UK Health Security Agency

Asymptomatic and pre-symptomatic transmission of zoonotic influenza A

A rapid systematic review

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Main messages

1. This rapid systematic review (search up to 6 May 2025) aimed to identify and summarise evidence relating to asymptomatic and presymptomatic transmission of zoonotic influenza A (influenza that originates in animals and causes infections in humans). This review focussed on the following zoonotic influenza A subtypes: H7N9, H9N2, H5N5, H5N2, H5N6, H5N8, H10N3, H10N5 and H3N8.

2. In total, 1,168 records from 5 databases were screened; however, no relevant studies were identified for inclusion in this review.

3. In summary, no published observational studies (case control or cohort studies), case series or case reports were identified that reported evidence of asymptomatic or presymptomatic transmission of zoonotic influenza A in humans. As there have not been any human outbreaks of the zoonotic influenza A subtypes covered in the review, this is not unexpected. An update of this evidence review will be needed if any human outbreaks occur in future to determine whether asymptomatic or presymptomatic transmission occurs.

Purpose

The purpose of this rapid systematic review was to identify and summarise the available evidence that explored asymptomatic and presymptomatic transmission of zoonotic influenza A in humans.

The review question was:

1. What is the evidence for asymptomatic and pre-symptomatic transmission of zoonotic influenza A in humans?

Methods

A rapid systematic review was conducted, following streamlined systematic methods to accelerate the review process. A literature search was undertaken to look for relevant observational studies (case control and cohort studies), case series and case reports, published or available as preprint, up to 6 May 2025.

This review included any evidence of asymptomatic or pre-symptomatic transmission in humans, in any setting. Exposures of interest were any of the following influenza A subtypes: H7N9, H9N2, H5N5, H5N2, H5N6, H5N8, H10N3, H10N5 and H3N8, with laboratory confirmation by polymerase chain reaction test. These subtypes were included based on the

rationale that they are the most common strains to infect humans. Swine influenza was excluded because it is highly complex and different to other zoonotic influenza strains due to the potential for mixing of human influenza and swine influenza genetic material. Relevant outcomes included both direct measures of transmission such as secondary attack rate or confirmed secondary cases and indirect measures of transmission such as viral positivity and viral load.

A protocol was produced before the literature search was conducted, including the review question, the eligibility criteria, and all other methods. Full details of the methodology are provided in the protocol in Annexe A. There were no deviations from the protocol.

Screening on title and abstract was undertaken in duplicate by 2 reviewers for 20% of the eligible studies, with the remainder completed by one reviewer. Screening on full text was undertaken by one reviewer and checked by a second. The reference lists of relevant reviews were checked to identify any additional primary studies.

Evidence

In total, 1,168 studies were screened at title and abstract and 40 studies were screened at full text. Of these, no studies met the inclusion criteria. A PRISMA diagram showing the flow of studies through the review is shown in Annexe B, and studies excluded on full text screening are available with the reasons why in Annexe C. The main reasons for excluding records at full text were no relevant outcomes reported by the study (n=29) and wrong exposure (n=5). Backwards and forwards citation searching of primary studies was not conducted, as no studies were included at full text screening stage.

Health inequalities

Groups more likely to experience health inequalities, such as those who may be at high risk from zoonotic influenza A including individuals on low income, migrant workers, rural farm workers, and those with immunosuppression were explicitly defined within the inclusion criteria in the review protocol. However, no studies were identified for inclusion in this review and therefore health inequalities could not be assessed.

Limitations

This rapid systematic review used streamlined systematic methods to accelerate the review process. Sources of evidence searched included databases of peer-reviewed and preprint research, but an extensive search of other sources was not conducted and most article screening was completed without duplication, so it is possible relevant evidence may have been

missed. The rapid systematic review approach was discussed and agreed with the subject matter experts at the outset.

Evidence gaps

No studies were identified for inclusion in this review highlighting an evidence gap relating to the asymptomatic or presymptomatic transmission of zoonotic influenza A in humans.

Conclusion

The aim of this review was to identify and assess available evidence relating to asymptomatic and presymptomatic transmission of Influenza A in humans. However, no relevant evidence (from observational studies, case series or case reports) was identified and therefore this review is unable to inform on the occurrence of such transmission in humans. As there have not been any human outbreaks of the zoonotic influenza A subtypes covered in the review, this is not unexpected. An update of this evidence review will be needed if any human outbreaks occur in future to determine whether asymptomatic or presymptomatic transmission occurs.

Acknowledgments

We would like to thank colleagues within the All Hazards Public Health Response division who either reviewed or input into aspects of the review.

Disclaimer

The UK Health Security Agency (UKHSA)'s rapid systematic reviews and evidence summaries aim to provide the best available evidence to decision makers in a timely and accessible way, based on published peer-reviewed scientific papers, and papers on preprint servers. Please note that the reviews:

- use accelerated methods and may not be representative of the whole body of evidence publicly available
- have undergone an internal independent peer review but not an external peer review
- are only valid as of the date stated on the review

In the event that this review is shared externally, please note additionally, to the greatest extent possible under any applicable law, that UKHSA accepts no liability for any claim, loss or damage arising out of, or connected with the use of, this review by the recipient or any third party including that arising or resulting from any reliance placed on, or any conclusions drawn from, the review.

References

1. JBI. 'JBI Critical appraisal tools' 2020
2. The Grade Working Group. 'GRADE handbook for grading quality of evidence and strength of recommendations' 2013

Annexe A. Protocol

Review question

The review question is:

1. What is the evidence for asymptomatic and pre-symptomatic transmission of zoonotic influenza in humans?

A search for primary evidence to answer this review question will be conducted up to 6 May 2025.

Eligibility criteria

Table A.1 Inclusion and exclusion criteria

	Included	Excluded
Population	All humans	Animals
Settings	All settings	
Intervention or exposure	Laboratory-confirmed (with the polymerase chain reaction test) zoonotic influenza A. Only the following subtypes will be included: • H7N9 • H9N2 • H5N5 • H5N2 • H5N6 • H5N8 • H10N3 • H10N5 • H3N8	Any other zoonotic influenza subtypes Studies in which the subtype is not stated or confirmed with the polymerase chain reaction test
Outcomes	• direct measure of transmission, for example secondary attack rate or confirmed secondary cases • indirect measures of transmission: -viral positivity -viral load	Animal-to-human transmission
Language	English	Any other language

	Included	Excluded
Date of publication	Database inception up to 6 May 2025	Published after 6 May 2025
Study design	Observational studies: case-control and cohort studies Case series and case reports	Experimental studies (randomised-controlled trials, quasi-experimental studies, cross-over designs, before-and-after studies) Systematic or narrative reviews Modelling studies Cross-sectional studies
Publication type	Peer-reviewed published research Preprints	Editorials Letters News articles Grey literature Conference abstracts

Identification of studies

The following databases will be searched for studies published up to 6 May 2025: Ovid Medline, Ovid Embase, Ovid Global Health, WHO Index Medicus and Web of Science Preprint Citation Index (1990 to current). The search strategy is presented below. Studies that are included following full text screening will be used as seed papers for backwards and forwards citation searching using Lens.org via CitationChaser.

Screening

Title and abstract screening will be undertaken in duplicate by 2 reviewers for at least 20% of the eligible studies, with the remainder completed by one reviewer. Disagreement was resolved by discussion or with involvement of a third reviewer where necessary. Screening on full text will be undertaken by one reviewer and checked by a second. Results of citation searching will be screened by a single reviewer.

Data extraction

Summary information for each study will be extracted and reported in tabular form. Information to be extracted will include country, study period, study design, participants, results, and any relevant contextual data. This will be undertaken by one reviewer and checked by a second.

Risk of bias assessment

We will perform a risk of bias assessment at the primary study level using the relevant JBI checklist (1). Risk of bias will be assessed by 2 reviewers independently with disagreements resolved through discussion or with a third reviewer.

Quality of evidence

The quality of evidence identified within this review will be assessed, if available evidence allowed, using a modified version of the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) framework (2). Quality of evidence was assessed at the outcome level, and be rated as one of 4 levels:

- very low (the true effect is probably different from the estimated effect)
- low (the true effect might be different from the estimated effect)
- moderate (the true effect is probably close to the estimated effect)
- high (the authors are confident that the true effect is similar to the estimated effect)

The quality of evidence will be assessed for each outcome across 4 domains:

1. Risk of bias: where results may not represent the true effect because of limitations in the design or conduct of the study. This will be measures as described under: Risk of bias assessment.
2. Inconsistency: where studies show different effects for the same outcome of interest. This will be assessed where there are 2 or more studies measuring the same outcome. Inconsistency will be rated down if the point estimates are not similar, or the confidence intervals do not overlap. If there is only one study for the outcome of interest, then inconsistency will not be assessed. Inconsistency will be assessed by one reviewer and checked by a second.
3. Indirectness: where elements of the study differ from the intended elements in the review question (for example, the outcome of interest has not been directly measured). This will be rated down if the population, intervention, comparator, or outcome of interest have not been directly measured. Indirectness will be assessed by one reviewer and checked by a second.
4. Imprecision: a measure of how uncertain the estimate is. Imprecision will be rated down if the confidence intervals cross the line of no effect, or if the reviewer judges that the confidence intervals are overly wide and so the true effect is likely to be different at the upper versus the lower end of the confidence interval. Imprecision will be assessed by one reviewer and checked by a second.

If the studies only report count data without a measure of variance, a full GRADE assessment will not be possible.

Synthesis

Where studies are similar enough to combine and present data in a consistent format, a narrative synthesis will be produced to interpret the findings. The number of studies, the number of participants in each study, effect size and variance and a summary of study limitations across studies reporting each outcome will be summarised and presented. Alternatively, if studies present methodological differences that would make synthesis inappropriate, a narrative summary of each study will be provided.

Health inequalities

Variations across the following populations and subgroups will be considered, where evidence is available: those who may be at high risk from influenza A including individuals on low income, migrant workers, and rural farm workers, and those with immunosuppression. Differences in outcomes by age will also be assessed if the data are available.

Search strategy

Ovid MEDLINE(R) ALL (1946 to 5 May 2025)

1. Influenza in Birds/ and (Influenza A virus/ or Influenza, Human/) (5,411)
2. Influenza A Virus, H7N9 Subtype/ (1,587)
3. h7n9*.tw,kf. (2,277)
4. ah7n9*.tw,kf. (0)
5. ((flu or influenza) adj5 H7*).tw,kf. (2,637)
6. (H7* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (1,725)
7. Influenza A Virus, H9N2 Subtype/ (1,520)
8. h9n2*.tw,kf. (2,117)
9. ah9n2*.tw,kf. (1)
10. ((flu or influenza) adj5 H9*).tw,kf. (1,671)
11. (H9* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (1,340)
12. h10n3*.tw,kf. (44)
13. ah10n3*.tw,kf. (0)
14. ((flu or influenza) adj5 H10*).tw,kf. (170)
15. (H10* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (127)
16. h10n5*.tw,kf. (17)
17. ah10n5*.tw,kf. (0)
18. Influenza A Virus, H3N8 Subtype/ (562)
19. h3n8*.tw,kf. (643)
20. ah3n8*.tw,kf. (0)
21. ((flu or influenza) adj5 H3*).tw,kf. (5,790)
22. (H3* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (411)
23. h5n5*.tw,kf. (66)

24. ah5n5*.tw,kf. (0)
25. Influenza A Virus, H5N2 Subtype/ (474)
26. h5n2*.tw,kf. (749)
27. ah5n2*.tw,kf. (0)
28. Influenza A Virus, H5N6 Subtype/ (8)
29. h5n6*.tw,kf. (488)
30. ah5n6*.tw,kf. (0)
31. Influenza A Virus, H5N8 Subtype/ (327)
32. h5n8*.tw,kf. (635)
33. ah5n8*.tw,kf. (0)
34. ((flu or influenza) adj5 H5*).tw,kf. (7,605)
35. (H5* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (5,574)
36. or/1-35 (20,911)
37. transmission.tw,kf. (511,011)
38. transmit*.tw,kf. (217,188)
39. transmission.fs. (165,508)
40. (breakthrough* or break through*).tw,kf. (46,777)
41. ((viral or virus*) adj load*).tw,kf. (48,132)
42. ((viral or virus*) adj burden*).tw,kf. (1,600)
43. ((viral or virus*) adj level*).tw,kf. (1,037)
44. ((viral* or virus*) adj6 shed*).tw,kf. (9,103)
45. ((viral* or virus*) adj6 titer*).tw,kf. (16,592)
46. ((viral* or virus*) adj6 titre*).tw,kf. (3,725)
47. cytopath* effect*.tw,kf. (9,296)
48. cytopathogenicity.tw,kf. (715)
49. exp Disease Transmission, Infectious/ (85,144)
50. Cytopathogenic Effect, Viral/ (9,631)
51. Virus Shedding/ (4,466)
52. Viral Load/ (41,273)
53. Seroepidemiologic Studies/ (26,978)
54. (seroprevalen* or sero-prevalen*).tw,kf. (27,348)
55. (seroepidemiolog* or sero-epidemiolog*).tw,kf. (6,612)
56. (serum adj3 prevalen*).tw,kf. (1,782)
57. serological prevalen*.tw,kf. (378)
58. ((anti-bod* or antibod*) adj3 prevalen*).tw,kf. (9,078)
59. ((anti-bod* or antibod*) adj3 (titer* or titre*)).tw,kf. (50,736)
60. (secondary adj1 (case* or attack*)).tw,kf. (3,659)
61. (R0 or (reproduct* adj (ratio* or rate* or number*))).tw,kf. (25,750)
62. or/37-61 (1,031,187)
63. asymptomatic*.tw,kf. (207,066)
64. symptomatic*.tw,kf. (246,170)
65. (pre-symptomatic* or presymptomatic*).tw,kf. (7,576)
66. (non-symptomatic* or nonsymptomatic*).tw,kf. (1,770)
67. (symptom* adj2 free).tw,kf. (13,067)

68. no symptom*.tw,kf. (12,862)
69. with* symptom*.tw,kf. (91,639)
70. symptomless.tw,kf. (3,318)
71. symptom* status.tw,kf. (1,825)
72. pauci-symptomatic*.tw,kf. (220)
73. (sub-clinical* or subclinical*).tw,kf. (60,087)
74. (mild* adj2 (symptom* or disease* or illness* or infection*)).tw,kf. (33,493)
75. exp Asymptomatic Diseases/ (10,663)
76. or/63-75 (572,860)
77. 62 and 76 (36,193)
78. 36 and 77 (335)
79. transmission.ti. (86,010)
80. asymptomatic.ti. (30,710)
81. 79 or 80 (116,385)
82. 36 and 81 (643)
83. 78 or 82 (934)
84. limit 83 to (comment or editorial or letter or news or newspaper article) (28)
85. 83 not 84 (906)

Embase (1974 to 5 May 2025)

1. (avian influenza/ or highly pathogenic avian influenza/ or low pathogenic avian influenza/ or avian influenza virus/) and (Influenzavirus A/ or Influenza A virus/) (2,254)
2. "Influenza A virus (H7N9)"/ (2,251)
3. h7n9*.tw,kf. (2,490)
4. ah7n9*.tw,kf. (1)
5. ((flu or influenza) adj5 H7*).tw,kf. (2,852)
6. (H7* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (1,851)
7. "Influenza A virus (H9N2)"/ (2,344)
8. h9n2*.tw,kf. (2,226)
9. ah9n2*.tw,kf. (0)
10. ((flu or influenza) adj5 H9*).tw,kf. (1,777)
11. (H9* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (1,418)
12. h10n3*.tw,kf. (40)
13. ah10n3*.tw,kf. (0)
14. ((flu or influenza) adj5 H10*).tw,kf. (174)
15. (H10* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (120)
16. h10n5*.tw,kf. (13)
17. ah10n5*.tw,kf. (0)
18. "Influenza A virus (H3N8)"/ (717)
19. h3n8*.tw,kf. (693)
20. ah3n8*.tw,kf. (0)
21. ((flu or influenza) adj5 H3*).tw,kf. (6,782)
22. (H3* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (427)

23. h5n5*.tw,kf. (60)
24. ah5n5*.tw,kf. (0)
25. "Influenza A virus (H5N2)"/ (815)
26. h5n2*.tw,kf. (759)
27. ah5n2*.tw,kf. (0)
28. "Influenza A virus (H5N6)"/ (145)
29. h5n6*.tw,kf. (474)
30. ah5n6*.tw,kf. (0)
31. "Influenza A virus (H5N8)"/ (530)
32. h5n8*.tw,kf. (649)
33. ah5n8*.tw,kf. (0)
34. ((flu or influenza) adj5 H5*).tw,kf. (8,386)
35. (H5* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw,kf. (5,994)
36. or/1-35 (22,397)
37. transmission.tw,kf. (564,094)
38. transmit*.tw,kf. (251,295)
39. (breakthrough* or break through*).tw,kf. (61,187)
40. ((viral or virus*) adj load*).tw,kf. (73,372)
41. ((viral or virus*) adj burden*).tw,kf. (2,019)
42. ((viral or virus*) adj level*).tw,kf. (1,295)
43. ((viral* or virus*) adj6 shed*).tw,kf. (10,151)
44. ((viral* or virus*) adj6 titer*).tw,kf. (19,841)
45. ((viral* or virus*) adj6 titre*).tw,kf. (4,112)
46. cytopath* effect*.tw,kf. (10,147)
47. cytopathogenicity.tw,kf. (667)
48. disease transmission/ (118,871)
49. cytopathogenic effect/ (12,466)
50. virus shedding/ (11,609)
51. virus load/ (121,443)
52. seroprevalence/ (34,273)
53. seroepidemiology/ (5,837)
54. (seroprevalen* or sero-prevalen*).tw,kf. (32,989)
55. (seroepidemiolog* or sero-epidemiolog*).tw,kf. (7,551)
56. (serum adj3 prevalen*).tw,kf. (2,402)
57. serological prevalen*.tw,kf. (449)
58. ((anti-bod* or antibod*) adj3 prevalen*).tw,kf. (10,996)
59. ((anti-bod* or antibod*) adj3 (titer* or titre*)).tw,kf. (63,961)
60. (secondary adj1 (case* or attack*)).tw,kf. (4,731)
61. (R0 or (reproduct* adj (ratio* or rate* or number*))).tw,kf. (41,557)
62. or/37-61 (1,174,762)
63. asymptomatic*.tw,kf. (302,824)
64. symptomatic*.tw,kf. (378,965)
65. (pre-symptomatic* or presymptomatic*).tw,kf. (11,044)
66. (non-symptomatic* or nonsymptomatic*).tw,kf. (2,508)

67. (symptom* adj2 free).tw,kf. (18,157)
68. no symptom*.tw,kf. (19,394)
69. with* symptom*.tw,kf. (140,544)
70. symptomless.tw,kf. (2,959)
71. symptom* status.tw,kf. (2,842)
72. pauci-symptomatic*.tw,kf. (299)
73. (sub-clinical* or subclinical*).tw,kf. (90,972)
74. (mild* adj2 (symptom* or disease* or illness* or infection*)).tw,kf. (49,908)
75. exp asymptomatic disease/ (35,919)
76. or/63-75 (864,934)
77. 62 and 76 (48,221)
78. 36 and 77 (354)
79. transmission.ti. (87,707)
80. asymptomatic.ti. (40,060)
81. 79 or 80 (127,390)
82. 36 and 81 (618)
83. 78 or 82 (929)
84. limit 83 to (conference abstract or conference paper or "conference review" or editorial or letter) (66)
85. 83 not 84 (863)

Global Health (1910 to 2025 Week 18)

1. (avian influenza/ or avian influenza a viruses/) and influenza a/ (2,762)
2. h7n9*.tw. (2,486)
3. ah7n9*.tw. (4)
4. ((flu or influenza) adj5 H7*).tw. (2,805)
5. (H7* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw. (1,797)
6. h9n2*.tw. (1,563)
7. ah9n2*.tw. (2)
8. ((flu or influenza) adj5 H9*).tw. (1,358)
9. (H9* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw. (1,007)
10. h10n3*.tw. (30)
11. ah10n3*.tw. (0)
12. ((flu or influenza) adj5 H10*).tw. (166)
13. (H10* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw. (131)
14. h10n5*.tw. (10)
15. ah10n5*.tw. (0)
16. h3n8*.tw. (275)
17. ah3n8*.tw. (0)
18. ((flu or influenza) adj5 H3*).tw. (6,182)
19. (H3* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw. (277)
20. h5n5*.tw. (36)
21. ah5n5*.tw. (0)

22. h5n2*.tw. (370)
23. ah5n2*.tw. (0)
24. h5n6*.tw. (448)
25. h5n8*.tw. (436)
26. ah5n8*.tw. (0)
27. ((flu or influenza) adj5 H5*).tw. (6,557)
28. (H5* adj3 (bird* or avian or chicken* or duck* or fowl or poultry)).tw. (4,484)
29. or/1-28 (16477)
30. transmission.tw. (305,788)
31. transmit*.tw. (133,605)
32. exp disease transmission/ (279,137)
33. (breakthrough* or break through*).tw. (7,563)
34. viral load/ (27,070)
35. ((viral or virus*) adj load*).tw. (41,353)
36. ((viral or virus*) adj burden).tw. (795)
37. ((viral or virus*) adj level*).tw. (536)
38. ((viral* or virus*) adj6 shed*).tw. (4,668)
39. ((viral or virus*) adj titer*).tw. (2,621)
40. ((viral or virus*) adj titre*).tw. (1,819)
41. cytopath* effect*.tw. (4,756)
42. cytopathogenicity/ (4,144)
43. cytopathogenicity.tw. (4,267)
44. seroprevalence/ (38,661)
45. serological surveys/ (27,544)
46. (seroprevalen* or sero-prevalen*).tw. (43,740)
47. (seroepidemiolog* or sero-epidemiolog*).tw. (30,598)
48. (serum adj3 prevalen*).tw. (1,078)
49. serological prevalen*.tw. (422)
50. ((anti-bod* or antibod*) adj3 prevalen*).tw. (7,195)
51. ((anti-bod* or antibod*) adj3 (titer* or titre*)).tw. (29,531)
52. (secondary adj1 (case* or attack*)).tw. (2,820)
53. (R0 or (reproduct* adj (ratio* or rate* or number*))).tw. (6,452)
54. or/30-53 (617,760)
55. asymptomatic*.tw. (52,245)
56. symptomatic*.tw. (36,390)
57. (presymptomatic* or pre-symptomatic*).tw. (979)
58. (non-symptomatic* or nonsymptomatic*).tw. (340)
59. (symptom* adj2 free).tw. (1,996)
60. no symptom*.tw. (3,792)
61. with* symptom*.tw. (15,094)
62. symptomless.tw. (1,543)
63. symptom* status.tw. (295)
64. pauci-symptomatic*.tw. (79)
65. (sub-clinical* or subclinical*).tw. (15,026)

66. (mild* adj2 (symptom* or disease* or illness* or infection*)).tw. (11,661)
67. exp asymptomatic infections/ (19,169)
68. or/55-67 (123,184)
69. 54 and 68 (31,373)
70. 29 and 69 (329)
71. transmission.ti. (44,515)
72. asymptomatic.ti. (7,975)
73. 71 or 72 (52,193)
74. 29 and 73 (493)
75. 70 or 74 (783)
76. limit 75 to (conference or conference paper or conference proceedings or conference slides or editorial) (15)
77. 75 not 76 (768)

Web of Science Preprint Citation Index

Date of search: 6 May 2025

#1: TS=(h7n9*) OR TS=(ah7n9*) OR TS=(((flu or influenza) NEAR/4 (H7 OR H7N*))) OR TS=(((H7 OR H7N*) NEAR/2 (bird* or avian or chicken* or duck* or fowl or poultry))) OR TS=(h9n2*) OR TS=(ah9n2*) OR TS=(((flu or influenza) NEAR/4 (H9 OR H9N*))) OR TS=(((H9 OR H9N*) NEAR/2 (bird* or avian or chicken* or duck* or fowl or poultry))) OR TS=(h10n3*) OR TS=(ah10n3*) OR TS=(((flu or influenza) NEAR/4 H10*)) OR TS=((H10* NEAR/2 (bird* or avian or chicken* or duck* or fowl or poultry))) OR TS=(h10n5*) OR TS=(ah10n5*) OR TS=(h3n8*) OR TS=(ah3n8*) OR TS=(((flu or influenza) NEAR/4 (H3N* OR H3))) OR TS=(((H3 OR H3N*) NEAR/2 (bird* or avian or chicken* or duck* or fowl or poultry))) OR TS=(h5n5*) OR TS=(ah5n5*) OR TS=(h5n2*) OR TS=(ah5n2*) OR TS=(h5n6*) OR TS=(ah5n6*) OR TS=(h5n8*) OR TS=(ah5n8*) OR TS=(((flu or influenza) NEAR/4 (H5 OR H5N*))) OR TS=(((H5 OR H5N*) NEAR/2 (bird* or avian or chicken* or duck* or fowl or poultry)))

AND

#2: TS=(transmission) OR TS=(transmit*) OR TS=((breakthrough* or "break through*")) OR TS=(((viral or virus*) NEAR/0 load*)) OR TS=(((viral or virus*) NEAR/0 burden*)) OR TS=(((viral or virus*) NEAR/0 level*)) OR TS=(((viral* or virus*) NEAR/5 shed*)) OR TS=(((viral* or virus*) NEAR/5 titer*)) OR TS=(((viral* or virus*) NEAR/5 titre*)) OR TS=("cytopath* effect*") OR TS=(cytopathogenicity) OR TS=(seroprevalen* or “sero-prevalen*” OR seroepidemiolog* OR “sero-epidemiolog*”) OR TS=(serum NEAR/3 prevalen*) OR TS=(“serological prevalence”) OR TS=((“anti-bod*” OR antibod*) NEAR/3 prevalen*) OR TS=((“anti-bod*” OR antibod*) NEAR/3 (titer* OR titre*)) OR TS=(secondary NEAR/1 (case* OR attack*”)) OR TS=(R0 OR (reproduct* NEAR/1 (ratio* OR rate* OR number*)))

AND

#3: TS=(asymptomatic*) OR TS=(symptomatic*) OR TS=((pre-symptomatic* or presymptomatic*)) OR TS=((non-symptomatic* or nonsymptomatic*)) OR TS=((symptom* NEAR/2 free")) OR TS=("no symptom*) OR TS=("with* symptom*) OR TS=(symptomless) OR TS=("symptom* status") OR TS=(pauci-symptomatic*) OR TS=((sub-clinical* or subclinical*)) OR TS=((mild* NEAR/1 (symptom* or disease* or illness* or infection*)))

#4: #1 AND #2 AND #3

#5: TI=(transmission) OR TI=(asymptomatic)

#6: #1 AND #5

#7: #4 OR #6

25 results

Global Index Medicus

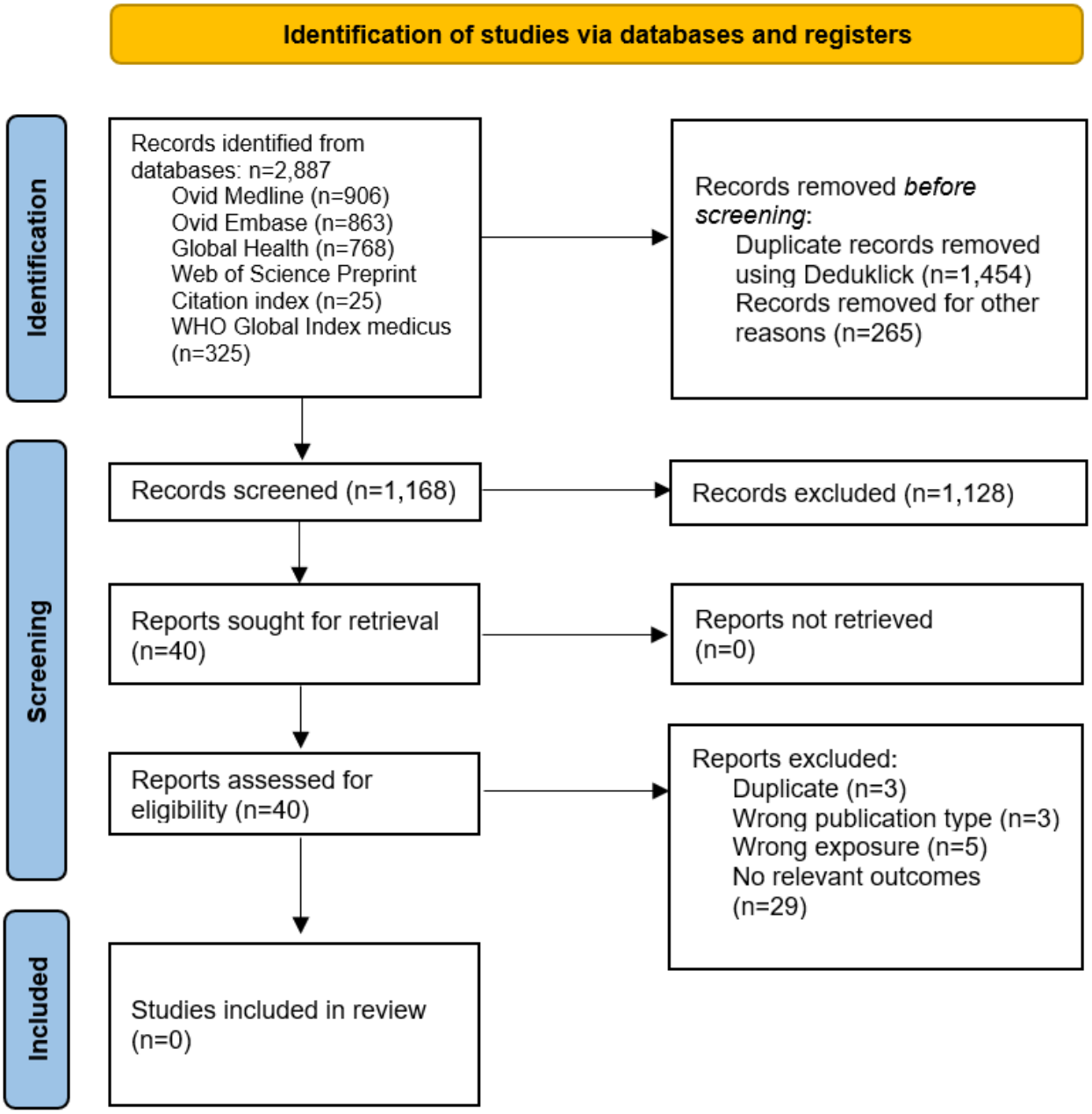
Date of search: 6 May 2025

(h7n9 OR ah7n9 OR h9n2 OR ah9n2 OR h10n3 OR ah10n3 OR h10n5 OR ah10n5 OR h3n8 OR ah3n8 OR h5n5 OR ah5n5 OR h5n2 OR ah5n2 OR h5n6 OR ah5n6 OR h5n8 OR ah5n8) AND (transmission OR "viral load" OR "viral burden" OR “viral level” OR “viral shedding” OR “virus shedding” OR cytopathogenic OR cytopathic OR asymptomatic OR symptomatic OR “pre symptomatic” OR presymptomatic OR “non symptomatic” OR nonsymptomatic OR “symptom free” OR “no symptoms” OR “without symptoms” OR symptomless OR “symptom status” OR “pauci symptomatic” OR “sub clinical” OR subclinical OR “mild symptoms” OR “mild disease” OR “mild illness” OR “mild infection” OR seroprevalence OR seroepidemiology)

325 results

Annexe B. Study selection flowchart

Figure B.1. PRISMA diagram



Text version of Figure B.1. PRISMA diagram

This PRISMA diagram shows the flow of studies through this review, ultimately including 0 studies.

From identification of studies via databases and registers, n=2,887 records identified from databases:

- Ovid Medline (n=906)
- Ovid Embase (n=863)
- Global Health (n=768)
- Web of Science Preprint Citation Index (n=25)
- WHO Global Index Medicus (n=325)

From these, records removed before screening:

- duplicate records removed using Deduklick (n=1,454)
- records removed for other reasons (n=265)
- duplicate records removed manually (n=0)

n=1,168 records screened, of which n=1,128 were excluded, leaving n=40 papers sought for retrieval, of which n=0 were not retrieved

No studies were identified from identification of studies via other methods: n=0 studies were identified from expert consultation.

Of the n=40 papers assessed for eligibility, n=40 reports were excluded:

- duplicate (n=3)
- wrong publication type (n=3)
- wrong exposure (n=5)
- no relevant outcomes (n=29)

n=0 papers included in the review

Annexe C. Excluded full texts

Duplicate (3 studies)

Ding H and others. 'A family cluster of three confirmed cases infected with avian influenza A (H7N9) virus in Zhejiang Province of China' BMC Infectious Diseases 2014: volume 14, page 698

Fang CF and others. 'Nosocomial transmission of avian influenza A (H7N9) virus in China: epidemiological investigation' The BMJ 2015: volume 351

Qi X and others. 'Probable person to person transmission of novel avian influenza A (H7N9) virus in Eastern China, 2013: epidemiological investigation' The BMJ 2013: volume 347

Wrong publication type (3 studies)

Wang Y and others. 'Seroprevalence of Avian Influenza A(H5N6) Virus Infection, Guangdong Province, China, 2022' Emerging Infectious Diseases 2024: volume 30, pages 826 to 828

Xu W and others. 'Serological investigation of subclinical influenza A(H7H9) infection among healthcare and non-healthcare workers in Zhejiang Province, China' Clinical Infectious Diseases 2013: volume 57, issue 6, pages 919 to 921

Yin X and others. 'Antibodies against influenza A (H7N9) virus among veterinarians in China before 2013' Influenza and other Respiratory Viruses 2015: volume 9, issue 1, pages 38 to 39

Wrong exposure (5 studies)

Chen H and others. 'Nosocomial Co-Transmission of Avian Influenza A(H7N9) and A(H1N1)pdm09 Viruses between 2 Patients with Hematologic Disorders' Emerging Infectious Diseases 2016: volume 22, issue 4, pages 598 to 607

Kleynhans J and others. 'Outbreak of influenza A in a boarding school in South Africa, 2016' The Pan African Medical Journal 2019: volume 33, page 42

Wang B and others. 'Predictors of influenza A molecular viral shedding in Hutterite communities' Influenza and other Respiratory Viruses 2017: volume 11, issue 3, pages 254 to 262

Yang S and others. 'Avian-origin influenza A(H7N9) infection in influenza A(H7N9)-affected areas of China: a serological study' Journal of Infectious Diseases 2014: volume 209, issue 2, pages 265 to 269

Zhou L and others. 'Clusters of Human Infection and Human-to-Human Transmission of Avian Influenza A(H7N9) Virus, 2013-2017' Emerging Infectious Diseases 2018: volume 24, issue 2, page 2

No relevant outcomes (29 studies)

Bi Y and others. 'A new reassortment of influenza A (H7N9) virus causing human infection in Beijing, 2014' Scientific Reports 2016: volume 6, article number 26,624

Chen Z and others. 'Asymptomatic, mild, and severe influenza A(H7N9) virus infection in humans, Guangzhou, China' Emerging Infectious Diseases 2014: volume 20, issue 9, pages 1,535 to 1,540

Chen Z and others. 'Detection of avian influenza A(H7N9) virus from live poultry markets in Guangzhou, China: a surveillance report' PLoS ONE [Electronic Resource] 2014: volume 9, issue 9, e107266

Cheng V and others. 'Infection of immunocompromised patients by avian H9N2 influenza A virus' Journal of Infection 2011: volume 62, issue 5, pages 394 to 399

Ding H and others. 'A family cluster of three confirmed cases infected with avian influenza A (H7N9) virus in Zhejiang Province of China' BMC Infectious Diseases 2014: volume 14, issue 698

Fang CF and others. 'Nosocomial transmission of avian influenza A (H7N9) virus in China: epidemiological investigation' BMJ 2015: volume 351, h5765

Feng L and others. 'Clinical severity of human infections with avian influenza A(H7N9) virus, China, 2013/14' European Communicable Disease Bulletin 2014: volume 19, issue 49, page 11

Ge E and others. 'Estimating Risks of Inapparent Avian Exposure for Human Infection: Avian Influenza Virus A (H7N9) in Zhejiang Province, China' Scientific Reports 2017: volume 7, article number 40016

Guinat C and others. 'Bayesian phylodynamics reveals the transmission dynamics of avian influenza A(H7N9) virus at the human-live bird market interface in China' Proceedings of the National Academy of Sciences of the United States of America 2023: volume 120, issue 17, e2215610120

Hassan MZ and others. 'Interpretation of molecular detection of avian influenza A virus in respiratory specimens collected from live bird market workers in Dhaka, Bangladesh: infection or contamination?' International Journal of Infectious Diseases 2023: volume 136, pages 22 to 28

Hu J and others. 'Limited human-to-human transmission of avian influenza A(H7N9) virus, Shanghai, China, March to April 2013' European Communicable Disease Bulletin 2014: volume 19, issue 25, page 26

Krueger WS and others. 'Prospective study of avian influenza virus infections among rural Thai villagers' PLoS ONE [Electronic Resource] 2013: volume 8, issue 8, e72196

Kucharski AJ and others. 'Transmission Potential of Influenza A(H7N9) Virus, China, 2013-2014' Emerging Infectious Diseases 2015: volume 21, issue 5, pages 852 to 855

Mubareka S and others. 'Influenza virus emitted by naturally-infected hosts in a healthcare setting' Journal of Clinical Virology 2015: volume 73, pages 105 to 107

Mulatti P and others. 'Integration of genetic and epidemiological data to infer H5N8 HPAI virus transmission dynamics during the 2016-2017 epidemic in Italy' Scientific Reports 2018: volume 8, issue 1, article number 18037

Qi X and others. 'Probable person to person transmission of novel avian influenza A (H7N9) virus in Eastern China, 2013: epidemiological investigation' BMJ 2013: volume 347, f4752

Shi C and others. 'Person-to-Person Transmission of Avian Influenza A (H7N9) Among Family Members in Eastern China, 2016' Disaster Medicine and Public Health Preparedness 2021: volume 15, issue 2, pages 164 to 169

Song R and others. 'Surveillance of the first case of human avian influenza A (H7N9) virus in Beijing, China' Infection 2014: volume 42, issue 1, pages 127 to 133

Virlogeux V and others. 'Evaluation of animal-to-human and human-to-human transmission of influenza A (H7N9) virus in China, 2013-15' Scientific Reports 2018: volume 8, issue 1, page 552

Wang X and others. 'Seroprevalence to avian influenza A(H7N9) virus among poultry workers and the general population in southern China: a longitudinal study' Clinical Infectious Diseases 2014: volume 59, issue 6, pages e76 to 83

Xiang N and others. 'Sero-epidemiologic study of influenza A(H7N9) infection among exposed populations, China 2013-2014' Influenza and Other Respiratory Viruses 2017: volume 11, issue 2, pages 170 to 176

Xiao XC and others. 'Transmission of avian influenza A(H7N9) virus from father to child: a report of limited person-to-person transmission, Guangzhou, China, January 2014' European Communicable Disease Bulletin 2014: volume 19, issue 25, page 26

Xu W and others. 'Epidemiological and Evolutionary Inference of the Transmission Network of the 2014 Highly Pathogenic Avian Influenza H5N2 Outbreak in British Columbia, Canada' Scientific Reports 2016: volume 6, article number 30858

Yang BS and others. 'Human infection of avian influenza A H3N8 virus and the viral origins: a descriptive study' The Lancet. Microbe 2022: volume 3, issue 11, pages e824 to e834

Yi L and others. 'Family clusters of avian influenza A H7N9 virus infection in Guangdong Province, China' Journal of Clinical Microbiology 2015: volume 53, issue 1, pages 22 to 28

Yu H and others. 'Human infection with avian influenza A H7N9 virus: an assessment of clinical severity' Lancet 2013: volume 382, issue 9887, pages 138 to 145

Zhang J and others. 'Genomic evolution, transmission dynamics, and pathogenicity of avian influenza A (H5N8) viruses emerging in China, 2020' Virus Evolution 2021: volume 7, issue 1, veab046

Zhang ZH and others. 'A Suspected Person-to-person Transmission of Avian Influenza A (H7N9) Case in Ward' Chinese Medical Journal 2017: volume 130, issue 10, pages 1,255 to 1,256

Zheng Y and others. 'Proteomic Analysis of Avian Influenza A (H7N9) Patients within a Family Cluster' Journal of Global Infectious Diseases 2018: volume 10, issue 2, pages 58 to 66

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