

## Supplementary Materials - Benefit–Risk Assessment of the French Surveillance Protocol of Apparently Healthy Biting Dogs and Cats for Human Rabies Prevention

### Supplementary Material A. Survey on dog and cat bites

In order to obtain parameter values about dog and cat bites, we used results from a survey conducted among the general French population. Results about pet owner practices from this survey are presented elsewhere [1] and are also used in this work (for the probability for a pet to be “at-risk” for rabies). We describe here the materials and methods and present the main results about dog and cat bites.

#### Materials and methods

The survey targeted people living in France mainland over 18 years of age. An online questionnaire which used Sphinx™ platform was designed to collect data about pet management practices and pet travels [1], but also dog and cat bites on humans. Only bites with skin-punctures were considered.

Observations were appropriately weighted following a post-stratification process using three variables (also called raking) as described by Lumley (2011) [2]. The three variables used for the raking process were the socio-professional category-age variable, pet ownership variable, gender variable, in order to reflect the structure of the French population (as presented in Tables A1, A2, and A3). People working in a veterinary profession were considered as a separate stratum (representing 86,875 people), given their specific risk for dog and cat bites, and were not considered in the raking process but accounted for in the post-stratification (i.e. weighting).

**Table A1.** Structure of the French population for age and socio-professional category [3]

Age	Socio-professional category	% among French people
15-29	Lower socio-professional category	8.05%
15-29	Higher socio-professional category	1.43%
15-29	Student	7.98%
15-29	No activity	3.75%
30-39	Lower socio-professional category	9.09%
30-39	Higher socio-professional category	3.15%
30-39	No activity (including students and retired)	3.00%
40-49	Lower socio-professional category	9.81%
40-49	Higher socio-professional category	3.60%
40-49	No activity (including students and retired)	2.71%
50-59	Lower socio-professional category	9.20%
50-59	Higher socio-professional category	3.27%
50-59	No activity (including students and retired)	3.85%
≥60	Lower socio-professional category	1.85%
≥60	Higher socio-professional category	1.16%
≥60	No activity (including students and retired)	27.94%

**Table A2.** Structure of the French population for gender [4]

Gender	% among French people
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Man	47.70%
Woman	52.30%

**Table A3.** Structure of the French population for pet ownership [5]

Pet ownership	% among French people
Owens a dog and/or a cat	42.20%
Does not own a dog nor a cat	57.80%

Descriptive analyses were performed on post-stratified observations. Results were presented in the form of proportions or means with their 95% confidence intervals (95%CI), with variance estimates taking into account the post-stratification process as described by Valliant (1993) [6].

## Results on dog and cat bites

### *Participation to the study*

2,384 questionnaires were completed and 2,336 met the inclusion criteria (34 concerned respondents outside mainland France, 14 concerned respondents that did not meet the age criterion).

### *Results about dog and cat bite incidence*

Among the participants (and after the post-stratification process), 3.1% [2.3; 4.1]<sub>95%CI</sub> had been bitten at least once by a dog in the five previous years and 7.8% [6.3; 9.6]<sub>95%CI</sub> had been bitten at least once by a cat in the five previous years. Bite incidence results are presented in Table A4.

**Table A4.** Dog and cat bite annual incidences

Species	Mean annual bite number per person	Standard deviation	95% Confidence interval
Dog	$1.04 \times 10^{-2}$	$1.10 \times 10^{-1}$	[ $5.29 \times 10^{-3}$ ; $1.55 \times 10^{-2}$ ]
Cat	$4.30 \times 10^{-2}$	$2.47 \times 10^{-1}$	[ $3.19 \times 10^{-2}$ ; $5.41 \times 10^{-2}$ ]

Among people bitten at least once in the five previous years, 25.9% [13.2; 42.6]<sub>95%CI</sub> and 18.2% [11.5; 26.9]<sub>95%CI</sub> declared that at least one biting dog and at least one biting cat, respectively, was presented to a veterinarian.

## References

1. Crozet, G.; Lacoste, M.-L.; Rivière, J.; Robardet, E.; Cliquet, F.; Dufour, B. Management Practices of Dog and Cat Owners in France (Pet Traveling, Animal Contact Rates and Medical Monitoring): Impacts on the Introduction and the Spread of Directly Transmitted Infectious Pet Diseases. *Transbound Emerg Dis* **2021**, doi:10.1111/tbed.14088.
2. Lumley, T. *Complex Surveys: A Guide to Analysis Using R*; John Wiley & Sons, 2011; ISBN 978-1-118-21093-2.
3. INSEE. Activité, Emploi et Chômage En 2018. Available online: <https://www.insee.fr/fr/statistiques/4191029#consulter> (accessed on 13 April 2020).
4. INSEE. Pyramide Des Âges 2018. Available online: <https://www.insee.fr/fr/statistiques/2381472> (accessed on 13 April 2020).
5. FACCO. Les Chiffres de La Possession Animale En France. Available online: <https://www.facco.fr/les-chiffres/>.
6. Valliant, R. Poststratification and Conditional Variance Estimation. *Journal of the American Statistical Association* **1993**, *88*, 89–96, doi:10.2307/2290701.

**Supplementary Material B.** Probabilities associated with scenarios-tree branches and mortality probabilities

**Model “M0”**

*Probabilities associated with branches (n=7) of the scenario-tree model*

$$\begin{aligned}
 M0_1 &= Pr \times P_{Exc} \times P_{inf} \times P_{CSecc,15} \times ((1 - P_{decla3}) + P_{decla3} \times (1 - P_{LTAcln}) \times (1 - P_{suspi})) \\
 M0_2 &= Pr \times P_{Exc} \times P_{inf} \times P_{CSecc,15} \times P_{decla3} \times P_{LTAcln} \\
 M0_3 &= Pr \times P_{Exc} \times P_{inf} \times P_{CSecc,15} \times P_{decla3} \times (1 - P_{LTAcln}) \times P_{suspi} \times P_{LTAPEP} \\
 M0_4 &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{CSecc,15} \times P_{decla3} \times P_{LTAcln} \\
 M0_5 &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{CSecc,15} \times P_{decla3} \times (1 - P_{LTAcln}) \times P_{suspi} \times P_{LTAPEP} \\
 M0_6 &= Pr \times (1 - P_{Exc}) \times P_{inf} \times P_{CSnexc,15} \times P_{decla3} \times P_{LTAcln} \\
 M0_7 &= Pr \times (1 - P_{Exc}) \times P_{inf} \times P_{CSnexc,15} \times P_{decla3} \times (1 - P_{LTAcln}) \times P_{suspi} \times P_{LTAPEP}
 \end{aligned}$$

*Human death probabilities*

$$\begin{aligned}
 P_{Morabies} &= M0_1 && \text{(Rabies death probability)} \\
 P_{M0LTA} &= \sum_{i \in \{2:7\}} M0_i && \text{(Traffic accident death probability)}
 \end{aligned}$$

**Model “3V”**

*Probabilities associated with branches (n=42) of the scenario-tree model*

$$\begin{aligned}
 M3V_1 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
 &\quad \times (1 - P_{CSecc,7}) \times P_{compV3} \times (1 - P_{LTAcln}) \times P_{CSecc,15} \times P_{LTAPEP} \\
 M3V_2 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
 &\quad \times (1 - P_{CSecc,7}) \times P_{compV3} \times P_{LTAcln} \\
 M3V_3 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
 &\quad \times (1 - P_{CSecc,7}) \times (1 - P_{compV3}) \times P_{CSecc,15} \times P_{decla2} \times (1 - P_{LTAcln}) \times P_{LTAPEP} \\
 M3V_4 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
 &\quad \times (1 - P_{CSecc,7}) \times (1 - P_{compV3}) \times P_{CSecc,15} \times P_{decla2} \times P_{LTAcln} \\
 M3V_5 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
 &\quad \times (1 - P_{CSecc,7}) \times (1 - P_{compV3}) \times P_{CSecc,15} \times (1 - P_{decla2}) \\
 M3V_6 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
 &\quad \times P_{CSecc,7} \times P_{LTAPEP} \\
 M3V_7 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times P_{compV2} \times P_{LTAcln} \\
 M3V_8 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times (1 \\
 &\quad - P_{compV2}) \times P_{CSecc,15} \times P_{decla2} \times (1 - P_{LTAcln}) \times P_{LTAPEP} \\
 M3V_9 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times (1 \\
 &\quad - P_{compV2}) \times P_{CSecc,15} \times P_{decla2} \times P_{LTAcln} \\
 M3V_{10} &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times (1 \\
 &\quad - P_{compV2}) \times P_{CSecc,15} \times (1 - P_{decla2}) \\
 M3V_{11} &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times P_{CSecc,1} \times P_{LTAPEP} \\
 M3V_{12} &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times P_{LTAcln} \\
 M3V_{13} &= Pr \times P_{Exc} \times P_{inf} \times ((1 - P_{V1owner}) + P_{V1owner} \times (1 - P_{V1vet})) \\
 &\quad \times P_{CSecc,15} \times P_{decla3} \times (1 - P_{LTAcln}) \times P_{suspi} \times P_{LTAPEP} \\
 M3V_{14} &= Pr \times P_{Exc} \times P_{inf} \times ((1 - P_{V1owner}) + P_{V1owner} \times (1 - P_{V1vet})) \\
 &\quad \times P_{CSecc,15} \times P_{decla3} \times P_{LTAcln} \\
 M3V_{15} &= Pr \times P_{Exc} \times P_{inf} \times ((1 - P_{V1owner}) + P_{V1owner} \times (1 - P_{V1vet})) \\
 &\quad \times P_{CSecc,15} \times ((1 - P_{decla3}) + P_{decla3} \times (1 - P_{LTAcln}) \times (1 - P_{suspi})) \\
 M3V_{16} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
 &\quad \times (1 - P_{CSecc,7}) \times P_{compV3} \times (1 - P_{LTAcln}) \times P_{CSecc,15} \times P_{LTAPEP} \\
 M3V_{17} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSecc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
 &\quad \times (1 - P_{CSecc,7}) \times P_{compV3} \times P_{LTAcln}
 \end{aligned}$$

$$\begin{aligned}
M3V_{18} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSexc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
&\quad \times (1 - P_{CSexc,7}) \times (1 - P_{compV3}) \times P_{CSexc,15} \times P_{decla2} \times (1 - P_{LTAcln}) \times P_{LTAPEP} \\
M3V_{19} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSexc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
&\quad \times (1 - P_{CSexc,7}) \times (1 - P_{compV3}) \times P_{CSexc,15} \times P_{decla2} \times P_{LTAcln} \\
M3V_{20} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSexc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
&\quad \times P_{CSexc,7} \times P_{LTAPEP} \\
M3V_{21} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSexc,1}) \times P_{compV2} \times P_{LTAcln} \\
M3V_{22} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSexc,1}) \times (1 \\
&\quad - P_{compV2}) \times P_{CSexc,15} \times P_{decla2} \times (1 - P_{LTAcln}) \times P_{LTAPEP} \\
M3V_{23} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSexc,1}) \times (1 \\
&\quad - P_{compV2}) \times P_{CSexc,15} \times P_{decla2} \times P_{LTAcln} \\
M3V_{24} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times (1 - P_{LTAcln}) \times P_{CSexc,1} \times P_{LTAPEP} \\
M3V_{25} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times P_{compV1} \times P_{LTAcln} \\
M3V_{26} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times ((1 - P_{V1owner}) + P_{V1owner} \times (1 - P_{V1vet})) \\
&\quad \times P_{CSexc,15} \times P_{decla3} \times (1 - P_{LTAcln}) \times P_{suspi} \times P_{LTAPEP} \\
M3V_{27} &= Pr \times P_{Exc} \times (1 - P_{inf}) \times ((1 - P_{V1owner}) + P_{V1owner} \times (1 - P_{V1vet})) \\
&\quad \times P_{CSexc,15} \times P_{decla3} \times P_{LTAcln} \\
M3V_{28} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSnexc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
&\quad \times (1 - P_{CSnexc,7}) \times P_{compV3} \times (1 - P_{LTAcln}) \times P_{CSnexc,15} \times P_{LTAPEP} \\
M3V_{29} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSnexc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
&\quad \times (1 - P_{CSnexc,7}) \times P_{compV3} \times P_{LTAcln} \\
M3V_{30} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSnexc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
&\quad \times (1 - P_{CSnexc,7}) \times (1 - P_{compV3}) \times P_{CSnexc,15} \times P_{decla2} \times (1 - P_{LTAcln}) \times P_{LTAPEP} \\
M3V_{31} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSnexc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
&\quad \times (1 - P_{CSnexc,7}) \times (1 - P_{compV3}) \times P_{CSnexc,15} \times P_{decla2} \times P_{LTAcln} \\
M3V_{32} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSnexc,1}) \times P_{compV2} \times (1 - P_{LTAcln}) \\
&\quad \times P_{CSnexc,7} \times P_{LTAPEP} \\
M3V_{33} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSnexc,1}) \times P_{compV2} \times P_{LTAcln} \\
M3V_{34} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSnexc,1}) \times (1 \\
&\quad - P_{compV2}) \times P_{CSnexc,15} \times P_{decla2} \times (1 - P_{LTAcln}) \times P_{LTAPEP} \\
M3V_{35} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSnexc,1}) \times (1 \\
&\quad - P_{compV2}) \times P_{CSnexc,15} \times P_{decla2} \times P_{LTAcln} \\
M3V_{36} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times (1 - P_{LTAcln}) \times P_{CSnexc,1} \times P_{LTAPEP} \\
M3V_{37} &= Pr \times (1 - P_{Exc}) \times P_{compV1} \times P_{LTAcln} \\
M3V_{38} &= Pr \times (1 - P_{Exc}) \times ((1 - P_{V1owner}) + P_{V1owner} \times (1 - P_{V1vet})) \\
&\quad \times P_{CSnexc,15} \times P_{decla3} \times (1 - P_{LTAcln}) \times P_{suspi} \times P_{LTAPEP} \\
M3V_{39} &= Pr \times (1 - P_{Exc}) \times ((1 - P_{V1owner}) + P_{V1owner} \times (1 - P_{V1vet})) \\
&\quad \times P_{CSnexc,15} \times P_{decla3} \times P_{LTAcln} \\
M3V_{40} &= (1 - Pr) \times P_{compV1} \times (1 - P_{LTAcln}) \times P_{compV2} \times (1 - P_{LTAcln}) \times P_{compV3} \times P_{LTAcln} \\
M3V_{41} &= (1 - Pr) \times P_{compV1} \times (1 - P_{LTAcln}) \times P_{compV2} \times P_{LTAcln} \\
M3V_{42} &= (1 - Pr) \times P_{compV1} \times P_{LTAcln}
\end{aligned}$$

Human death probabilities

$$P_{M3Vrabies} = M3V_5 + M3V_{10} + M3V_{15} \quad (\text{Rabies death probability})$$

$$P_{M3VLTA} = \sum_{i \in \{1:42\} \setminus \{5,10,15\}} M3V_i \quad (\text{Traffic accident death probability})$$

## Model “1V10D”

Probabilities associated with branches ( $n=31$ ) of the scenario-tree model

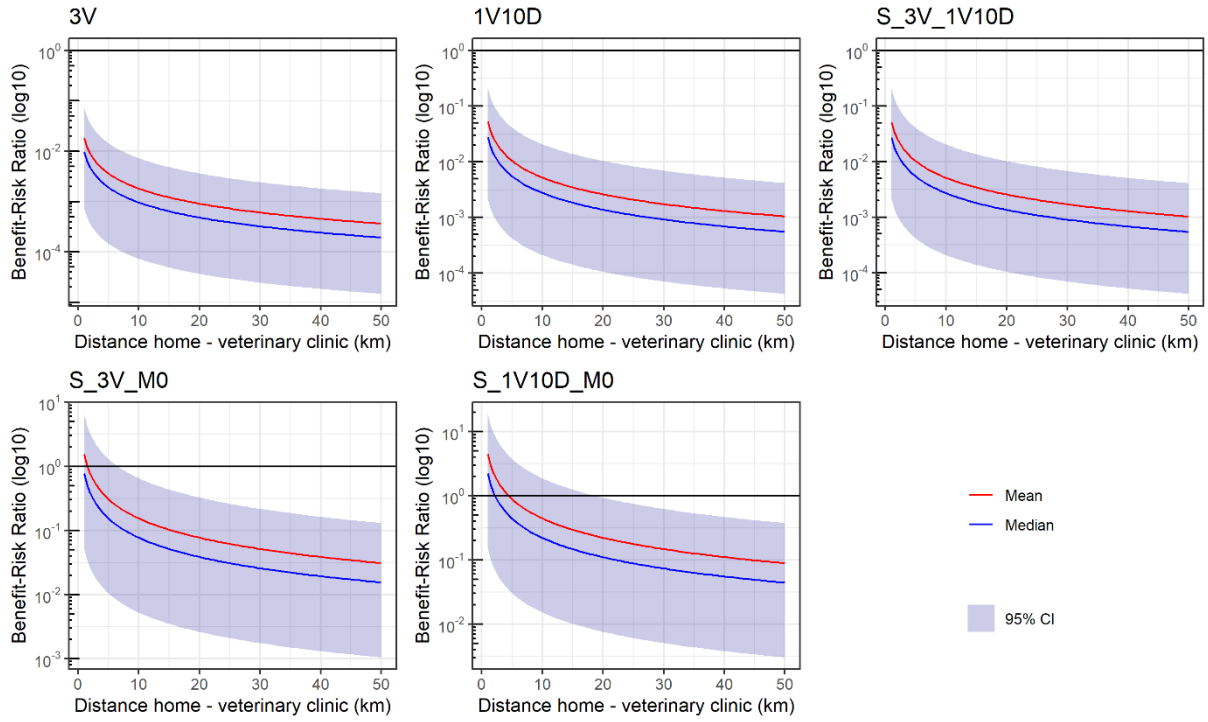
$$\begin{aligned}
M1V10D_1 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times P_{CSexc,1} \times P_{LTAPEP} \\
M1V10D_2 &= Pr \times P_{Exc} \times P_{inf} \times P_{compV1} \times (1 - P_{LTAcln}) \times (1 - P_{CSexc,1}) \times P_{comp10D} \times P_{CSexc,10} \\
&\quad \times P_{LTAPEP}
\end{aligned}$$

[illegible]

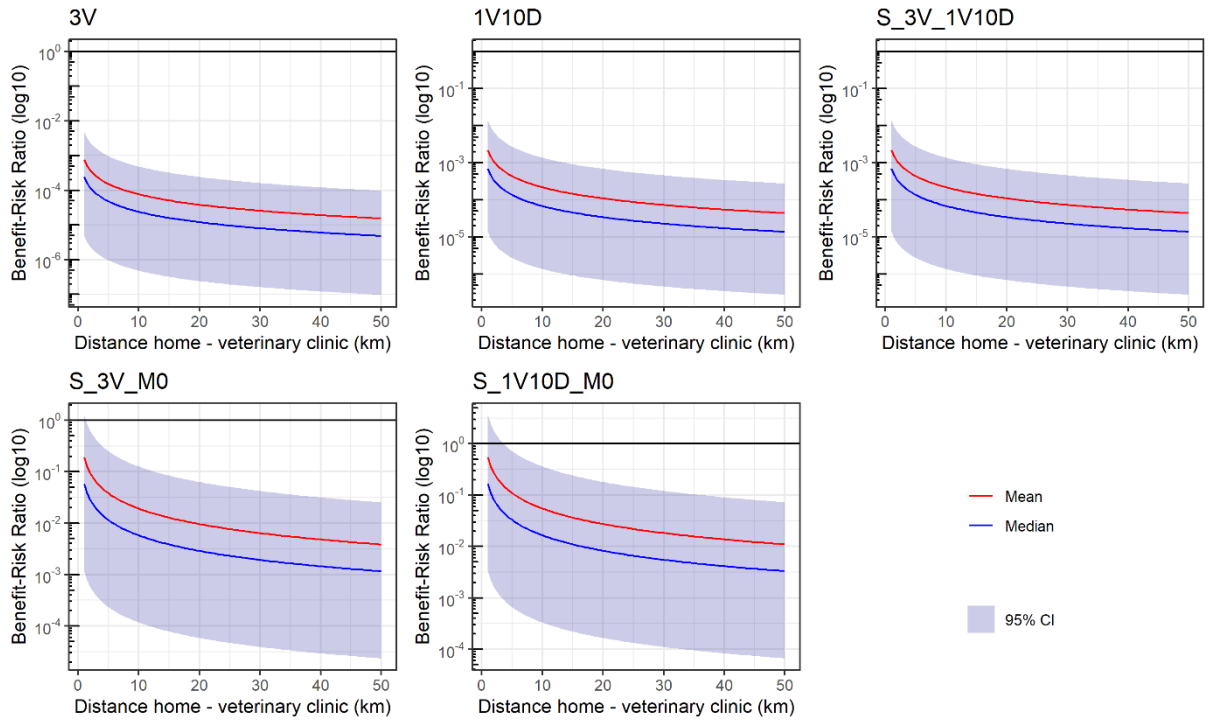
$$P_{M1V10Drabies} = M1V10D_5 + M1V10D_8 + M1V10D_{12} \quad (\text{Rabies death probability})$$

$$P_{M1V10DLTA} = \sum_{i \in \{1:31\} \setminus \{5,8,12\}} M1V10D_i \quad (\text{Traffic accident death probability})$$

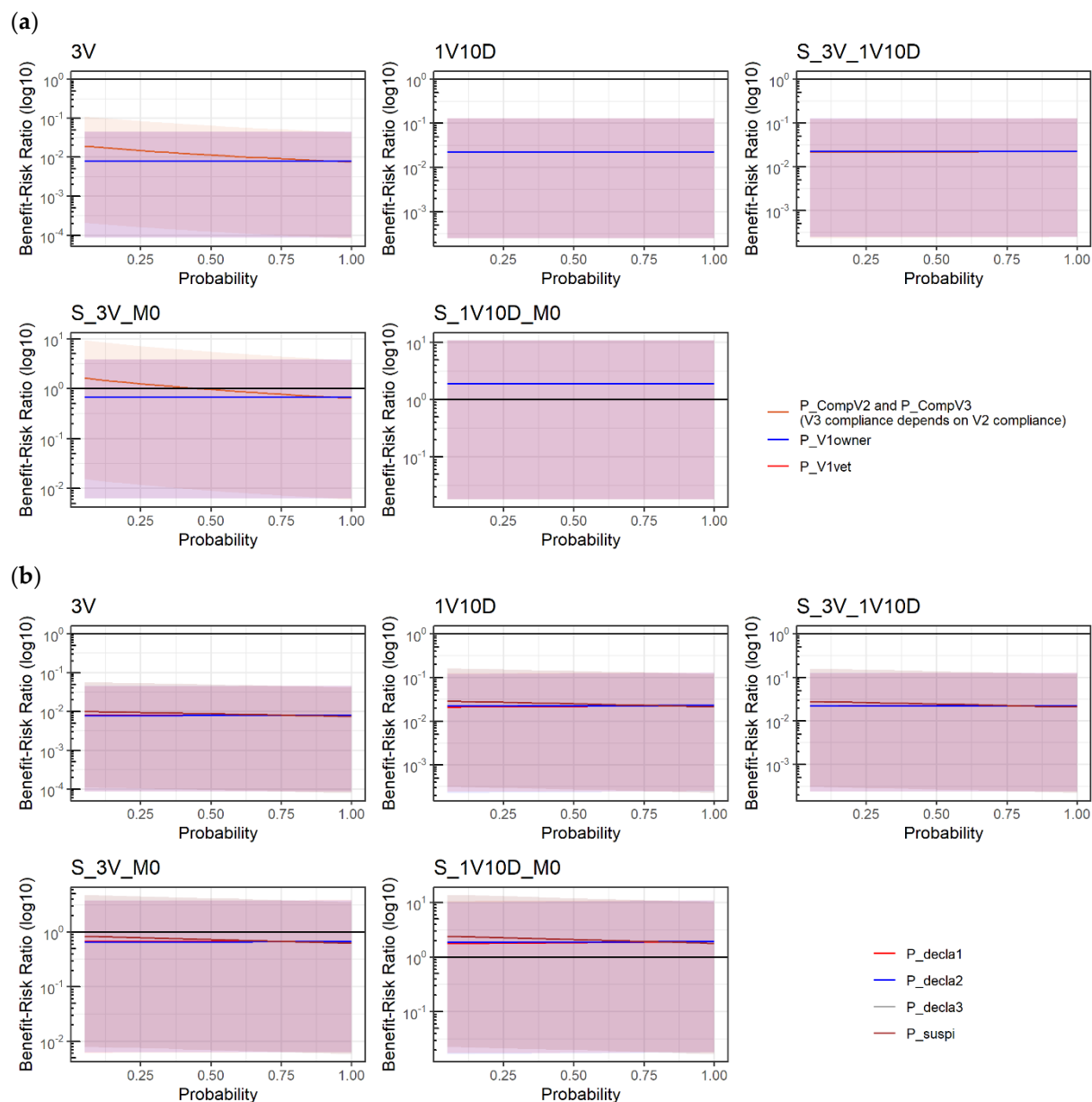
### Supplementary Material C. Results of the sensitivity analyses



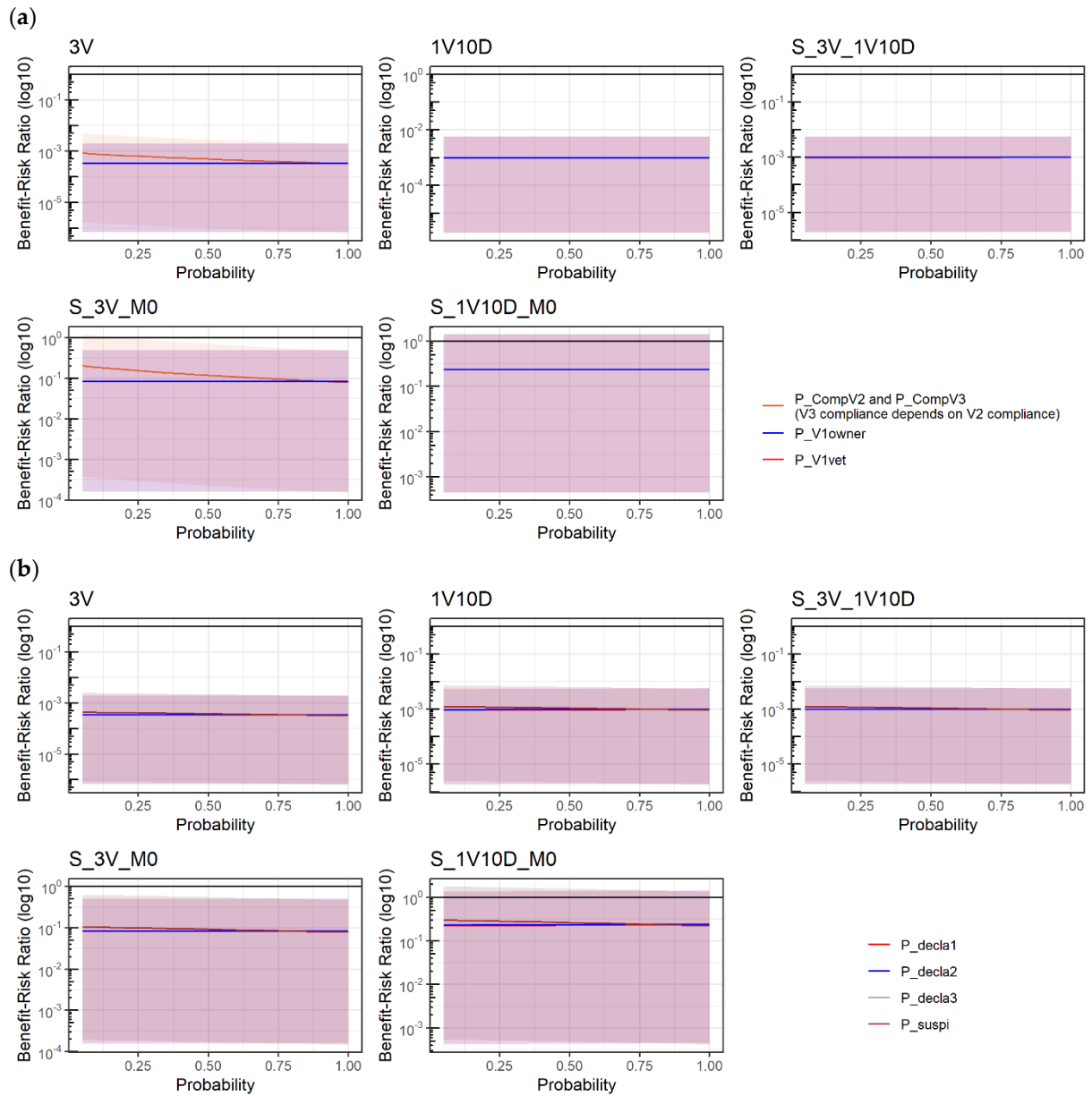
**Figure C1.** One-way sensitivity analyses on the home-veterinary clinic distance for dog bite surveillance protocol models. The distance considered corresponded to one journey between the home of the pet owner and a veterinary clinic. CI: confidence interval.



**Figure C2.** One-way sensitivity analyses on the home-veterinary distance clinic for cat bite surveillance protocol models. The distance considered corresponded to one journey between the home of the pet owner and a veterinary clinic. CI: confidence interval.



**Figure C3.** One-way sensitivity analyses on the compliance parameters for dog bite surveillance protocol models: (a) Veterinary visit compliance parameters; (b) Clinical sign declaration probability parameters. Lines represent the mean of the Benefit-Risk Ratio distributions and shaded areas the 95% confidence intervals



**Figure C4.** One-way sensitivity analyses on the compliance parameters for cat bite surveillance protocol models: (a) Veterinary visit compliance parameters; (b) Clinical sign declaration probability parameters. Lines represent the mean of the Benefit-Risk Ratio distributions and shaded areas the 95% credibility intervals.