

Potential impact of species and livestock density on the epidemic size and effectiveness of control measures for foot-and-mouth disease in Japan

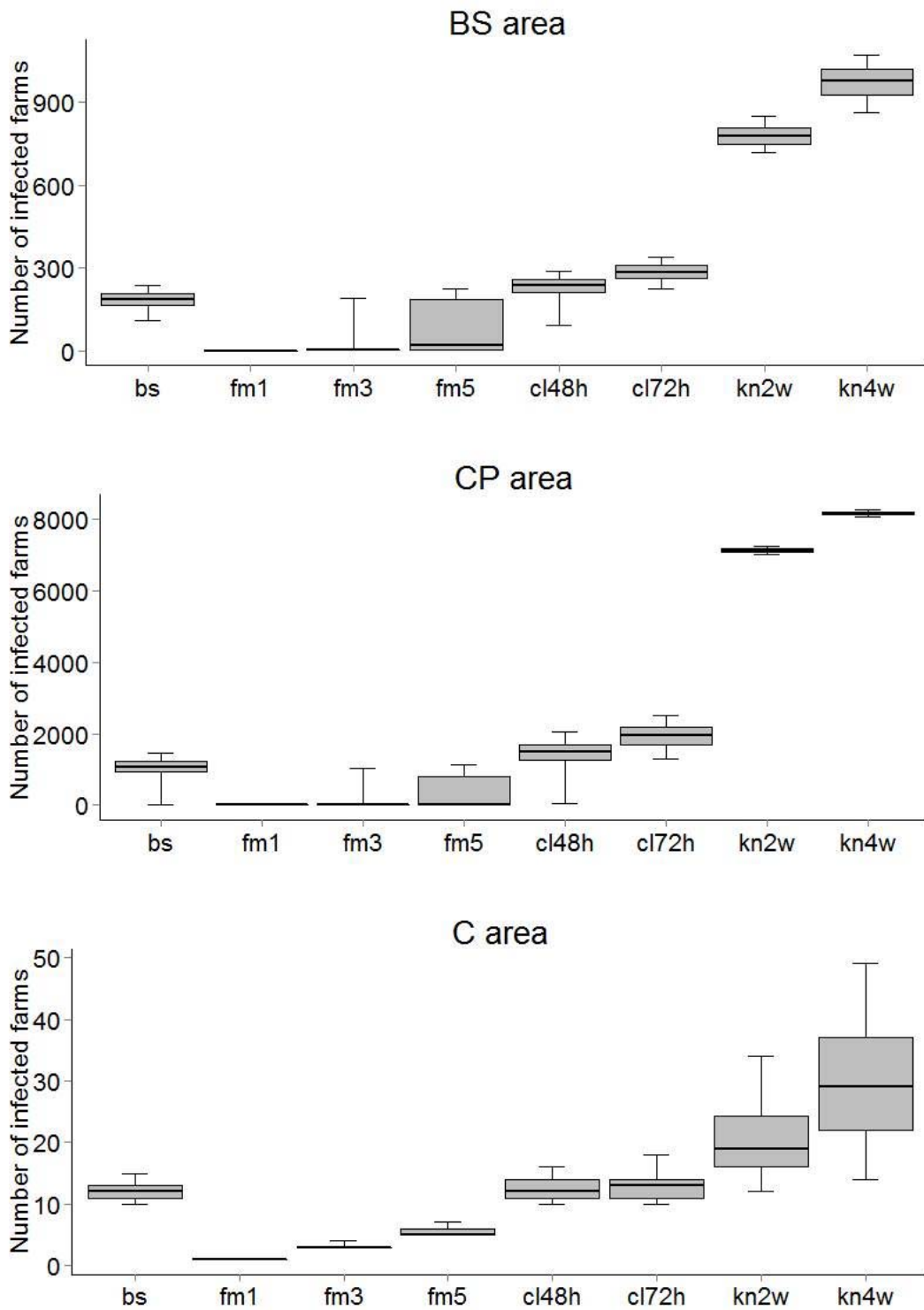
Results of the sensitivity analysis

Impacts on foot-and-mouth disease (FMD) spread were investigated using sensitivity analyses that altered the baseline situation (bs) for each simulation area as follows:

- The number of initially infected farms was decreased from 10 farms to five farms (fm5), three farms (fm3), or one farm (fm1).
- The duration required to complete culling animals on an infected farm was increased from 24 hr to 48 hr (cl48h) or 72 hr (cl72h) after disease detection.
- The width of the transmission kernel was changed by increasing the parameter value (r_0) of the transmission kernel by two fold (kn2w) or four fold (kn4w).

The sensitivity analysis was conducted in each simulation area; the baseline area (BS area), which was defined as the FMD endemic region in the Japan 2010 outbreak; the cattle and pig mixed production area (CP area); and the cattle production area (C area).

Fig. 1 compares the cumulative number of infected farms over a 100-day period under the conditions of the sensitivity analysis in each simulation area. Tables 1–3 detail the number of infected farms and animals by species in each simulation area.



Supplementary Fig.1 Comparison of the cumulative number of infected farms during 100 days under the sensitivity analysis conditions in each simulation area. The middle of the box indicates the median, the bottom and top of the box are the 25th and 75th percentiles, respectively, and the ends of the whiskers are the 5th and 95th percentiles.

Supplementary Table 1 FMD epidemic sizes on day 100 and sensitivity analysis in the BS area

Scenarios	Number of infected farms				Number of infected animals ($\times 10^3$)				Probability of containing the disease within 100 days
	Cattle		Pigs		Cattle		Pigs		
	Median	(5 th –95 th percentiles)	Median	(5 th –95 th percentiles)	Median	(5 th –95 th percentiles)	Median	(5 th –95 th percentiles)	
Baseline	124	(74–162)	63	(36–81)	11	(6.2–18)	115	(61–144)	90%
Sensitivity analysis									
Number of initial infected farms									
1 farm	1	(1–1)	0	(0–0)	0.02	(0.02–0.04)	0	(0–0)	99%
3 farms	3	(3–123)	0	(0–64)	0.8	(0.8–10)	0	(0–117)	97%
5 farms	17	(5–149)	3	(0–75)	3.0	(1.9–16)	8	(0–137)	88%
Days required for culling									
within 48 hr	161	(70–201)	74	(18–89)	14	(6.5–22)	132	(33–159)	77%
within 72 hr	200	(149–244)	84	(64–97)	18	(11–27)	147	(112–171)	66%
Width of transmission kernel									
2 times wide	643	(589–709)	134	(124–144)	58	(52–63)	223	(206–243)	87%
4 times wide	827	(728–915)	144	(130–155)	67	(60–72)	238	(215–254)	60%

Supplementary Table 2 FMD epidemic sizes on day 100 and sensitivity analysis in the CP area

Scenarios	Number of infected farms				Number of infected animals ($\times 10^3$)				Probability of containing the disease within 100 days
	Cattle		Pigs		Cattle		Pigs		
	Median	(5 th –95 th percentiles)	Median	(5 th –95 th percentiles)	Media n	(5 th –95 th percentiles)	Media n	(5 th –95 th percentiles)	
Baseline	879	(16–1229)	177	(0–240)	43	(0.4–59)	271	(0–396)	12%
Sensitivity analysis									
Number of initial infected farms									
1 farm	1	(1–2)	0	(0–0)	0.005	(0.04–0.2)	0	(0–0)	100%
3 farms	4	(3–849)	0	(0–177)	0.1	(0.02–42)	0	(0–279)	82%
5 farms	7	(5–946)	0	(0–193)	0.3	(0.05–48)	0	(0–297)	68%
Days required for culling									
within 48 hr	1,273	(49–1747)	218	(3–296)	58	(2.3–77)	351	(6.0–490)	5%
within 72 hr	1,674	(1,101–2,168)	269	(198–341)	74	(49–93)	437	(298–587)	2%
Width of transmission kernel									
2 times wider	5,743	(5,649–5,822)	642	(629–654)	207	(204–212)	933	(910–947)	*
4 times wider	6,674	(6,619–6,737)	659	(649–669)	223	(221–226)	947	(926–960)	*

*The probability of containing the disease is not shown because the increased viral transmission caused nearly all farms within the area to be infected within 100 days.

Supplementary Table 3 FMD epidemic sizes on day 100 and sensitivity analysis in the C area

Scenarios	Number of infected farms				Number of infected animals ($\times 10^3$)				Probability of containing the disease within 100 days
	Cattle		Pigs		Cattle		Pigs		
	Median	(5 th –95 th percentiles)	Median	(5 th –95 th percentiles)	Median	(5 th –95 th percentiles)	Median	(5 th –95 th percentiles)	
Baseline	12	(10–15)	0	(0–0)	7.9	(2.2–17)	0	(0–0)	100%
Sensitivity analysis									
Number of initial infected farms									
1 farm	1	(1–1)	0	(0–0)	0.2	(0.1–0.3)	0	(0–0)	100%
3 farms	3	(3–4)	0	(0–0)	0.3	(0.3–0.5)	0	(0–0)	100%
5 farms	5	(5–7)	0	(0–0)	0.6	(0.6–1.2)	0	(0–0)	100%
Days required for culling									
within 48 hr	12	(10–16)	0	(0–0)	10	(5.0–18)	0	(0–0)	100%
within 72 hr	13	(10–18)	0	(0–0)	10	(5.0–20)	0	(0–0)	100%
Width of transmission kernel									
2 times wider	19	(12–34)	0	(0–0)	14	(4.9–32)	0	(0–0)	100%
4 times wider	29	(14–49)	0	(0–0)	26	(6.9–42)	0	(0–0)	100%