**Epidemiological features of influenza circulation in swine populations: a systematic review and meta-analysis**

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S1 Table. Risk factors associated with influenza circulation in studies carried out on or after 1990

References can be found in S1 References. \*Values from univariate analyses (no multivariate analysis done)

F=Farm, S=Slaughterhouse, A=Agricultural fairs; Pos=positively associated, Neg=negatively associated.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Category** | **Detail** | **OR (Estimate)** | **OR 95% CI (Estimate)** | **p-value** | **Subtype** | **Pre-mise** | **Country** | **Refe-rence** |
| **Swine population** | number of other pig herds >2 in the vicinity (2km) | 3.2 | 1.4-7.6 | 0.01 | H1N1 | F | France | 50 |
|  | number of other pig herds >2 in the vicinity (2km) | 3.5 | 1.5-8.1 | <0.01 | H1N2 | F | France | 50 |
|  | number of pig herds in the municipality (increase of one herd/km2) | 1.98 | 1.11-3.55 | 0.022 | H1N1 | F | Belgium | 108 |
|  | number of pig herds in the municipality (increase of one herd/km2) | 1.46 | 1.07-2.01 | 0.019 | H3N2 | F | Belgium | 108 |
|  | reported distance to the nearest barn | (-0.34) | (-0.69,0.02) | 0.02 | H1N1 | F | Canada | 148 |
|  | distance to nearest pig barn (<1 & 1-3km) | 7.32 & 10.18 | 1.49–55.15 & 1.51-204.38 | 0.01\* |  | F | Canada | 149 |
|  | pig farm density (0.1 farms/km2) | 1.41 | 1.00-2.04 | 0.02 |  | F | Canada | 149 |
|  | pig farm density (0.1 farms/km2) (different census data) | 32.46, 317.35 | 3.60-1422.26, 13.87->9999 | <0.01\* |  | F | Canada | 149 |
|  | far location to another farm | 0.06 | 0.02-0.16 | 0.00 | H3N2 | F | Malaysia | 182 |
|  | number of pigs in the municipality (increase of 500 pigs/km2) | 1.35 | - | 0.025 | H3N2 | F | Belgium | 107 |
|  | pig density | (-0.0350) | - | 9.03E-05 | H3N2 | F,S | Cambodia | 124 |
|  | pig density (100 pigs/km2) (different census data) | 1.02, 1.05 | 1.01-1.05, 1.02-1.09 | 0.02, <0.01\* |   | F | Canada | 149 |
|  | number of pigs at a fair (increase 20 pigs) | 1.012 | 1.002-1.026 | 0.012 |  | A | USA | 16 |
|  | number of pigs per pen in the post-weaning room >28 | 3.2 | 1.2-8.6 | 0.02 | H1N1 | F | France | 50 |
|  | number of pigs in the fattening room >110 | 2.5 | 1.1-5.9 | 0.03 | H1N2 | F | France | 50 |
|  | herd size | 1.01 | 1-1.02 | 0.009 | H1N1pdm09 | F | Norway | 58 |
|  | number of fattening pigs per pen (increase of one pig/pen) | 1.2 | 1.03-1.40 | 0.02 | H3N2 | F | Belgium | 108 |
|  | more than 18 finishers per water space | 5.22 | 1.57-17.43 | 0.01 |  | F | UK | 112 |
|  | number of pigs in a barn (100) | (0.10) | (0.01,0.2) | 0.01 | H1N1 | F | Canada | 148 |
|  | number of sows | curvilinear | - | 0.05\* |  | F | Canada | 149 |
|  | increase in number of finisher pigs by 1000 | 4.44 | 1.90-13.07 | <0.01 |  | F | Canada | 149 |
|  | farm size >5000 pigs | 4.97 | 1.74-14.14 | 0 | H1N1 | F | Malaysia | 182 |
|  | farm size >5000 pigs | 9.16 | 3.23-25.98 | 0 | H3N2 | F | Malaysia | 182 |
|  | Government breeding farms vs village backyard farm | pos | - | -\* | H1N1  | F | Bhutan | 118 |
|  | new gilts compared to gilts | 7.9 | 1.4-43.9 | <0.05 |  | F | USA | 46 |
|  | piglets compared to gilts | 4.4 | 1.1-17.1 | <0.05 |  | F | USA | 46 |
|  | piglets compared to gilts | 1.3 | 1.1-1.6 | 0.004 |  | F | USA | 76 |
|  | pigs in multiplier farms vs breed-to-wean farms | 0.7 | 0.5-0.9 | 0.011 |  | F | USA | 76 |
|  | pigs in gilt development units vs breed-to-wean farms | 1.6 | 1.2-2.1 | <0.001 |   | F | USA | 76 |
| **Farm management** | purchase from ≥2 herds | 9.68 | - | 0.023 | H3N2 | F | Belgium | 107 |
|  | no purchase of pigs | 0.33 | 0.16-0.60 | 0.00 | H1N1 | F | Malaysia | 182 |
|  | no purchase of pigs | 0.23 | 0.11-0.44 | 0.00 | H3N2 | F | Malaysia | 182 |
|  | external source of gilts | 4.62 | 1.14-20.91 | 0.03\* |  | F | Canada | 149 |
|  | parity of the sow | pos | - | - |  | F | Canada | 149 |
|  | sow replacement rate | 1.02, 1.04, 1.07 | 1.01-1.04, 1.01-1.07, 1.02-1.12 | 0.007, 0.005, NA |  | F | Spain | 172 |
|  | fattening farm only | 0.35 | 0.17-0.70 | <0.01 |  | F | Vietnam | 186 |
|  | finisher only | 0.11 | 0.01-0.62 | <0.01 |  | F | Canada | 149 |
|  | farm type (farrow-to-finish and nursery compared to finisher) | >1 | - | <0.05 |  | F | USA | 41 |
|  | transfer through a room housing older pigs when moving a batch of pigs from the post-weaning to the fattening room | 3.3 | 1.1-9.6 | 0.03 | H1N1 | F | France | 50 |
|  | housing in gestating crates (weaner prevalence) | neg | - | 0.031\* |  | F | Germany | 114 |
|  | group housing of gestating sows (sow prevalence) | pos | - | 0.025\* |  | F | Germany | 114 |
|  | farrowing and nursery units placed in the same barn (weaner prevalence) | neg | - | 0.019\* |  | F | Germany | 114 |
|  | suckling period ≥28 days (weaner prevalence) | neg | - | 0.011\* |  | F | Germany | 114 |
|  | production system 2 vs 1 | 1.7 | 1.3-2.3 | <0.001 |   | F | USA | 76 |
| **Housing** | floor space ≤0.35m2/pig in the post-weaning pen | 2.9 | 1.2-7.0 | 0.02 | H1N2 | F | France | 50 |
|  | presence of discontinuous partitions between pens in fattening units | 5.31 | 1.59-17.70 | 0.007 |  | F | Spain | 172 |
|  | at least some pigs kept indoors | 3.59 | 1.11-11.57 | 0.03 |  | F | UK | 112 |
|  | fully slatted floor | 9.11 | - | 0.009 | H1N1 | F | Belgium | 107 |
|  | at least some pigs kept in straw yards | 0.3 | 0.11-0.82 | 0.02 |   | F | UK | 112 |
| **Environmental factors** | temperature setpoint of the heating device in the farrowing room ≤25C | 2.6 | 1.1-6.4 | 0.03 | H1N1 | F | France | 50 |
|  | temperature setpoint of the ventilation controller in the post-weaning room ≤24C | 2.6 | 1.1-6.1 | 0.03 | H1N1 | F | France | 50 |
|  | range of temperature values for the ventilation rate control in the fattening room ≤5C | 3.2 | 1.4-7.4 | <0.01 | H1N2 | F | France | 50 |
|  | temperature: 1°C increase | 1.04 | 1.01-1.07 | <0.05 |  | F | USA | 41 |
|  | wind speed: 1km/h increase | 1.24 | 1.08-1.43 | <0.05 |  | F | USA | 41 |
|  | pigs not sampled in Summer (Jul-Sep) | 2.54 | 1.09-5.95 | 0.03 |   | F | UK | 112 |
| **Biosecurity** | duration of the empty period between successive batches in the farrowing facilities <4 days after cleaning and disinfection | 2.6 | 1.1-6.3 | 0.03 | H1N2 | F | France | 50 |
|  | lack of all-in all-out in the fattening room | 2.4 | 1.0-5.8 | 0.04 | H1N2 | F | France | 50 |
|  | uncontrolled access to farm | 2.44, 3.46 | 1.01-5.87, 1.08-11.1 | 0.047, NA |  | F | Spain | 172 |
|  | lack of bird-proof nets | 2.82 | 1.08-7.40 | - |  | F | Spain | 172 |
|  | carcasses disposed by authority | 7.32 | 3.42-15.68 | 0 | H3N2 | F | Malaysia | 182 |
|  | separation of diseased pigs in sick bays | neg | - | 0.025, 0.007\* |  | F | Germany | 65 |
|  | separate pen in the nursery for runting or diseased piglets (sow prevalence) | pos | - | 0.025\* |  | F | Germany | 114 |
|  | housing of runting and diseased weaner pigs in a hospital pen in the farrowing unit (weaner prevalence) | pos | - | 0.007\* |  | F | Germany | 114 |
|  | vaccination against PRRS | neg | - | 0.002\* |  | F | Germany | 65 |
|  | vaccination against PCV2 | neg | - | 0.007\* |  | F | Germany | 65 |
|  | vaccination of sows and piglets against PRRSV (sow prevalence) | neg | - | 0.002, 0.024\* |  | F | Germany | 114 |
|  | vaccination of piglets against PCV2 (weaner prevalence) | neg | - | 0.001\* |  | F | Germany | 114 |
|  | vaccination of gilts against SIV (weaner prevalence) | neg | - | 0.014\* |  | F | Germany | 114 |
|  | vaccination of the entire sow herd against SIV (weaner prevalence) | neg | - | 0.013\* |   | F | Germany | 114 |
| **Human contact** | human ILI in farm staff | 4.15 | 1.5-11.4 | 0.005 | H1N1pdm09 | F | Norway | 58 |
|  | human density | (0.0031) | - | 0.003 | H3N2 | F,S | Cambodia | 124 |
|  | employment of external swine workers | (-1.23) | - | <0.01 |  | F | Vietnam | 186 |
| **Other animal species** | contact rates between free-ranging swine and domestic ducks | pos | - | best predictor | H1N1 pdm09 | F | Cameroon | 93 |
|  | contact rates between free-ranging swine and wild Columbiformes | pos | - | best predictor | H1N1 pdm09 | F | Cameroon | 93 |
|  | contact rates between humans and ducks | pos | - | best predictor | H1N1 pdm09 | F | Cameroon | 93 |
|  | presence of avian species in farm | 4.3 | 2.10-8.75 | 0.00 | H1N1 | F | Malaysia | 182 |
|  | presence of dogs vs cats | 0.22 | 0.06-0.81 | 0.02 | H1N1 | F | Malaysia | 182 |
|  | presence of cats and dogs vs cats | 0.05 | 0.005-0.46 | 0.01 | H1N1 | F | Malaysia | 182 |
|  | no presence of cats or dogs in farm vs cats | 0.03 | 0.01-0.09 | 0.00 | H1N1 | F | Malaysia | 182 |
| **Clinical observation** | outbreak of an influenza-like disease 1–3 weeks before sampling (sow prevalence) | pos | - | 0.014\* |  | F | Germany | 114 |
|  | diseased herds | 1.03 | 1.01-1.05 | -\* |  | F | Germany | 121 |
|  | in-term birth of stillborn and weak born piglets (sow prevalence) | neg | - | 0.019\* |   | F | Germany | 114 |
| **Geography** | Illinois vs Oklahoma | 1.9 | 1.4-2.6 | <0.001 |   | F | USA | 76 |
|  | East-Central & East regions | 0.15 & 0.12 | 0.05-0.46 & 0.03-0.53 | - |   | F | Bhutan | 118 |
| **Other** | presence of breeding show | 21.676 | 2.417-inf. | 0.005 |   | A | USA | 16 |