

Estimating the level of disease risk and biosecurity on commercial poultry farms in New Zealand

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Supplementary Table 1. The breakdown of 120 producers in the New Zealand commercial poultry industry, including 33 layer enterprises, 57 broiler enterprises, 24 breeder enterprises and 6 enterprises representing either duck, turkey or pullet operations, and the number of neighbouring commercial poultry farms within a 5km radius of their production premises.

Number of neighbouring farms	Number of farms (% within the sector)			
	Layers ^a (n = 33)	Broilers (n = 57)	Breeders (n = 24)	Other poultry ^b (n = 6)
1	18 (54.5)	6 (10.5)	2 (8.3)	3 (50.0)
2	6 (18.2)	6 (10.5)	8 (33.3)	1 (16.7)
3	4 (12.1)	6 (10.5)	0 (0.0)	0 (0.0)
4	1 (3.3)	7 (12.3)	3 (12.5)	0 (0.0)
5	0 (0.0)	5 (8.8)	2 (8.3)	0 (0.0)
6	1 (3.3)	3 (5.3)	3 (12.5)	0 (0.0)
7	0 (0.0)	2 (3.5)	5 (20.8)	2 (33.3)
≥ 8	3 (9.9)	22 (38.6)	1 (4.2)	0 (0.0)

^a includes mixed pullet and layer enterprises, ^b includes duck, pullet and turkey enterprises

Supplementary Table 2. Water source and treatment on 120 producers in the New Zealand commercial poultry industry, including 33 layer enterprises, 57 broiler enterprises, 24 breeder enterprises and 6 enterprises representing either duck, turkey or pullet operations.

		Number of farms (% within the sector)			
		Layers ^a (n = 33)	Broilers (n = 57)	Breeders (n = 24)	Other poultry ^b (n = 6)
Water source	Town supply	6 (18.2)	10 (17.5)	18 (75.0)	3 (50.0)
	River/ stream/ spring	3 (9.1)	4 (7.0)	0 (0.0)	0 (0.0)
	Bore	16 (48.5)	43 (75.4)	6 (25.0)	3 (50.0)
	Rain/ roof water	8 (24.2)	0 (0.0)	0 (0.0)	0 (0.0)
Treatment	No treatment	16 (48.5)	3 (5.3)	4 (16.7)	5 (83.3)
	Chlorine Dioxide	7 (21.2)	52 (91.2)	9 (37.5)	0 (0.0)
	Ultraviolet	8 (24.2)	0 (0.0)	0 (0.0)	0 (0.0)
	Sodium Hypochlorite	0 (0.0)	2 (3.5)	11 (45.8)	0 (0.0)
	Filtration	2 (6.1)	0 (0.0)	0 (0.0)	0 (0.0)
	Citric acid mix	0 (0.0)	0 (0.0)	0 (0.0)	1 (16.7)

^a includes mixed pullet and layer enterprises, ^b includes duck, pullet and turkey enterprises

Supplementary Table 3. Litter management on 120 producers in the New Zealand commercial poultry industry, including 33 layer enterprises, 57 broiler enterprises, 24 breeder enterprises and 6 enterprises representing either duck, turkey or pullet operations.

		Number of farms (% within the sector)			
		Layers ^a (n = 33)	Broilers (n = 57)	Breeders (n = 24)	Other poultry ^b (n = 6)
Litter type	No litter	15 (45.5)	6 (10.5)	2 (8.3)	2 (33.3)
	Sawdust	5 (15.2)	0 (0.0)	0 (0.0)	0 (0.0)
	Wood shavings	10 (30.3)	51 (89.5)	0 (0.0)	0 (0.0)
	Other	3 (9.09)	0 (0.0)	22 (91.7)	4 (66.7)
Litter shed	Present	10 (30.3)	4 (7.0)	2 (8.3)	4 (66.7)
	Absent	23 (69.7)	53 (93.0)	22 (91.7)	2 (33.3)
Regularity of cleaning sheds	Partially	3 (9.09)	0 (0.0)	0 (0.0)	2 (33.3)
	Fully	23 (69.7)	57 (100)	23 (95.8)	4 (66.7)
	N/A	7 (21.2)	0 (0.0)	1 (4.2)	0 (0.0)
Disinfectant used	None	14 (42.4)	19 (33.3)	3 (12.5)	3 (50.0)
	Techsan	0 (0.0)	4 (7.0)	3 (12.5)	1 (16.7)
	Glutasan	0 (0.0)	4 (7.0)	11 (45.8)	0 (0.0)
	Enviro-san	2 (6.06)	5 (8.8)	0 (0.0)	0 (0.0)
	Virkon	9 (27.3)	8 (14.0)	0 (0.0)	1 (16.7)
	Other	8 (24.2)	17 (29.8)	7 (29.2)	1 (16.7)
Litter moisture	Too dry	2 (6.06)	1 (1.8)	0 (0.0)	0 (0.0)
	About right	24 (72.7)	56 (98.2)	23 (95.8)	6 (100)
	Too wet	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	N/A	7 (21.2)	0 (0.0)	1 (4.2)	0 (0.0)
Litter treatment	No	24 (72.7)	57 (100)	23 (95.8)	6 (100)
	Yes	2 (6.06)	0 (0.0)	0 (0.0)	0 (0.0)
	N/A	7 (21.2)	0 (0.0)	1 (4.2)	0 (0.0)

^a includes mixed pullet and layer enterprises, ^b includes duck, pullet and turkey enterprises

Supplementary Table 4. Reported sightings of wild birds, including six common species and waterfowl, on 120 producers in the New Zealand commercial poultry industry, including 33 layer enterprises, 57 broiler enterprises, 24 breeder enterprises and 6 enterprises representing either duck, turkey or pullet operations.

		Number of farms (% within the sector)			
		Layers ^a (n = 33)	Broilers (n = 57)	Breeders (n = 24)	Other poultry ^b (n = 6)
In the <u>same area</u> as poultry (%)	Wild birds	21 (63.6)	20 (35.1)	1 (4.2)	3 (50.0)
	Waterfowl	3 (9.1)	5 (8.8)	1 (4.2)	0 (0.0)
	Sparrows	21 (63.6)	24 (42.1)	0 (0.0)	3 (50.0)
	Starlings	15 (45.5)	14 (24.6)	0 (0.0)	3 (50.0)
	Sea gulls	4 (12.1)	5 (8.8)	0 (0.0)	0 (0.0)
	Duck	3 (9.1)	7 (12.3)	1 (4.2)	1 (16.7)
	Other	6 (18.2)	8 (14.0)	8 (33.3)	2 (33.3)
On <u>ponds or</u> <u>waterways</u> on the farm (%)	Wild birds	7 (21.2)	14 (24.6)	1 (4.2)	3 (50.0)
	Waterfowl	7 (21.2)	17 (29.8)	6 (25.0)	3 (50.0)
	Sparrows	2 (6.1)	10 (17.5)	0 (0.0)	1 (16.7)
	Starlings	3 (9.1)	7 (12.3)	0 (0.0)	1 (16.7)
	Sea gulls	3 (9.1)	1 (1.8)	0 (0.0)	0 (0.0)
	Duck	7 (21.2)	15 (26.3)	1 (4.2)	1 (16.7)
	Other	1 (3.0)	5 (8.8)	1 (4.2)	1 (16.7)

^{a1} includes mixed pullet and layer enterprises, ^b includes duck, pullet and turkey enterprises

Supplementary Table 5. Equipment shared by 120 producers in the New Zealand commercial poultry industry and the proportion cleaning them upon return.

	Number of study farms sharing equipment (n = 120) (% cleaned)	% of farms that shared but <u>did not</u> clean equipment	Number of study farms <u>not</u> sharing equipment (n = 120) (%)
Vehicles	39 (53.8, 21/39)	46.2 (18/39)	81 (67.5)
Gates	21 (33.3, 7/21)	66.7 (14/21)	99 (82.5)
Lawn equipment	33 (51.5, 17/33)	48.5 (16/33)	87 (72.5)
Sprayers	47 (63.8, 30/47)	36.2 (17/47)	73 (60.8)
Skid steer loaders	53 (67.9, 36/53)	32.1 (17/53)	67 (55.8)
Other equipment	43 (65.1, 28/43)	34.9 (15/43)	77 (64.1)

Supplementary Table 6. Frequency of implementing seven common biosecurity measures amongst 120 producers in the New Zealand commercial poultry industry including 33 layer enterprises, 57 broiler enterprises, 24 breeder enterprises and 6 enterprises representing either duck, turkey or pullet operations.

		Number of farms (%)			
		Layers ^a (n = 33)	Broilers (n = 57)	Breeders (n = 24)	Other poultry ^b (n = 6)
Vehicle disinfection	Never	30 (90.9)	20 (35.1)	4 (16.7)	2 (33.3)
	Rarely	1 (3.0)	5 (8.8)	8 (33.3)	1 (16.7)
	Sometimes	2 (6.1)	10 (17.5)	1 (4.2)	0 (0.0)
	Often	0 (0.0)	8 (14.0)	0 (0.0)	1 (16.7)
	Always	0 (0.0)	14 (24.6)	11 (45.8)	2 (33.3)
Clean coveralls	Never	20 (60.6)	18 (31.6)	1 (4.2)	6 (100)
	Rarely	2 (6.1)	3 (5.3)	0 (0.0)	0 (0.0)
	Sometimes	4 (12.1)	15 (26.3)	1 (4.2)	0 (0.0)
	Often	3 (9.1)	4 (7.0)	0 (0.0)	0 (0.0)
	Always	4 (12.1)	17 (29.8)	22 (91.7)	0 (0.0)
Boot covers	Never	18 (54.5)	1 (1.8)	1 (4.2)	1 (16.7)
	Rarely	1 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Sometimes	3 (9.1)	2 (3.5)	0 (0.0)	0 (0.0)
	Often	2 (6.1)	0 (0.0)	0 (0.0)	3 (50.0)
	Always	9 (27.3)	54 (94.7)	23 (95.8)	2 (33.3)
Footbaths	Never	21 (63.6)	10 (17.5)	0 (0.0)	0 (0.0)
	Rarely	0 (0.0)	2 (3.5)	11 (45.8)	0 (0.0)
	Sometimes	2 (6.1)	4 (7.0)	0 (0.0)	0 (0.0)
	Often	2 (6.1)	2 (3.5)	0 (0.0)	0 (0.0)
	Always	8 (24.2)	39 (68.4)	13 (54.2)	6 (100)
Rodent bait stations	Never	1 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Rarely	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Sometimes	1 (3.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Often	1 (3.0)	2 (3.5)	0 (0.0)	0 (0.0)
	Always	30 (90.9)	55 (96.5)	24 (100)	6 (100)
Bird-proofed housing	Never	7 (21.2)	1 (1.8)	0 (0.0)	0 (0.0)
	Rarely	3 (9.1)	0 (0.0)	0 (0.0)	0 (0.0)
	Sometimes	1 (3.0)	4 (7.0)	0 (0.0)	0 (0.0)
	Often	2 (6.1)	0 (0.0)	0 (0.0)	0 (0.0)
	Always	20 (60.6)	52 (91.2)	24 (100)	6 (100)
Bird-proofed feed store	Never	3 (9.1)	0 (0.0)	1 (4.2)	0 (0.0)
	Rarely	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Sometimes	2 (6.1)	0 (0.0)	0 (0.0)	0 (0.0)
	Often	1 (3.0)	1 (1.8)	0 (0.0)	0 (0.0)
	Always	27 (81.8)	56 (98.2)	23 (95.8)	6 (100)

^a includes mixed pullet and layer enterprises, ^b includes duck, pullet and turkey enterprises

Supplementary Figure 1. Scatter plots showing the relationship between the estimated biosecurity score, calculated from the reported frequency of implementing seven common biosecurity practices, and the estimated disease contact risk score across (a) 57 broiler enterprises, (b) 33 layer enterprises, (c) 24 breeder enterprises and (d) 6 enterprises representing either duck, turkey or pullet operations in the New Zealand commercial poultry industry. The Pearson's correlation coefficient (PCC) and 95% confidence intervals were -0.03 (-0.29, 0.23), -0.02 (-0.11, 0.33), 0.66 (0.34, 0.84), and -0.01 (-0.82, 0.81) for plots (a), (b), (c) and (d) respectively (P -value <0.01).

