

1 **Title:** Understanding Rabbit Owners' Willingness to Engage in Disease Prevention Behaviors

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11

12 **Abstract:** Rabbit hemorrhagic disease virus 2 (RHDV2) is a fatal, highly contagious pathogen  
13 that infects wild and domestic lagomorphs (rabbits and hares). RHDV2 is an important cause of  
14 disease in pet and companion rabbits, has resulted in economic losses for the commercial rabbit  
15 industry, and has caused declines of wild lagomorph populations. It is essential for domestic  
16 rabbit owners to engage in appropriate actions (e.g., using effective disinfectants, creating secure  
17 barriers between domestic and wild rabbits) to protect the health and welfare of their rabbits and  
18 reduce the risk of human-mediated spread of RHDV2. Thus, we investigated rabbit owners'  
19 stated willingness to engage in nine commonly recommended biosecurity practices and their  
20 support for seven potential government-implemented management actions. We administered an  
21 online survey to 1,790 rabbit owners in the United States between April and August 2021.  
22 Respondents were likely to engage in all biosecurity measures and were supportive of most  
23 management actions that could be implemented by government agencies. Respondents'

24 willingness to engage in and support biosecurity measures was positively correlated with their  
25 perceptions of the importance of biosecurity, risk perceptions pertaining to the impact of RHDV2  
26 on lagomorphs and rabbit-related industries, knowledge of RHDV2, and trust in government to  
27 manage RHDV2. Respondents' motivations for owning rabbits, husbandry behaviors, and  
28 demographic characteristics also influenced their willingness to engage in or support biosecurity  
29 measures. Engaging domestic rabbit owners in collaborative biosecurity measures is critical for  
30 protecting domestic rabbit health and preventing potential spillover between domestic and free-  
31 roaming lagomorphs, as there are still many uncertainties about how RHDV2 is spreading across  
32 the United States and the world. Implementing outreach strategies that communicate the  
33 importance and effectiveness of biosecurity practices in protecting rabbit welfare, rabbit-related  
34 activities, and wild lagomorph populations may increase the likelihood of rabbit owners adopting  
35 biosecurity measures.

36 **Keywords:** Rabbit hemorrhagic disease virus 2 (RHDV2); biosecurity; pet; animal rescues; risk  
37 perceptions

### 38 **Introduction**

39 Rabbit hemorrhagic disease virus 2 (GI.2/RHDV2/b; Le Pendu *et al.*, 2017) is a highly  
40 contagious pathogen (genus *Lagovirus*, family *Caliciviridae*) that causes rabbit hemorrhagic  
41 disease (RHD) in wild and domestic lagomorphs (Asin *et al.*, 2021). Rabbit hemorrhagic disease  
42 virus 2 (hereafter, RHDV2) causes disease within 2-4 days of infection (with mortality rates of  
43 up to 80%), but infected lagomorphs often show no visible signs of disease before death (Le  
44 Gall-Reculé *et al.*, 2013). The virus was first detected in France in 2010 and has since spread  
45 outside Europe to Africa, Asia, Australia, and North America (Rouco *et al.*, 2019; Katayama *et*  
46 *al.*, 2021). The spread of RHDV2 was likely exacerbated by the human-mediated movement of

47 lagomorphs, as the virus is hardy (surviving up to 15 weeks in dry conditions and more than 90  
48 days in decaying animal tissue outdoors) and can be transmitted through multiple pathways  
49 (contact with infected lagomorphs, fomites, mechanical transmission by insects, and other animal  
50 vectors; Marschang *et al.*, 2018; Rouco *et al.*, 2019). In Europe, RHDV2 is an important cause of  
51 disease in pet rabbits, with one study finding that 37.4% of samples collected from domestic  
52 rabbits submitted by vets and owners throughout Europe were positive for RHDV2 (Marschang  
53 *et al.*, 2018). RHDV2 has also caused population declines of wild lagomorphs and lagomorph  
54 predators, with one study finding a 60-70% decline in lagomorph populations, followed by  
55 fecundity decreases of 65.7% in Iberian lynx (*Lynx pardinus*) and 45.5% in Spanish Imperial  
56 eagles (*Aquila adalberti*; Monterroso *et al.*, 2016). RHDV2 has resulted in economic losses for  
57 the lagomorph hunting and commercial rabbit industries (Campagnolo *et al.*, 2003; Rouco *et al.*,  
58 2019).

59         In the United States (U.S.), RHDV2 is classified as a foreign animal disease and is  
60 reportable to the World Organization for Animal Health (OIE). In March 2020, an outbreak of  
61 RHDV2 was confirmed in domestic and wild lagomorphs in New Mexico (U.S. Department of  
62 Agriculture [USDA], 2022). As of August 2023, RHDV2 has been detected in wild lagomorphs,  
63 domestic rabbits and/or feral rabbits in 29 states (Fig. 1). This virus has the potential to impact a  
64 diverse array of rabbit-owning stakeholders, including people who own rabbits as pets or  
65 companion animals, volunteer or work at animal rescues and shelters, breed rabbits, raise rabbits  
66 for meat or fur, and show rabbits at exhibitions. The estimated worth of the domestic rabbit trade  
67 is \$2.2 to \$2.3 billion (Grannis, 2002), and in 2017, almost 500,000 rabbits were sold for  
68 commercial use (USDA, 2019). Americans own over two million rabbits as pets or companion  
69 animals (American Veterinary Medical Association, 2018). However, despite the popularity of

70 rabbits as pets or companion animals and the significant value of the domestic rabbit trade, rabbit  
71 owner disease preventive behaviors and the movement of rabbits across the U.S. are poorly  
72 documented. This lack of data makes it difficult to monitor, track, and prevent RHDV2 spread,  
73 unless stakeholders who own or interact with rabbits voluntarily report RHDV2 detections or  
74 suspicious rabbit deaths to veterinarians or relevant government agencies (e.g., state agricultural  
75 agencies).

76 In response to the risks posed by RHDV2, state animal health officials and veterinarians  
77 recommended that rabbit owners develop customized biosecurity plans, establish best practices  
78 to prevent RHDV2 transmission, and consider available tools for disease mitigation and control  
79 (e.g., vaccines; NASAHO RHDV2 Subcommittee 2020a, 2020b). Animal health experts  
80 specifically recommended that rabbit owners should prevent domestic rabbits from interacting  
81 with wild lagomorphs, feral rabbits, and contaminated environments (e.g., keeping rabbits  
82 indoors or on man-made surfaces, creating a secure barrier between domestic rabbits and wild  
83 lagomorphs; NASAHO RHDV2 Subcommittee, 2020a). Additionally, state animal health  
84 officials developed guidelines for rabbit shows and exhibitions, including limiting interactions  
85 with domestic rabbits and other rabbit owners, isolating rabbits on return from shows, and  
86 following rules pertaining to the interstate movement of domestic rabbits (NASAHO RHDV2  
87 Subcommittee, 2020b). Some states created or temporarily adopted rules and regulations to slow  
88 or prevent potential human-mediated spread of RHDV2 (e.g., reducing the length of time that a  
89 certificate of veterinary inspection is considered valid, canceling rabbit shows); however, the  
90 implementation and enforcement of these measures varies greatly between states (Shapiro *et al.*,  
91 2022a). Thus, many agencies rely on people who own or interact with domestic rabbits to report  
92 suspicious rabbit mortalities and engage in voluntary biosecurity actions.

93           In 2021, we surveyed rabbit owners in the U.S. to ascertain whether rabbit owners are  
94 willing to adopt recommended biosecurity actions or support potential government-mandated  
95 biosecurity measures. Consistent with social science studies of other wildlife diseases, we  
96 posited that rabbit owners would be more likely to engage in or support biosecurity measures if  
97 they believe biosecurity measures are important, perceive the economic, ecological or animal  
98 welfare risks associated with RHDV2 spread (Hanisch-Kirkbride *et al.*, 2013; Triezenberg *et al.*,  
99 2014; Wiethoelter *et al.*, 2017; Pienaar *et al.*, 2022), trust the government to manage RHDV2  
100 (Siegrist *et al.*, 2000; Hanisch-Kirkbride *et al.*, 2014; Wright *et al.*, 2018), and are  
101 knowledgeable about RHDV2. We also posited that rabbit owners' motivations for owning  
102 domestic rabbits (e.g., as companion animals, for exhibition, for sale), rabbit husbandry (Rooney  
103 *et al.*, 2014; Welch *et al.*, 2017), and demographic characteristics (Wiethoelter *et al.*, 2017;  
104 Wright *et al.*, 2018) would influence their willingness to engage in or support biosecurity  
105 measures.

106           This study builds on our recent finding that rabbit owners in the U.S. agreed that  
107 individuals who own or interact with domestic rabbits must engage in biosecurity measures to  
108 prevent the spread of RHDV2 to new areas, regardless of access to vaccinations or the RHDV2  
109 status of their state (Shapiro *et al.*, 2022b). Survey respondents had high awareness and  
110 knowledge of RHDV2, believed RHDV2 poses a large risk to rabbit-related industries, and were  
111 concerned about the economic and ecological impacts of RHDV2 (Shapiro *et al.*, 2022b). In this  
112 paper, we build on our previous analysis by 1) examining rabbit owners' stated willingness to  
113 engage in specific, voluntary biosecurity practices and support potential government-  
114 implemented disease management actions, and 2) identifying determinants of rabbit owners'  
115 willingness to engage in or support biosecurity actions.

## 116 **Methods**

### 117 *Survey Design*

118         We created and distributed online surveys to examine respondents' willingness (very  
119 unlikely=1; unlikely=2; neither likely nor unlikely=3; likely=4; very likely=5) to engage in nine  
120 voluntary biosecurity actions, specifically: 1) reporting suspicious rabbit deaths to their state  
121 agricultural agency; 2) keeping rabbits inside; 3) creating a secure barrier between areas used by  
122 domestic rabbits and wild lagomorphs; 4) using USDA-recommended disinfectants to clean  
123 rabbit enclosures; 5) having separate shoes and clothes for inside and outside rabbit enclosures;  
124 6) preventing other rabbit owners from interacting with their rabbits; 7) isolating new rabbits  
125 from other rabbits for at least 30 days; 8) acquiring a certificate of veterinary inspection (CVI)  
126 before transporting rabbits between states; and 9) vaccinating rabbits if/when the RHDV2  
127 vaccine became available (NASAHO, 2020a, 2020b). It is important to note that during data  
128 collection, RHDV2 vaccines could only be imported from Europe by states with confirmed  
129 RHDV2 mortalities (Shapiro *et al.*, 2022a). A vaccine developed and produced in the U.S.  
130 received emergency use authorization from the USDA in September 2021 (Bosco-Lauth *et al.*,  
131 2022), and most states have approved its use as of April 2023. Respondents could indicate which  
132 biosecurity measures were not applicable to their situation. We also asked respondents about  
133 their support for or opposition to seven potential government measures to prevent the spread of  
134 RHDV2 (strongly oppose=1, oppose=2, neither oppose nor support=3, support=4, strongly  
135 support=5), namely: 1) relocating rabbit shows/exhibitions at least 150 miles (241.40 km) from  
136 counties with RHDV2; 2) requiring rabbit owners to obtain a CVI before attending any events  
137 with live rabbits; 3) penalizing rabbit transporters who do not obtain a CVI for the rabbits they  
138 transport; 4) requiring rescued rabbits to be inspected by a vet before being moved by rabbit

139 rescues or animal shelters over state borders; 5) banning rabbit rescues from acquiring rabbits  
140 from states with RHDV2; 6) banning the trade of rabbits (alive and dead) that come from states  
141 with confirmed RHDV2 cases; and 7) banning the trade of all rabbits (alive and dead) until the  
142 U.S. produces and distributes a domestic RHDV2 vaccine.

143         As part of this research effort, we asked respondents to provide us with information  
144 about: their rabbit husbandry behaviors; prior awareness and knowledge of RHDV2; perceptions  
145 of the level of risk that RHDV2 poses to the commercial rabbit trade and lagomorph hunting (a  
146 measure of risk susceptibility); level of concern about the impact of RHDV2 on the commercial  
147 rabbit trade, lagomorph hunting, the health of domestic rabbits and wild lagomorphs in their  
148 state, and biodiversity (a measure of risk sensitivity); perceptions of the importance of  
149 biosecurity measures; trust in state government to manage RHDV2; and demographics (gender,  
150 age, and education level). Responses to these survey questions are published in Shapiro *et al.*  
151 (2022b). See also the Supporting Information.

152         Veterinary medicine and animal disease specialists, human dimensions experts, and  
153 wildlife biologists reviewed the survey instrument prior to implementation. We also pre-tested  
154 the survey using cognitive testing with members of key stakeholder groups who interact with  
155 lagomorphs, including high-level members of rabbit rescue and rabbit breeder groups. Our study  
156 was reviewed by the Institutional Review Board at our university and classified as not human  
157 subjects research.

### 158 ***Survey Implementation***

159         We distributed online surveys from April to August 2021. Individuals were eligible to  
160 participate in this study if they were adults ( $\geq 18$  years of age), and owned or interacted with  
161 domestic rabbits at the time of the study (i.e., participants bred rabbits, worked or volunteered at

162 rabbit rescues, and/or owned rabbits as companion animals). We conducted an online search of  
163 rabbit breeders across the U.S. and sent 3,696 rabbit breeders an online invitation to participate  
164 in this research. We also paid Qualtrics Research Services to survey 220 people who owned  
165 rabbits as pets or companion animals. The House Rabbit Society emailed the survey information  
166 and link to 8,363 email subscribers and educators. The American Rabbit Breeders Association  
167 posted the survey link on the RHDV2 page of their website. Potential participants who were  
168 emailed an online invitation to take the survey were sent one to three reminders to participate in  
169 the research if they had not responded to the survey. The survey remained open for three months  
170 after dissemination.

### 171 *Statistical Analysis*

172 We used the SPSS 28.0 (SPSS Statistics for Windows, Version 28.0, Armonk, NY: IBM  
173 Corp.) to run descriptive analyses and principal factor analysis. We used principal factor  
174 analysis, with varimax rotation, and Cronbach's alpha (Cronbach, 1951) to test whether survey  
175 items could be combined to generate composite variables (e.g., respondents' susceptibility and  
176 sensitivity to risk). We generated composite variables by averaging responses to survey items  
177 that loaded onto factors with an eigenvalue  $\geq 1$  and Cronbach's alpha  $\geq 0.7$  (Gliem and Gliem,  
178 2003).

179 We used ordinal logistic regression models to analyze respondents' willingness to engage  
180 in each biosecurity measure and their support for government strategies to prevent the spread of  
181 RHDV2. We included respondents' sociodemographic variables, rabbit ownership, husbandry  
182 behaviors, awareness of RHDV2 and composite measures of their knowledge of RHDV2, risk  
183 sensitivity, risk susceptibility, perceptions of the importance of engaging in biosecurity, and trust  
184 in government to manage RHDV2 as explanatory variables in the regression models. We also

185 included interaction effects in the regression models to test whether the influence of respondents'  
186 socio-psychological characteristics on their willingness to engage in or support biosecurity  
187 measures was influenced by whether or not they breed rabbits. We used the polr package in R  
188 4.1.2 (R Core Team, 2021) to estimate the ordinal logistic regression models. We used the  
189 Akaike Information Criterion (AIC) to identify best-fit models (Burnham and Anderson, 2004)  
190 after comparing all possible models using the MuMIn package. We averaged models that were  
191 within  $AIC \leq 2$  of the model with the lowest AIC. We considered a coefficient to be statistically  
192 significant at  $p \leq 0.05$ .

### 193 **Results**

194 We collected a total of 1,790 completed surveys from rabbit owners, breeders, and rescue  
195 volunteers and staff. The response rate for the surveys sent by the House Rabbit Society was  
196 12.3% and the response rate for the surveys we sent to an online list of rabbit breeders was 5.9%.  
197 We could not calculate response rates for surveys administered by Qualtrics Research Services  
198 or collected from the online link posted on the American Rabbit Breeders Association website  
199 because we do not know how many individuals received or saw the invitation to participate in  
200 this study.

201 Most respondents were female (80.0%) and had completed a university degree (63.5%).  
202 The median age range of respondents was 35-44 years, and the median number of rabbits owned  
203 by respondents was 2-5 animals. Most respondents owned pet or companion rabbits (n=1,311;  
204 73.2%), but respondents also bred rabbits (n=560; 31.3%) or volunteered or worked at a rabbit  
205 rescue or animal shelter (n=322; 18.0%).

206 Most respondents were likely or very likely to engage in all voluntary biosecurity actions,  
207 with respondents expressing greatest willingness to report suspicious rabbit deaths and least

208 willingness to acquire a CVI before transporting rabbits between states (Table 1). On average,  
209 respondents expressed support for most agency actions to prevent RHDV2 spread, with the  
210 exception of banning rabbit rescues from acquiring rabbits from states with RHDV2 and banning  
211 the trade of rabbits until the U.S. starts producing and distributing a RHDV2 vaccine (Table 2).

212 Most respondents had heard of RHDV2 (90.0%), and these respondents had high levels  
213 of RHDV2 knowledge (median=0.87;  $0.81\pm 0.20$ ; range=0-1; Shapiro *et al.*, 2022b). We used  
214 principal factor analysis to combine survey items and generate five variables (see Supporting  
215 Information). Respondents were concerned about the impacts of RHDV2 on lagomorphs  
216 (variable name: risk sensitivity to lagomorph deaths; median=4.50;  $4.31\pm 0.82$ ; range=1-5; Table  
217 S1). Respondents expressed less concern about the impacts of RHDV2 on rabbit-related  
218 industries (variable name: risk sensitivity to the economic impacts of RHDV2; median=3.75;  
219  $3.59\pm 1.12$ ; range=1-5; Table S1). Respondents believed that RHDV2 poses a risk to rabbit-  
220 related industries (variable name: risk susceptibility to the economic impacts of RHDV2,  
221 median=3.60;  $3.49\pm 0.53$ ; range=1-4; Table S2). Respondents recognized the necessity of  
222 biosecurity measures (variable name: perceived importance of biosecurity, median=4.60;  
223  $4.47\pm 0.58$ ; range=1-5; Table S3). Finally, respondents expressed neither trust nor distrust in  
224 their state government's management of RHDV2 (variable name: trust in government,  
225 median=3.00;  $2.91\pm 0.80$ ; range=1-5; Table S4).

## 226 ***Ordinal Logistic Regression Analysis of Rabbit Owners' Willingness to Engage in or Support***

### 227 ***Biosecurity Actions***

#### 228 *Engagement in Rabbit-Related Activities*

229 Rabbit breeders ( $p=0.003$ ) and rescue staff ( $p=0.001$ ) were more likely to use USDA-  
230 recommended disinfectants to clean rabbit enclosures (Table 3). Breeders were more likely to

231 isolate new rabbits before introducing them into the rabbit herd ( $p=0.014$ ; Table 3) and support a  
232 government ban on rabbit rescues obtaining rabbits from states with RHDV2 ( $p<0.001$ ; Table 4).  
233 Breeders were less likely to keep their rabbits inside ( $p<0.001$ ) and vaccinate their rabbits  
234 ( $p<0.001$ ). Breeders were less likely to support mandated CVIs for events with live rabbits  
235 ( $p<0.001$ ), penalties for individuals who transport rabbits without CVIs ( $p<0.001$ ), or rabbit trade  
236 bans ( $p<0.001$ ), whereas rescue staff were more likely to support these measures ( $p\leq 0.04$ ).  
237 Breeders were also less likely to support rules requiring rescued rabbits to be inspected by a vet  
238 before being moved between states ( $p=0.005$ ). Rescue staff were more likely to report suspicious  
239 rabbit deaths ( $p=0.013$ ), have separate clothes for rabbit enclosures ( $p=0.034$ ), and vaccinate  
240 rabbits ( $p=0.014$ ), but they were less likely to prevent interactions between their rabbits and other  
241 rabbit owners ( $p=0.003$ ). Rescue staff were more likely to support the relocation of rabbit shows  
242 ( $p=0.013$ ).

#### 243 *Rabbit Husbandry and Respondent Demographics*

244 Respondents who housed their rabbits outside were less likely to move their rabbits  
245 indoors ( $p<0.001$ ), have separate clothing for their rabbit enclosures ( $p=0.019$ ), create secure  
246 barriers between their rabbits and wild lagomorphs ( $p<0.001$ ), or vaccinate their rabbits  
247 ( $p=0.017$ ). Respondents who traveled across state lines with their rabbits were more likely to  
248 disinfect enclosures ( $p=0.016$ ) but were less likely to acquire CVIs ( $p=0.028$ ). They were also  
249 more likely to support relocation of rabbit shows ( $p=0.048$ ) and bans on the movement of  
250 rescued rabbits from states with RHDV2 ( $p=0.003$ ) but were less likely to support CVI  
251 requirements for transporters and rabbit shows ( $p<0.001$ ). Respondents from states with RHDV2  
252 were more likely to obtain CVIs ( $p=0.004$ ) but were less likely to support relocation of rabbit  
253 shows ( $p<0.001$ ), CVI requirements ( $p=0.031$ ), and bans on the transport of rabbits out of states

254 with RHDV2 ( $p < 0.001$ ). The number of rabbits owned by respondents and respondents'  
255 sociodemographic characteristics (age, gender, education) influenced their willingness to engage  
256 in and support biosecurity measures. These effects were often small, but we note that female  
257 respondents were more likely to prevent other owners interacting with their rabbits ( $p = 0.018$ ), to  
258 acquire CVIs before transporting rabbits ( $p = 0.002$ ), and to isolate new rabbits for 30 days  
259 ( $p = 0.016$ ).

#### 260 *Knowledge of RHDV2*

261 Respondents who were previously aware of RHDV2 were less likely to change clothes  
262 after exiting rabbit enclosures ( $p < 0.001$ ), even if they had high knowledge of RHDV2 ( $p = 0.009$ ).  
263 Respondents who were aware of RHDV2 were also less likely to acquire CVIs ( $p = 0.042$ ).  
264 Respondents with greater knowledge of RHDV2 were more likely to report suspicious rabbit  
265 deaths ( $p = 0.003$ ) and isolate new rabbits from the herd for 30 days ( $p = 0.039$ ), but they were less  
266 likely to support CVI requirements for rabbit-based events ( $p < 0.001$ ) and bans on the movement  
267 of rescued rabbits ( $p < 0.001$ ) or the rabbit trade ( $p \leq 0.047$ ).

#### 268 *Perceived Importance of Biosecurity, Risk Perceptions, and Trust in Government*

269 Respondents who perceived the importance of biosecurity were more likely to engage in  
270 all voluntary biosecurity actions and to support government-mandated biosecurity measures  
271 ( $p \leq 0.002$ ). Respondents who trusted state government to manage RHDV2 were more likely to  
272 keep their rabbits inside ( $p = 0.007$ ), change clothes after exiting rabbit enclosures ( $p = 0.011$ ),  
273 create secure barriers between domestic and wild rabbits ( $p = 0.023$ ), acquire CVIs ( $p < 0.001$ ),  
274 vaccinate their rabbits ( $p = 0.006$ ), and support a ban on rabbit rescues acquiring rabbits from  
275 states with RHDV2 ( $p < 0.001$ ). Breeders who trusted the state government to manage RHDV2

276 were more likely to support the relocation of rabbit shows ( $p=0.005$ ), CVI requirements for  
277 rabbit shows ( $p<0.001$ ), and trade bans until a domestic vaccine was produced ( $p=0.005$ ).

278         Respondents who expressed high susceptibility to the economic risks of RHDV2 (i.e.,  
279 they believed RHDV2 poses substantial risks to rabbit-based activities and industries) were more  
280 likely to engage in or support biosecurity measures ( $p\leq 0.002$ ), with the exception of keeping  
281 rabbits inside and requiring veterinary inspection of rescued rabbits. Respondents who expressed  
282 greater concerns about the economic impacts of RHDV2 (i.e., high risk sensitivity) were more  
283 likely to disinfect rabbit enclosures ( $p<0.001$ ), have separate clothing for enclosures ( $p=0.043$ ),  
284 prevent other rabbit owners from interacting with their rabbits ( $p=0.002$ ), and acquire a CVI  
285 ( $p<0.001$ ). These individuals were more likely to support mandatory veterinary inspections of  
286 rescued rabbits ( $p=0.017$ ) and bans on interstate movement of rescued rabbits ( $p<0.001$ ) but were  
287 less likely to support rabbit trade bans ( $p\leq 0.038$ ). Respondents who were concerned about the  
288 impact of RHDV2 on rabbit rescues were more likely to vaccinate rabbits ( $p<0.001$ ), have  
289 separate clothing for rabbit enclosures ( $p=0.031$ ), keep rabbits inside ( $p=0.001$ ), support CVI  
290 requirements for rabbit-based events ( $p=0.037$ ), support veterinary inspections of rescued rabbits  
291 ( $p=0.013$ ), and support a ban on rabbit trade until a vaccine was produced ( $p=0.002$ ). These  
292 individuals were less likely to support bans on rescues acquiring rabbits from states with RHDV2  
293 ( $p<0.001$ ). Rabbit breeders who were concerned about the impact of RHDV2 on rescues were  
294 more likely to acquire CVIs before transporting rabbits between states ( $p=0.002$ ) and to support  
295 penalties for transporters who did not acquire CVIs ( $p=0.002$ ). Respondents who expressed risk  
296 sensitivity to RHDV2-related lagomorph deaths were more likely to report suspicious rabbit  
297 deaths ( $p<0.001$ ), have separate clothes for rabbit enclosures ( $p=0.016$ ), acquire CVIs ( $p=0.029$ ),  
298 and vaccinate rabbits ( $p<0.001$ ). These individuals were more likely to support all government-

309 mandated biosecurity measures ( $p \leq 0.036$ ), with the exception of banning rabbit rescues from  
300 acquiring rabbits from states with RHDV2.

301         There are, however, caveats to these findings based on whether respondents were rabbit  
302 breeders. For example, rabbit breeders who expressed susceptibility to the economic impacts of  
303 RHDV2 were less likely to report suspicious rabbit deaths ( $p=0.009$ ), unless they were also  
304 concerned about the economic impacts of RHDV2 (i.e., they expressed sensitivity to economic  
305 risks;  $p=0.012$ ). Breeders who were concerned about the economic impacts of RHDV2 were less  
306 likely to acquire CVIs ( $p=0.006$ ), and breeders who trusted the government to manage RHDV2  
307 were less likely to support bans on rabbit rescues acquiring rabbits from states with RHDV2  
308 ( $p < 0.001$ ).

### 309 **Discussion**

310         Rabbit owners' voluntary engagement in RHDV2 biosecurity behaviors and support for  
311 management actions to reduce the risk of human-mediated RHDV2 spread are essential for  
312 protecting domestic rabbit health. It is therefore encouraging that most respondents stated that  
313 they were likely to engage in appropriate biosecurity measures, in particular keeping their rabbits  
314 inside, thereby decreasing the risk of RHDV2 transmission between domestic rabbits, free-  
315 roaming lagomorphs, and contaminated environments. Respondents also supported most  
316 potential management actions designed to prevent the human mediated spread of RHDV2, with  
317 the exception of banning rabbit rescues from acquiring rabbits from states with RHDV2 and  
318 banning rabbit trade until the U.S. started producing and distributing a RHDV2 vaccine.  
319 Although these findings are encouraging, it is important to note that because of limited records  
320 on rabbit ownership in the U.S., we sampled a small proportion of rabbit-owning stakeholders,  
321 many of whom were recruited by rabbit-specialist groups. It is unlikely that our sample is

322 representative of the population of rabbit owners in the U.S., and thus our results cannot be  
323 generalized. Agencies should identify and engage with rabbit owners in their state to determine if  
324 our results are representative of the larger rabbit-owning population.

325         Top-down RHDV2 management strategies, particularly bans on the interstate movement  
326 of rabbits, will be ineffective if they are not consistent across states and rigorously enforced.  
327 Unfortunately, many state agricultural agencies in the U.S. do not have jurisdiction over  
328 domestic rabbits or lack the resources to institute or enforce domestic rabbit movement controls  
329 (Shapiro *et al.*, 2022a). Thus, we recommend that government agencies, veterinarians, and rabbit  
330 specialist groups focus their efforts on increasing rabbit owners' adoption of voluntary  
331 biosecurity behaviors by addressing motivations that are important to rabbit owners. For  
332 example, educational materials should highlight the importance of engaging in biosecurity  
333 measures to protect domestic rabbits and prevent the spread of RHDV2. Consistent with other  
334 studies of pet and livestock owners, we found that respondents were more likely to adopt or  
335 support biosecurity measures if they recognize the importance of engaging in biosecurity or  
336 considered them effective (Schemann *et al.*, 2012; Brennan and Christley, 2013; Damiaans *et al.*,  
337 2018). In written comments at the end of our survey, respondents suggested that some  
338 recommended practices are ineffective, impractical, or unnecessary. Several respondents argued  
339 that CVIs are ineffective in detecting and preventing the spread of RHDV2 because unvaccinated  
340 rabbits infected with RHDV2 often die quickly and without obvious signs of illness. Traditional  
341 CVIs, which require veterinary inspection 30 days before travel, are unlikely to assist in RHDV2  
342 detection before rabbits are transported across state borders. Some states have tried to address  
343 this issue by shortening the CVI time (e.g., 72 hours before travel) to increase the likelihood of  
344 RHDV2 detection. However, CVIs for rabbits remain poorly enforced, and agencies do not have

345 a system in place to monitor pathogen spread through the domestic rabbit trade (Shapiro *et al.*,  
346 2022a).

347         Since it is unlikely that effective monitoring of the rabbit trade (in particular, the pet  
348 trade) will be implemented in the immediate future, improved outreach and communication  
349 about how rabbit owners can protect their rabbits and may prevent the spread of RHDV2 is  
350 important. Educational efforts should provide clear and consistent information about RHDV2  
351 and how it is spread. Although we found that respondents' risk perceptions were stronger  
352 determinants of their stated support for biosecurity than knowledge of RHDV2, this is likely  
353 attributable to the fact that most respondents were knowledgeable about RHDV2. Our  
354 respondents may have been more knowledgeable about RHDV2 than the general population of  
355 rabbit owners because we partnered with rabbit-specialist groups that have actively engaged in  
356 RHDV2 outreach. Nonetheless, previous research suggests that education on the health and  
357 welfare of rabbits by trusted sources is an important determinant of rabbit husbandry and health  
358 (Edgar and Mullan, 2011; Welch *et al.*, 2017; Rioja-Lang *et al.*, 2019), which reinforces our  
359 suggestion that messaging may increase rabbit owners' adoption of biosecurity.

360         Based on our findings, educational messaging or programs should also communicate the  
361 scientific reasoning behind recommended biosecurity measures and highlight the effectiveness of  
362 these measures in protecting rabbit-based industries, wild lagomorphs, and the health and welfare  
363 of domestic rabbits to increase the likelihood of rabbit owners voluntarily adopting biosecurity  
364 measures (see related findings by Gramza *et al.*, 2015; Robin *et al.*, 2017; Slunge and Boman,  
365 2018; Steele and Pienaar, 2021, Shapiro *et al.*, 2023). Communication efforts by trusted sources  
366 (e.g., veterinarians, state animal health officials) should highlight the negative impacts of  
367 RHDV2 on the welfare of rabbits and how engaging in biosecurity measures lowers the risk of

368 RHDV2 transmission (Edgar and Mullan, 2011; Welch *et al.*, 2017; McMahon and Wigham,  
369 2020). These efforts should also note how economically important industries (e.g., pet trade) and  
370 socially important rabbit-based activities (e.g., showing rabbits) could be affected by RHDV2.

371         However, we recognize that risk perceptions pertaining to the impacts of RHDV2 on  
372 lagomorphs and rabbit-based industries and activities did not always translate into increased  
373 willingness to engage in or support biosecurity measures. We found that rabbit rescue volunteers  
374 or staff and breeders differed in their willingness to engage in and support multiple biosecurity  
375 actions, even if they expressed concern about the economic and ecological impacts of RHDV2.  
376 Although both these groups agreed that transporting rabbits increases the risk of RHDV2 spread  
377 and that biosecurity is important, rescue staff or rabbit breeders may still engage in higher-risk  
378 behaviors (Shapiro *et al.*, 2022b). For example, rescue volunteers or staff were less likely to  
379 disallow interaction between their rabbits and other rabbit owners, as this behavior is central to  
380 rescue operations. Rabbit breeders were less likely to engage in costly biosecurity measures (e.g.,  
381 vaccinating their rabbits) owing to how these measures would impact their profits (Shapiro *et al.*,  
382 2022b). Rabbits owned by stakeholders who interact with numerous rabbits and/or travel with  
383 their rabbits are at a higher risk of becoming infected with RHDV2 and these stakeholders are at  
384 a higher risk of spreading RHDV2. As such, state animal health officials, veterinarians, and  
385 rabbit specialist groups should identify stakeholder-specific barriers to engaging in biosecurity  
386 and work with rabbit owners to overcome these barriers. Reducing the cost of CVIs and vaccines  
387 and making vaccines widely available for both rabbit owners and veterinarians will likely be  
388 necessary to increase rabbit owners' adoption of these practices. Equally importantly,  
389 veterinarians and state animal health officials should customize educational strategies based on  
390 the specific goals and constraints of breeders, rescues, and pet owners. Understanding different

391 stakeholders' beliefs, attitudes, motivations for engaging in the rabbit trade or rabbit-based  
392 activities, and constraints to engaging in biosecurity will be crucial to improve adoption of and  
393 support for biosecurity. Animal health officials and private veterinarians will likely play an  
394 essential role in this process, as both groups have been shown to be important, trusted sources of  
395 information capable of increasing animal owners' adoption of biosecurity measures (Wiethoelter  
396 *et al.*, 2007; Welch *et al.*, 2017).

397 In addition to outreach and education, we recommend that agencies partner with rabbit  
398 specialist and enthusiast groups to prevent the spread of RHDV2 through collaborative actions.  
399 We note that respondents' trust in their state government was positively correlated with their  
400 likelihood of engaging in biosecurity, but most respondents did not have an opinion or did not  
401 know about their state government's efforts to manage RHDV2. This is not surprising, as many  
402 state agricultural agencies did not have any established relationships or communication with  
403 rabbit stakeholder groups prior to the RHDV2 outbreak (Shapiro *et al.*, 2022a). However, some  
404 state agricultural agencies have worked with rabbit-specialist groups to disseminate RHDV2  
405 information and move rabbit-based events away from counties with RHDV2 cases (Shapiro *et*  
406 *al.*, 2022a), which are important first steps towards collaborative RHDV2 management.

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515 **Table 1.** Respondents’ willingness to engage in voluntary biosecurity actions to prevent the spread of RHDV2 (n=1,790).

516 Respondents answered the question “How likely are you to engage in the following behaviors?”

Biosecurity action	Median response	Percent of respondents who provided response					
		Very unlikely <sup>a</sup>	Unlikely	Neither likely nor unlikely	Likely	Very likely	Not applicable
Report suspicious rabbit deaths	Very likely	2.7	1.5	3.0	17.7	73.7	1.5
Keep your rabbit(s) inside	Very likely	5.1	5.8	4.7	9.4	72.6	2.4
Use USDA-recommended disinfectants to clean rabbit housing areas	Very likely	3.1	6.4	9.4	23.2	55.6	2.1
Prevent other rabbit owners from interacting with your rabbit(s)	Very likely	1.6	5.1	10.9	21.5	58.4	2.5

Have separate clothes and shoes for inside and outside your rabbit enclosure area	Likely	6.1	15.2	14.1	20.1	41.0	3.4
Create a secure barrier between areas used by domestic and wild rabbits	Very likely	3.0	4.8	7.6	15.1	49.6	19.9
Acquire a Certificate of Veterinary Inspection (CVI) before transporting rabbits between states	Likely	9.2	9.0	13.9	13.9	27.7	26.5
Isolate new rabbit(s) from your other rabbit(s) for at least 30 days	Very likely	1.7	3.2	5.1	16.7	58.3	15.0
Vaccinate your rabbit(s) if/when the RHDV2 vaccine becomes available	Very likely	3.7	4.5	8.5	14.6	66.9	1.7

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517 <sup>a</sup> Very unlikely=1, unlikely=2, neither likely nor unlikely=3, likely=4, very likely=5

518 **Table 2.** Respondents’ support for agency actions to prevent the spread of RHDV2 in the U.S. (n=1,790) Respondents answered the  
 519 question “Please indicate if you oppose or support the following potential regulations designed to prevent the spread of RHDV2.”

Agency-mandated biosecurity measures	Median response	Percent of respondents who provided response				
		Strongly oppose <sup>a</sup>	Oppose	Neither oppose nor support	Support	Strongly support
Relocate rabbit shows/exhibitions at least 150 miles from counties with RHDV2	Support	2.7	3.9	19.5	32.3	41.7
Require rabbit owners to obtain a Certificate of Veterinary Inspection before attending events with live rabbits	Support	10.3	8.4	12.8	23.4	45.1
Penalize rabbit owners who do not obtain a Certificate of Veterinary Inspection for the rabbits they carry	Support	7.2	7.2	18.2	25.8	41.7

Require rescued rabbits to be inspected by a vet before being moved by rescues over state borders	Support	2.5	3.5	10.2	35.9	47.9
Ban rabbit rescues from acquiring rabbits from states with RHDV2	Neither oppose nor support	10.7	20.9	27.9	16.8	23.6
Trade ban on rabbits that come from states with confirmed RHDV2 cases	Support	6.9	11.9	23.5	22.0	35.8
Trade ban on all rabbits until the U.S. starts producing and distributing a RHDV2 vaccine	Neither oppose nor support	14.5	13.7	22.1	19.4	30.2

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520 <sup>a</sup> Strongly oppose=1, oppose=2, neither oppose nor support=3, support=4, strongly support=5.

521 **Table 3.** Ordinal logistic regression analysis of respondents' willingness to engage in biosecurity measures to prevent the spread of  
 522 RHDV2 in the U.S. Coefficient estimates with p values provided in parentheses.

	<b>Report suspicious rabbit deaths</b>	<b>Keep your rabbit(s) inside</b>	<b>Use USDA- recommen ded disinfectan ts to clean rabbit housing areas</b>	<b>Prevent other rabbit owners from interacting with your rabbit(s)</b>	<b>Have separate clothes and shoes for inside and outside your rabbit enclosure area</b>	<b>Create a secure barrier between areas used by domestic and wild rabbits</b>	<b>Acquire a Certificate of Veterinary Inspection (CVI) before transporti ng rabbits between states</b>	<b>Isolate new rabbit(s) from your other rabbit(s) for at least 30 days</b>	<b>Vaccinate your rabbit(s) if/when the RHDV2 vaccine becomes available</b>
Perceived	0.654	0.448	0.550	0.815	0.698	0.718	0.485	1.016	0.584
importance of biosecurity	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
× rabbit breeder	0.479 (0.017)								-0.471 (0.017)

Risk sensitivity	0.354	0.214	0.057	0.086	0.203	0.126	0.189	0.130	0.542
to lagomorph	(<0.001)	(0.062)	(0.388)	(0.192)	(0.016)	(0.068)	(0.029)	(0.093)	(<0.001)
deaths									
× rabbit		-0.228			-0.224		-0.138		
breeder		(0.132)			(0.069)		(0.304)		
Risk sensitivity	-0.021		0.206	0.156	0.095		0.282		0.123
to economic	(0.767)		(<0.001)	(0.002)	(0.043)		(<0.001)		(0.100)
impacts of									
RHDV2									
× rabbit	0.398		-0.166				-0.402		
breeder	(0.012)		(0.215)				(0.006)		
Concern about		0.363			0.123		-0.160	0.116	0.225
the impact of		(0.001)			(0.031)		(0.114)	(0.089)	(<0.001)
RHDV2 on									
rabbit rescues									
× rabbit		-0.505					0.438		
breeder		(<0.001)					(0.002)		

Risk	0.504	0.220	0.392	0.513	0.521	0.627	0.378	0.522	0.406
susceptibility	(<0.001)	(0.082)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.002)	(<0.001)	(0.002)
to economic									
impacts of									
RHDV2									
× rabbit	-0.661				-0.311	-0.441			
breeder	(0.009)				(0.106)	(0.028)			
Trust in		0.211	0.105		0.151	0.155	0.429	0.143	0.209
government to		(0.007)	(0.100)		(0.011)	(0.023)	(<0.001)	(0.097)	(0.006)
manage									
RHDV2									
× rabbit							-0.204	-0.167	
breeder							(0.127)	(0.262)	
Prior awareness	0.372		-0.205		-0.931		-0.524	-0.530	
of RHDV2	(0.184)		(0.235)		(<0.001)		(0.042)	(0.069)	
Knowledge of	0.856				0.665		0.360	0.716	0.436
RHDV2	(0.003)				(0.009)		(0.243)	(0.039)	(0.056)

RHDV2 status		0.243		0.146	0.155		0.315	0.182	0.229
of respondents'		(0.053)		(0.143)	(0.089)		(0.004)	(0.121)	(0.061)
state of									
residence									
Number of		0.003	0.004	0.002	0.002	0.001			-0.001
rabbits owned <sup>a</sup>		(0.048)	(0.002)	(0.065)	(0.011)	(0.182)			(0.189)
House rabbits		-2.656	-0.142	-0.161	-0.264	-0.560			-0.309
outside		(<0.001)	(0.257)	(0.213)	(0.019)	(<0.001)			(0.023)
Travel out of		0.279	0.282	-0.205	0.192		-0.254		
state with		(0.056)	(0.016)	(0.083)	(0.073)		(0.028)		
rabbits									
Rabbit breeder	-0.105	-0.646	0.425	0.234	-0.131	-0.234	-0.083	0.357	-1.251
	(0.536)	(<0.001)	(0.003)	(0.106)	(0.331)	(0.074)	(0.607)	(0.014)	(<0.001)
Rescue	0.473	0.322	0.443	-0.414	0.270			0.293	0.579
volunteer	(0.013)	(0.130)	(0.001)	(0.003)	(0.039)			(0.097)	(0.014)
Age <sup>b</sup>		0.007	-0.007	0.007		-0.012	-0.010	-0.010	-0.013
		(0.123)	(0.029)	(0.036)		(0.002)	(0.005)	(0.017)	(0.003)
Gender <sup>c</sup>				0.152		0.076	0.205	0.171	0.113

				(0.018)		(0.270)	(0.002)	(0.016)	(0.127)
Education <sup>d</sup>		-0.083	-0.046			0.042			
		(0.002)	(0.089)			(0.147)			
<b>Intercepts:</b>									
$\beta_1$	-3.256	-4.188	-4.969	-4.461	-3.147	-3.910	-3.024	-4.330	-4.537
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
$\beta_2$	-2.771	-3.166	-3.755	-2.964	-1.607	-2.843	-2.116	-3.170	-3.617
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
$\beta_3$	-2.149	-2.546	-2.908	-1.785	-0.804	-1.993	-1.141	-2.304	-2.603
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
$\beta_4$	-0.407	-1.617	-1.649	-0.537	0.155	-0.934	-0.227	-0.874	-1.576
	(0.009)	(<0.001)	(<0.001)	(0.253)	(0.332)	(0.049)	(0.292)	(<0.001)	(<0.001)
N	1,763	1,747	1,752	1,746	1,729	1,433	1,316	1,522	1,760
Log likelihood <sup>e</sup>	-1,236.85	-1,256.13	-1,965.21	-1,790.06	-2,353.94	-1,524.45	-1,723.36	-1,317.85	-1,318.37
AIC <sup>e</sup>	2,497.70	2,548.26	3,958.42	3,608.12	4,745.88	3,072.89	3,482.72	2,667.70	2,672.73

523 <sup>a</sup> Coded as 1 rabbit = 1; 2-5 rabbits=4; 6-10 rabbits=8; 11-20 rabbits=15; 21-50 rabbits=35; 51-100 rabbits=75; 101-500 rabbits=300.

524 <sup>b</sup> Coded as male=-1; prefer not to answer=0, female=1.

525 <sup>c</sup> Coded as 18–24 years old=21, 25-34=30; 35-44=40; 45-54=50; 55-64=60; 65-74=70; 75 years old and over=75.

526 <sup>d</sup> Coded as less than 12<sup>th</sup> grade=10; high school graduate=12; some college or an associate degree=14; Bachelor's degree=16; graduate degree=18.

527 <sup>e</sup> The MuMIn package in R identifies all models that are within 2 AIC of the model with the lowest AIC value, and then averages the estimated  
528 coefficients ( $\beta$ ) across these models. The estimated coefficients provided in the table are averages of the estimated coefficients across the different  
529 models that were good fits of the data. The AIC and log likelihood pertain to the best-fit model (i.e., the model with the lowest AIC).

530 **Table 4.** Ordinal logistic regression analysis of respondents' support for government-mandated biosecurity measures to prevent the  
 531 spread of RHDV2 in the U.S. Coefficient estimates with p values provided in parentheses.

	<b>Relocate rabbit shows/exhibiti ons at least 150 miles from counties with RHDV2</b>	<b>Require rabbit owners to obtain a CVI before attending events with live rabbits</b>	<b>Penalize rabbit transporters who do not obtain a CVI for the rabbits they carry</b>	<b>Require rescued rabbits to be inspected by a vet before being moved by rescues over state borders</b>	<b>Ban rabbit rescues from acquiring rabbits from states with RHDV2</b>	<b>Trade ban on rabbits that come from states with confirmed RHDV2 cases</b>	<b>Trade ban on all rabbits until the U.S. starts producing and distributing a RHDV2 vaccine</b>
Perceived	1.015	1.072	1.016	0.789	0.295	0.504	0.555
importance of	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.002)	(<0.001)	(<0.001)
biosecurity							
× rabbit breeder	0.258			0.510	0.151	0.338	
	(0.134)			(0.008)	(0.353)	(0.056)	
Risk sensitivity to	0.235	0.237	0.251	0.190	0.048	0.168	0.171
lagomorph deaths	(<0.001)	(0.007)	(0.002)	(0.027)	(0.428)	(0.036)	(0.026)

× rabbit breeder		-0.317	-0.377	-0.245	-0.043	-0.251	-0.160
		(0.016)	(0.004)	(0.058)	(0.648)	(0.036)	(0.175)
Risk sensitivity to		-0.101	0.052	0.122	0.197	-0.130	-0.098
economic impacts of		(0.058)	(0.297)	(0.017)	(<0.001)	(0.007)	(0.038)
RHDV2							
× rabbit breeder			-0.290	-0.361			
			(0.053)	(0.018)			
Concern about the		0.183	0.107	0.159	-0.203	0.097	0.182
impact of RHDV2		(0.037)	(0.197)	(0.013)	(<0.001)	(0.089)	(0.002)
on rabbit rescues							
× rabbit breeder		0.251	0.367				
		(0.040)	(0.002)				
Risk susceptibility	0.652	0.549	0.449	0.196	0.345	0.549	0.489
to the economic	(<0.001)	(<0.001)	(<0.001)	(0.059)	(<0.001)	(<0.001)	(<0.001)
impacts of RHDV2							
× rabbit breeder		-0.335					
		(0.111)					

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Trust in government	-0.049	-0.034	-0.051		0.311	0.101	0.064
to manage RHDV2	(0.501)	(0.676)	(0.495)		(<0.001)	(0.086)	(0.383)
× rabbit breeder	0.288	0.464	0.179		-0.423		0.295
	(0.005)	(<0.001)	(0.080)		(<0.001)		(0.005)
Prior awareness of				0.287			
RHDV2				(0.284)			
Knowledge of	0.107	-0.592		-0.302	-0.538	-0.337	-0.433
RHDV2	(0.510)	(0.001)		(0.277)	(<0.001)	(0.047)	(0.010)
RHDV2 status of	-0.519	-0.210	-0.175		-0.531	-0.667	
respondents' state of	(<0.001)	(0.031)	(0.056)		(<0.001)	(<0.001)	
residence							
Number of rabbits		-0.004			0.004	-0.001	-0.003
owned <sup>a</sup>		(<0.001)			(<0.001)	(0.091)	(0.002)
House rabbits							-0.188
outside							(0.103)
Travel out of state	0.208	-0.443	-0.407		0.312		
with rabbits	(0.048)	(<0.001)	(<0.001)		(0.003)		
Rabbit breeder	-0.125	-1.760	-0.962	-0.420	0.714	-0.804	-1.556

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	(0.270)	(<0.001)	(<0.001)	(0.005)	(<0.001)	(<0.001)	(<0.001)
Rescue volunteer	0.319	0.624	0.273			0.446	0.352
	(0.013)	(<0.001)	(0.040)			(<0.001)	(0.005)
Age <sup>b</sup>	0.009		0.009		0.020	0.012	0.011
	(0.005)		(0.004)		(<0.001)	(<0.001)	(<0.001)
Gender <sup>c</sup>							0.058
							(0.323)
Education <sup>d</sup>				-0.064	-0.039		-0.038
				(0.010)	(0.098)		(0.113)
<b>Intercepts:</b>							
$\beta_1$	-3.919	-4.571	-3.388	-5.204	-2.162	-3.236	-3.003
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(<0.001)
$\beta_2$	-2.885	-3.463	-2.424	-4.223	-0.688	-1.944	-1.883
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.092)	(<0.001)	(<0.001)
$\beta_3$	-1.047	-2.284	-1.032	-3.018	0.660	-0.607	-0.614
	(<0.001)	(<0.001)	(<0.001)	(<0.001)	(0.106)	(<0.001)	(0.128)
$\beta_4$	0.601	-0.754	0.351	-1.063	1.578	0.442	0.432
	(<0.001)	(<0.001)	(0.029)	(0.006)	(<0.001)	(0.013)	(0.285)

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N	1,790	1,790	1,790	1,790	1,790	1,790	1,790
Log likelihood <sup>e</sup>	-2,061.38	-1,967.94	-2,187.64	-1,939.19	-2,614.86	-2,439.91	-2,453.66
AIC <sup>e</sup>	4,148.76	3,973.88	4,407.28	3,906.38	5,263.72	4,915.82	4,941.31

532 <sup>a</sup> Coded as 1 rabbit = 1; 2-5 rabbits=4; 6-10 rabbits=8; 11-20 rabbits=15; 21-50 rabbits=35; 51-100 rabbits=75; 101-500 rabbits=300.

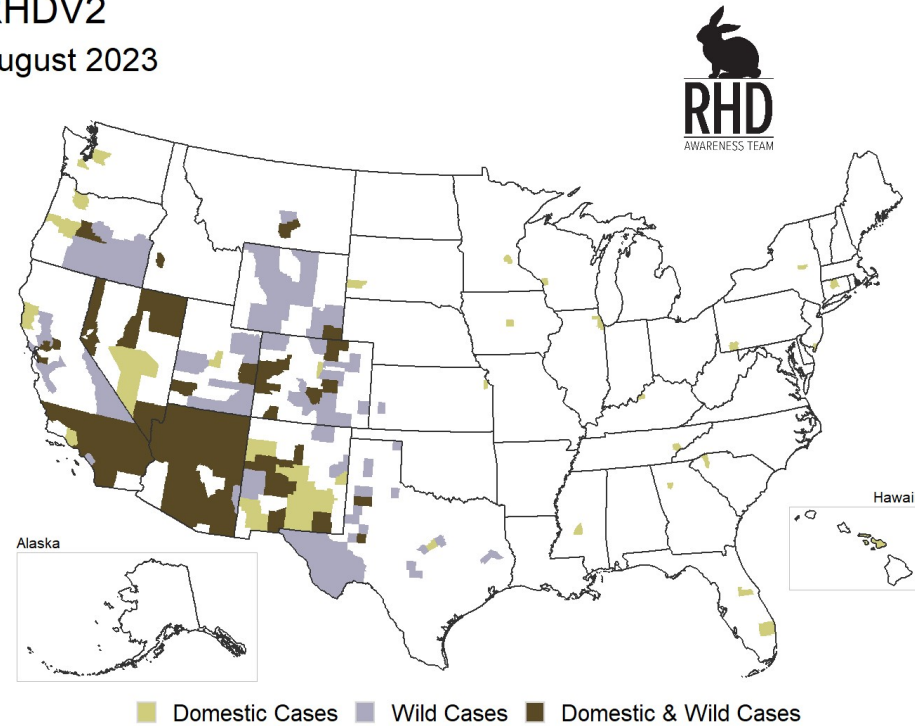
533 <sup>b</sup> Coded as male=-1; prefer not to answer=0, female=1.

534 <sup>c</sup> Coded as 18–24 years old=21, 25-34=30; 35-44=40; 45-54=50; 55-64=60; 65-74=70; 75 years old and over=75.

535 <sup>d</sup> Coded as less than 12<sup>th</sup> grade=10; high school graduate=12; some college or an associate degree=14; Bachelor's degree=16; graduate  
536 degree=18.

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539 coefficients across the different models that were good fits of the data. The AIC and log likelihood pertain to the best-fit model (i.e.,  
540 the model with the lowest AIC).

RHDV2  
August 2023



Data provided by USDA APHIS. Supplemental data reports (e.g., Press Releases) have been collated by Rabbits Rescue Society and WildRescue Inc. since the last USDA reporting period (every 3 months).

See [RHDV2.org/resources](https://RHDV2.org/resources) for USDA data disclaimer.  
Domestic cases include both domestic and feral rabbit cases.  
Map Credit: Dr. Michel Kohl, RHD Awareness Team, University of Georgia.  
Data last updated August 1 2023

541

542 **Figure 1.** Detections of rabbit hemorrhagic disease virus 2 (RHDV2) in wild and domestic lagomorphs in the United States from  
543 March 2020 through August 2023. Shaded counties represent detections of RHDV2 reported to, and/or confirmed by, the US  
544 Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS). Detections are primarily the result of  
545 investigation of mortality events involving wild and domestic lagomorphs by state or federal wildlife agencies, state agricultural

546 agencies, the USDA, or clinical veterinarians. The map represents the known distribution of RHDV2 in the US since March 2020. The  
547 number of impacted lagomorphs in a shaded county is not publicly available. Map last updated on August 1, 2023. Data source:  
548 USDA-APHIS. Supplemental data reports that have been verified using press releases were used to update the map between USDA  
549 reporting periods. Domestic cases include both domestic and feral rabbit (*Lagomorpha*) cases. Map credit: M.T. Kohl. Map publicly  
550 available at [rhv2.org](http://rhv2.org).