75.37, “Notice to Owners and Importers of Dogs,” explains the confinement requirements and serves as a binding confinement agreement with the importer. In this evaluation, we describe the characteristics of unimmunized dogs imported into the United States over a one-year period based upon dog confinement agreements recorded at the Centers for Disease Control and Prevention (CDC) quarantine stations. Confinement agreements were issued for nearly 2800 unimmunized dogs that entered the United States during June 1, 2011–May 31, 2012, the majority of which traveled to the United States by air and without any seasonal pattern in import volume. Over 60% of these animals were puppies <3 months of age and included a wide variety of breeds. The dogs arrived from 81 countries, with the majority arriving from North America or Europe. Dogs placed on confinement agreements had final destinations in 49 states. California, New York, Texas, Washington, and Florida received the largest number of dogs on confinement agreements. These results (which do not reflect human travel or U.S. dog ownership data) suggest that a large portion of unimmunized dogs arrive from rabies-endemic countries for commercial, shelter, and rescue purposes. Further evaluation and key stakeholder involvement are needed to assess whether the current dog importation regulations are an adequate compromise between the benefits and risks of dog importation.

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## Keywords

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## Introduction

Dogs of many different breeds and ages enter the United States on a daily basis: an estimated 287,000+ dogs entered in 2006 alone (McQuiston *et al.*, 2008). These dogs come from many different countries and may be imported as an individual's pet, as breeding stock, for re-sale, or for adoption. Some dogs are also imported as working animals, for example as police dogs. Dogs enter the United States with varying medical histories. Some are appropriately vaccinated against diseases such as rabies, but others are either too young for vaccination or importers (i.e., breeders, distributors, rescue organizations, shelters, or private owners) have elected not to immunize the animals before shipping. In some instances, the dog was properly vaccinated at one time, but the vaccination has expired. Thus, dog importation presents risks for importing infectious agents (McQuiston *et al.*, 2008; Ehnert and Galland, 2009; Castrodale *et al.*, 2008). In the past decade, several rabid dogs have been imported into the United States (Castrodale *et al.*, 2008; CDC, 2008; McQuiston *et al.*, 2008; Ehnert and Galland, 2009). Dogs also arrive at U.S. ports of entry ill or dead, often for unknown reasons (Sinclair, 2012).

Dog imports into the United States are regulated by the Centers for Disease Control and Prevention (abbrev. CDC; CDC, 2013a) and the U.S. Department of Agriculture (USDA-APHIS, 2012). CDC's current dog importation regulations (CFR, 2013) were established in the 1950s based on the existing knowledge of zoonotic diseases and dog import characteristics, with a focus primarily on the public health risks posed by rabid dogs (CFR, 1956). Canine rabies virus variant was successfully eliminated in the United States in 2007 (Velasco-Villa *et al.*, 2008). However, this variant is still present in many other countries (WHO, 2013). Accordingly, not only does travel to these countries pose a risk to humans, but clearly importing dogs unimmunized against rabies from these countries risks re-entry of the canine variant, as well as other rabies virus variants (Lankau *et al.*, 2013).

Current U.S. regulations require a valid rabies vaccination certificate for dogs arriving from rabies-endemic countries. CDC publishes a list of "Countries and political units not reporting indigenous cases of rabies" (CDC, 2013b) that is used in enforcing dog importation regulations. This list is based on the best available rabies surveillance data, and any country or political unit on this list is considered free of terrestrial rabies (i.e., rabies-free) for the purposes of CDC's dog importation regulations. Those countries or political units not on this list are considered rabies-endemic. CDC may modify the list when a country or political unit previously considered rabies-free reports an outbreak of terrestrial rabies (e.g., Greece and Taiwan in 2012 and 2013, respectively).

CDC requires importers of dogs that originate in rabies-endemic countries and that are not fully immunized against rabies to sign an agreement (CDC Form 75.37; Fig. S1) stating that they will confine these dogs until they are fully immunized against rabies (i.e., vaccinated at 3 months of age and confined a further 30 days to allow a full immune response;

NASPHV, 2011). Confinement takes place at a location designated by the importer, and the timing of any rabies vaccination or duration of confinement are as instructed by CDC on the agreement. As required by federal regulations, CDC shares the confinement agreement with the state agency “having jurisdiction at the point of destination ... to facilitate surveillance and other appropriate action” (CFR, 2013). A previous evaluation of public health risks from dog importation noted that “enforcement of this regulation is problematic because there is no federal requirement, mechanism, or capacity for documenting compliance” (McQuiston *et al.*, 2008).

In this evaluation, we used CDC’s records of dog confinement agreements completed by importers at U.S. ports of entry and received by CDC quarantine stations to describe the importation of dogs not fully immunized against rabies and coming from rabies-endemic countries into the United States [hereafter referred to as “dog(s) placed on confinement agreement(s)” or DPCA (s)].

## Methods

### Data collection

Confinement agreements were filled out by importers (or their agents) at the port of entry declaring one or more DPCAs. These agreements were reviewed and approved by a federal official, typically either a U.S. Customs and Border Protection officer or a CDC quarantine public health officer. CDC quarantine staff then entered dog confinement agreements into CDC’s secure database for documenting public health events related to air, land, and maritime travel before sending a copy to state health or agricultural officials in the destination state. During the evaluation period June 1, 2011–May 31, 2012, CDC used the “List of countries and political units reporting no cases of indigenous rabies in 2009” available in “CDC Health Information for International Travel 2010” (“The Yellow Book”, CDC, 2010) to identify DPCAs.

We used SAS<sup>®</sup> software (SAS Institute, Inc., Cary, NC, USA) to extract data on all confinement agreements issued during June 1, 2011–May 31, 2012 into a Microsoft Excel<sup>®</sup> spreadsheet (Professional Plus 2010, Version 14.0.6129.5000). Reports that included more than one DPCA were entered with individual dogs as the unit of observation. Electronically scanned copies of the paper records were used to validate electronic records and to complete records with missing values in the electronic database. Variables for which handwriting was illegible or which were blank on the handwritten record were treated as missing data in this analysis.

Original variables included were report date; quarantine station; destination (city and state); dog breed; dog age (in weeks); country of origin; conveyance type (air, land, or maritime); and the total number of animals in each shipment. Dog breeds were further categorized for analysis according to recognized American Kennel Club (AKC) breed categories (AKC, 2013), with any breeds listed as Foundation Service Stock (FSS), miscellaneous, or without recognized AKC status categorized as “other.” Mixed breed category included unknown breed, mixed breed, or any type of specified hybrid dog mix.

Descriptive analyses and graphics were produced in Microsoft Excel. Data were matched to geographic information systems (GIS) data and mapped using Quantum GIS (Version 1.8.0 Lisboa; Quantum GIS Development Team, 2013) using 1:110m scale base maps (Natural Earth, free vector, and raster map data at [naturalearthdata.com](http://naturalearthdata.com)). Countries of origin were assigned to geographic continents to facilitate mapping and graphical summary primarily adhering to World Health Organization assignments provided in the GIS base map files, except for assigning Russia to Asia rather than Europe in order to better visually capture the physical geography of country clusters in maps. US ports of entry and quarantine station jurisdictions were assigned according to CDC designations, available at <http://www.cdc.gov/quarantine/quarantinestations.html>.

This evaluation was based on pre-existing data collected as part of CDC's regulatory enforcement activities and was determined by CDC to not qualify as human subjects research. Analyses did not include any personally identifying information for either importers or their animals and did not require direct contact with importers or their dogs. All data are presented in aggregate to prevent identification of specific importers.

## Results

### Shipment characteristics

A total of 2746 unimmunized dogs from rabies-endemic countries (i.e., DPCAs) were placed on confinement agreements during June 1, 2011–May 31, 2012 (2746 is the common denominator throughout, unless noted). A median of 234 dogs were placed on confinement agreements per month (range=176–278) and monthly totals did not exhibit any notable seasonal trends. Nearly 90% of DPCAs (n=2431, 88.5%) traveled by air, while 286 (10.4%) traveled by land, and 15 (0.5%) traveled by ship. Over 80% of DPCAs arrived in the jurisdictions of six CDC quarantine stations: New York, NY (n=642; 23.4%), Houston, TX (n=601; 21.9%), Los Angeles, CA (n=389; 14.2%), Seattle, WA (n=259, 9.4%), Chicago, IL (n=207, 7.5%), and Miami, FL (n=155, 5.6%), with most arriving at the international airports where these quarantine stations are located.

All states but West Virginia received one or more DPCAs during the study period (Fig. 1). California, New York, Texas, Washington, and Florida received the largest numbers of DPCAs (Fig. 1a). Vermont, Maine, Washington, Alaska, and Arizona were the top five states when the number of DPCAs imported was adjusted for human population size (Fig. 1b).

The geographic spread of final state destinations varied considerable by quarantine station. For the top six quarantine stations by volume, the percentage of DPCAs remaining in the states of arrival for confinement ranged between 35% and 76%: Houston, TX, 35%; New York, NY, 46%; Chicago, IL, 47%; Los Angeles, CA, 64%; Seattle, WA, 67%; and Miami, FL, 76%. Over 70% of DPCAs processed at the Chicago, New York, Miami, Los Angeles, and Seattle quarantine stations either remained within the state of processing or were confined in a state directly bordering the state of entry. Only 41% of DPCAs processed through Houston, TX remained within Texas or bordering states.

## Dog demographics

The majority of DPCAs were puppies <3 months of age (n=1831, 66.7%; Table 1). Older puppies ≥3 months of age, adult dogs ≥1 year old, and age unknown made up the remainder (n=589, 21.4%; n=232, 8.4%; and n=94, 3.4%, respectively).

DPCAs were of 166 named breeds or were of mixed breed (Table S2). The top three breed categories were toy, nonsporting, and mixed breed (n=557, 20.3%; n=451, 16.4%; n=424, 15.4%, respectively). Across all breed categories, German shepherds and dogs of mixed or unknown breed were the most common (n=319, 11.6% and n=318, 11.6%, respectively), followed by standard poodles (n=198, 7.2%), Chihuahuas (n=196, 7.1%), and Yorkshire terriers (n=136, 5.0%).

DPCAs arrived from 81 countries (Table 2, Fig. 2). Nearly 50% (n=1325) originated in North America, primarily Canada and Mexico (n=577, 21.0% and n=347, 12.6%, respectively). Nearly a third of DPCAs originated in Europe (n=825, 30.0%), with over 60% of European arrivals coming from Germany (n=506, 18.4% of all DPCAs). Relatively few DPCAs were imported from South American, Asian, or African countries (n=312, 11.4%; n=233, 8.5%; and n=33, 1.2% respectively; Table 2, Fig. 2). Breeds imported varied regionally (Fig. S3).

## Discussion

Over a one year period, nearly 2800 dogs were placed on confinement agreements by government officials at U.S. ports of entry. Most of these dogs arrived by air. In contrast, the majority of human travelers (~67 million) in 2012 entered the United States via land borders (Johnson, 2013). In addition, the top U.S. international airports for entry of DPCAs and nonstop human travel also differed; the top five U.S. gateways for nonstop (human) international air travel in 2008 and 2009 were New York (JFK); Miami; Los Angeles; Newark; and Chicago (O'Hare); Houston and Seattle were numbers 8 and 17, respectively (U.S. Census Bureau, 2012). Also, human and dog population densities did not correspond because several states with relatively small human populations (i.e., Vermont, Maine, and Alaska) received a disproportionate number of DPCAs.

Conveyance type (i.e., land, air, or maritime), ports of entry, and destinations of DPCAs do not reflect the international movement of travelers or the human population distribution in the United States. In the authors' opinion, these differences indicate that most DPCAs are entering the United States for the purpose of increasing the dog supply. Therefore, these differences in human movement and DPCA entry may be due to local variability in dog ownership, local access to or preference for certain breeds, knowledge of and access to overseas dog sources, airlines' willingness to transport animals, or locations of airline hubs and destination cities relative to dog markets. For example, importers may obtain dogs from overseas breeders, organizations, or individuals with the intent to keep the dog(s) as their own pet, for breeding stock, to resell locally or through online purchases, or to place in local animal shelters or foster homes for eventual adoption. These importers may be addressing a perceived lack of certain age groups, breeds, or genetics locally; may have access to less

expensive dogs through overseas sources; or may be addressing a perceived overseas dog population or welfare issue.

U.S. regions differed in the proximity of confinement destinations and quarantine station. The majority of DPCAs stayed within the region of the CDC quarantine station processing their confinement agreements, but for some quarantine stations, final destinations were more diverse — in particular for Houston, TX. Thus, the quarantine station processing the DPCA is often an indicator for the intended confinement location, but since international ports of entry carry diverse domestic connecting flights, this predictive value can vary regionally. Accordingly, certain state or local agencies may be disproportionately burdened with confinement agreements due to the locations of international ports and associated dog importers. State or local agencies bearing a particularly large burden of DPCA imports might or might not have the resources to ensure confinement or rabies vaccination as required by federal or state importation regulations. CDC does request that the importers cooperate with any state or local efforts to follow up on confinement agreements or enforce their own state or local requirements (e.g., health certificates) but does not have the resources to directly enforce cooperation.

Many dogs placed on confinement agreements were <3 months of age, too young to have received rabies vaccination prior to transit. Current federal regulations permit transit of animals <3 months of age, despite not being fully immunized against rabies (CDC, 2013a; USDA-APHIS, 2013; U.S. Code of Federal Regulations, 2013). However, young puppies are more likely to arrive at ports of entry ill or dead due to either age-related illnesses (e.g., hypoglycemia or hypothermia) or without a clear diagnosis (Sinclair, 2012) further presenting a challenge to identifying dogs potentially already infected with the rabies virus (Castrodale, 2007). In addition for dogs <6 months of age, rabies vaccination certificates are more difficult to verify due to the individual and breed variability in tooth eruption and other growth indicators.

Although the majority of DPCAs entered the United States by airplane from noncontiguous countries, rather than across land borders, over a third arrived from Mexico and Canada — the majority also by airplane. These entries were primarily toy, nonsporting, and mixed breed puppies. In addition, the majority of German shepherds came from Europe, specifically Germany and the Czech Republic. These differences in country of origin may indicate true trends in desirable breeds or genetic lines available from overseas sources or access to a less expensive supply of dogs in specific countries. DPCAs routinely are imported from countries where domestic dogs are considered a major reservoir of the rabies virus (Lankau *et al.*, 2013). These patterns are difficult to interpret though as the country of origin listed on the confinement agreement might also reflect the dog's in transit location during a multiple flight itinerary. For example, an owner importing a dog from a rabies endemic country in West Africa through France (Table S1) might report the country of origin as France and not be issued a confinement agreement upon arrival in the United States.

Overall, dog age, breed, and country of origin, paired with a lack of seasonal variability in imports and importers' reliance primarily on air transit, suggests that many of the DPCAs

are arriving for the purpose of increasing the supply of these animals in the United States (i.e., an overseas kennel or distributor is shipping one or more puppies to a private individual, a distributor, a kennel, shelter, or rescue organization in the United States) rather than as travelers' personal pets. Thus, dog breeders, distributors, and animal adoption organizations, both within the United States and abroad, are likely key stakeholders in the discussions regarding federal importation regulations and policies and also represent a key demographic for targeted education about healthy pet travel and rabies risks.

### Limitations

The data on the confinement agreements are self-reported by dog importers or their agents. Importers self-identify DPCAs and provide any pertinent, but typically not verifiable, documents (i.e., health or rabies certificates). At most ports of entry, veterinary staff are not available to verify dog age and current regulations do not require importers to uniquely identify dogs (e.g., microchipping or tattooing). In addition, these data do not capture the total number of DPCAs as dogs may be smuggled (CBP, 2006; Ehnert and Galland, 2009), country of origin misrepresented, or rabies vaccination certificates falsified. Data accuracy and completeness also posed challenges because confinement agreements are filled out by hand by importers or their agents in conjunction with airport officials and, as such, were not always legible or complete. In response to these observations, CDC has revised CDC Form 75.37 (Fig. S2) to improve data completeness and legibility. Finally, because dogs are not uniquely identified on confinement agreement forms, confinement agreements analyzed may not represent unique dogs. For example, if permitted by the destination country, an importer could potentially have shipped the same DPCA in and out of the United States multiple times. Thus, while these data can inform understanding of importation patterns of declared DPCAs, our data may not present a complete picture of the risks posed by dog importation. Finally, these data on DPCAs should not be interpreted as representative of the overall trends in dog importation into the United States. Although only estimates of the total volume of dog importation are currently available, DPCAs represent only a fraction of total dog importations and their characteristics might not be generalizable to the total population of imported dogs.

### Conclusions

Dogs unimmunized against rabies and coming from rabies endemic countries (i.e., DPCAs) continue to be imported into the United States in considerable numbers. These DPCAs pose a demonstrated risk for re-introduction of canine rabies virus variant and may also pose risks for entry of other animal and zoonotic diseases. Furthermore, permitting entry of dogs unimmunized against rabies, whether from a rabies-free or rabies-endemic country even with a confinement agreement, does not align with many existing state and local regulations. These state and local regulations are in place because the United States is a rabies-endemic country. Consequently, any unimmunized dog residing in the United States is at risk of becoming infected with rabies.

Regulation of international dog importation is a mutual concern of the U.S. public and state and federal agencies. However, the current federal regulations confer the onus of surveillance and enforcement activities onto state and local agencies. This evaluation

suggests that in all likelihood many of the dogs placed on confinement agreements are puppies entering the United States for the purpose of increasing the supply of these animals in the United States rather than individuals or families traveling with their own previously owned pet. Further efforts are needed to assess the impact of dog imports using available tools to perform system evaluations (e.g., cost effectiveness evaluations) and risk analysis (Peeler *et al.*, 2013). Careful consideration with key stakeholders is needed to determine whether oversight methods based primarily upon an honor system of importers either self-reporting rabies vaccination status or completing an unsupervised home confinement provide the best possible compromise between the potential economic and social benefits of dog importation and the risks posed from importing dogs not immunized against rabies.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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The findings and conclusions in this report are those of the authors and may not represent the official position of CDC or HHS.

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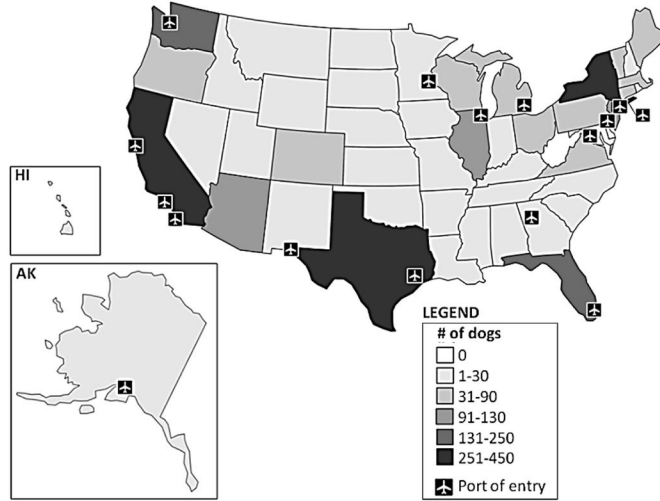


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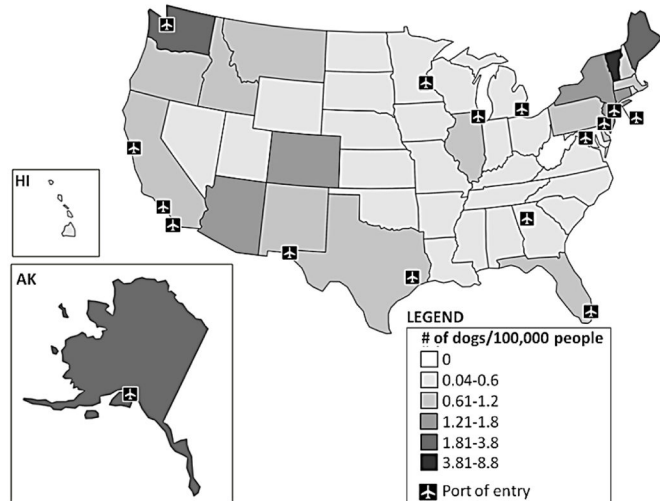
### Impacts

- Dogs entering the United States that are not immunized against rabies are placed on confinement agreements until immunizations are properly completed; subsequently, any monitoring to ensure compliance is performed at the state or local level.
- Dog confinement agreement records suggest that the majority of dogs entering the United States on confinement agreements are puppies imported for the purpose of increasing the supply of these animals in the United States (i.e., commercial transactions or shelter and rescue activities).
- Regulation of dog importation must balance potential benefits to importers with the risks of reintroducing the dog rabies virus variant to the United States or human exposure to this deadly virus.

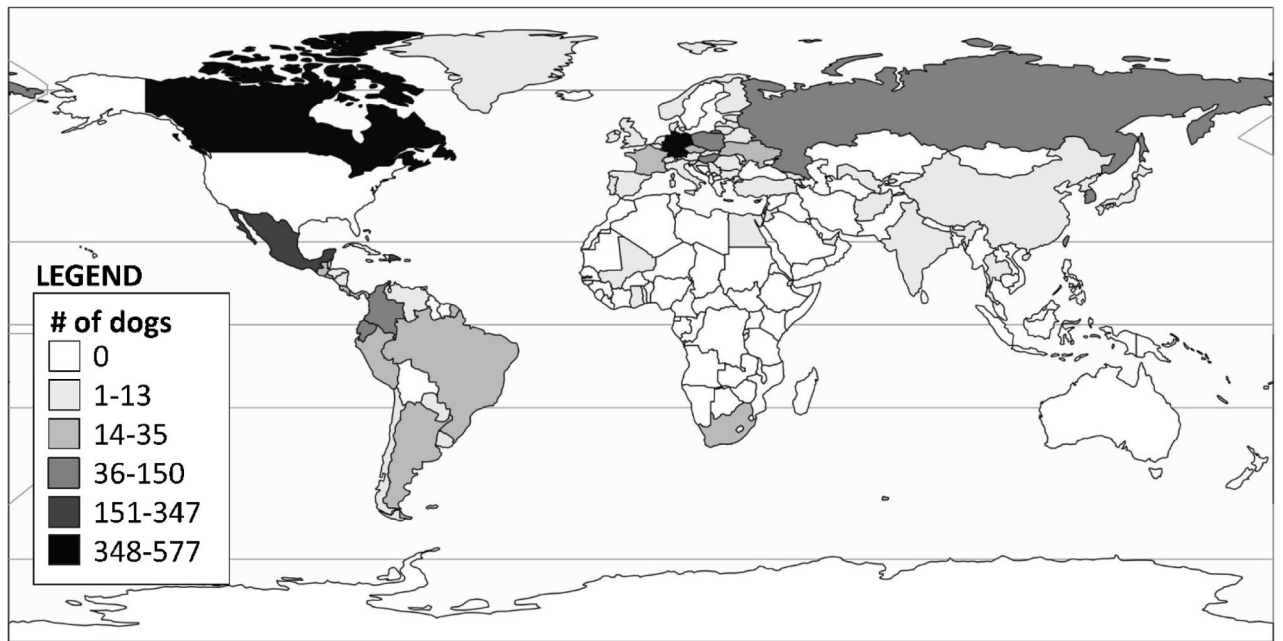
a. Number of dogs



b. Number of dogs/100,000 human population



**Fig. 1.** Number of imported dogs placed on confinement agreements by destination state – United States, June 2011–May 2012 (N=2663)  
 Panel a shows the number of dogs arriving for confinement by state over a one-year period. Panel b shows the number of dogs arriving for confinement, adjusted by destination state human population over a one-year period. Airplanes mark the locations of ports of entry processing arriving dogs placed on confinement agreements. Not shown on this map: Puerto Rico (62 dogs; 1.7 dogs/100,000 humans), U.S. Virgin Islands (6 dogs; 5.7 dogs/100,000 humans), and 15 dogs for which final destination information was missing or illegible.



**Fig. 2.** Number of imported dogs placed on confinement agreements by country of origin – United States, June 2011–May 2012 (N = 2728)  
Color gradation shows the number of dogs originating in each country. Country of origin information was missing or illegible for 18 dogs.

**Table 1**

Age distribution of imported dogs placed on confinement agreement – United States, June 2011–May 2012

<b>Age category</b>	<b>Age subcategory</b>	<b># dogs</b>	<b>% of total</b>
<i>Puppy &lt;3 months</i>		1831	66.7%
	0–7 wks	248	9.0%
	8–11 wks	1583	57.6%
<i>Puppy 3 months</i>		589	21.4%
	12–24 wks	544	19.8%
	25–51 wks	45	1.6%
<i>Adult 1 year</i>		232	8.4%
	1–2 yrs *	110	4.0%
	3–5 yrs	61	2.2%
	6–10 yrs	53	1.9%
	>10 years	8	0.3%
<i>Blank/Unknown</i>		94	3.4%
<b>GRAND TOTAL</b>		<b>2746</b>	

\* Summary by year includes animals up to 6 months older than top end of listed category. For example animals 1–2 year includes animals listed as 1 year old up to those listed as aged 2.5 years. Category 3–5 years includes animals listed as >2.5 years up to 5.5 years.

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**Table 2**

Countries of origin for imported dogs placed on confinement agreements – United States, June 2011–May 2012

Continent	Country	# dogs	% of total
<i>North America total (20 countries)</i>		1325	48.3%
	Canada	577	21.0%
	Mexico	347	12.6%
	Dominican Republic	247	9.0%
	Costa Rica	34	1.2%
	Panama	24	0.9%
	El Salvador	22	0.8%
	Guatemala	22	0.8%
	Other North America (13 countries)	52	1.9%
<i>Europe total (32 countries)</i>		825	30.0%
	Germany	506	18.4%
	Hungary	62	2.3%
	Poland	59	2.1%
	Ukraine	35	1.3%
	Czech Republic	32	1.2%
	France	29	1.1%
	Other Europe (26 countries)	107	3.9%
<i>South America (9 countries)</i>		312	11.4%
	Colombia	149	5.4%
	Ecuador	60	2.2%
	Peru	33	1.2%
	Argentina	25	0.9%
	Brazil	22	0.8%
	Other South America (4 countries)	23	0.8%
<i>Asia total (16 countries)</i>		233	8.5%
	Korea, South	98	3.6%
	Taiwan	52	1.9%
	Russian Federation	49	1.8%
	Other Asia (13 countries)	29	1.1%
<i>Africa total (4 countries)</i>		33	1.2%
	South Africa	27	1.0%
	Other Africa (3 countries)	6	0.2%
<i>Blank/Unknown</i>	<i>Blank/Unknown</i>	18	0.7%
<b>GRAND TOTAL</b>		<b>2746</b>	