



UK Health
Security
Agency

Effectiveness of public health and social measures (PHSM) when implemented to reduce or prevent transmission of meningococcal infection

A systematic evidence summary

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Main messages

1. This systematic evidence summary (search up to 3 April 2026) identified and summarised evidence relating to the effectiveness of public health and social measures (PHSM) when implemented to reduce or prevent transmission of meningococcal infection.
2. One study, a report of an outbreak of meningococcal serogroup C in the USA in 2009, was included ([1](#)). In this report, 10 close contacts (who were exposed while providing care to the index case) were identified. Five of these close contacts reported wearing either N95 respirators or surgical mask with face shield as part of their personal protective equipment. None of these 5 people developed meningococcal disease. However, there were 2 secondary cases who did not wear face masks who were hospitalised with meningococcal disease.
3. No evidence was identified for the use of cloth face masks, or face masks used in a non-occupational context in the community.
4. No evidence was identified for other PHSM including contact tracing and isolation, isolation of cases, hand and respiratory hygiene, cleaning and disinfection, ventilation, physical distancing, reducing informal social contact, modifications or restrictions on formal public gatherings (including mass gatherings), or modifications in early years or educational settings.
5. No evidence was identified for meningococcal serogroups A, B, W, X or Y.
6. Critical appraisal was not performed, which restricts the interpretation of the findings. Evidence was limited to one outbreak report with a very small sample. Outbreak reports are generally considered lower-quality study designs and more likely to be affected by methodological limitations such as recall bias, incomplete reporting and not adjusting for other factors that may have affected the outcome. Some, but not all close contacts were offered post-exposure prophylaxis, which is likely to have had an impact on the outcome and the conclusions that may be drawn on the effectiveness of face masks from this report.
7. In summary, evidence on the effectiveness of PHSM to reduce or prevent transmission of meningococcal infection was very limited in both quality and quantity. Although one outbreak report was identified that reported on the use of N95 respirators or a surgical mask with face shield and transmission in an occupational context, this was insufficient to inform on the effectiveness of face masks in the community. There was no other available evidence on the effectiveness of PHSM when implemented for the reduction or prevention of transmission of meningococcal infection.

Purpose

The purpose of this systematic evidence summary was to identify and summarise the available evidence on the effectiveness of public health and social measures (PHSM) to reduce or prevent transmission of meningococcal infection.

The review question was:

1. What is the effectiveness of public health and social measures (PHSM) implemented to reduce transmission of meningococcal infection?

This systematic evidence summary was commissioned to help inform the UKHSA response to the meningococcal disease outbreak in Kent in March 2026.

Methods

A systematic evidence summary was conducted, following streamlined systematic methods to accelerate the process. A literature search was undertaken to look for relevant experimental studies, observational studies (case-control and cohort studies), and outbreak reports that were published or available as preprint, up to 3 April 2026.

Studies were included if they considered the following PHSM implemented to reduce transmission of meningococcal infection:

- contact tracing and quarantine
- isolation of cases
- hand and respiratory hygiene
- face masks
- cleaning and disinfection
- ventilation
- physical distancing
- reducing informal social contact
- modifications or restrictions on formal public gatherings (including mass gatherings)
- modifications in early years or educational settings

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, however 2 clarifications were made:

- “PHSM implemented to reduce transmission of meningococcal disease” was altered to “PHSM implemented to reduce transmission of meningococcal infection” as the aim of this systematic evidence summary was to identify any evidence of effectiveness of PHSM to reduce transmission of meningitis during an outbreak
- outbreak reports were included regardless of whether they had been peer-reviewed

Screening on title and abstracts was undertaken in duplicate by at least 2 reviewers for 10% of records, with the remainder completed by one reviewer. Screening on full text was undertaken by one reviewer and excluded studies were checked by a second.

Data extraction was performed by one reviewer and checked by a second.

Evidence

In total, 5,173 studies were screened at title and abstract and 67 studies were screened at full text. Of these, only one study met the inclusion criteria. A PRISMA diagram showing the flow of studies through the evidence summary is shown in [Annexe B](#), and studies excluded on full text screening are available with the reasons why in [Annexe C](#). Study characteristics are available in [Annexe D](#).

One outbreak report was identified for inclusion, which described an outbreak in California in December 2009 ([1](#)). Evidence from this report is summarised in [Table D.1](#) and discussed below.

The outbreak report, by Materna and others, reported transmission events after occupational contact with a person with confirmed meningococcal disease ([1](#)). The index case, a 36-year-old man, was found unconscious in his home with a partially obstructed airway and vomit and faeces on his clothes and body. He was subsequently taken to hospital for treatment, which included airway suctioning and placement of a tube in his airway to help with breathing. In total, 23 people had contact with the index case while providing care, of whom 10 were reported to have been within 3 feet (approximately one metre) of the index case while providing care.

Of the 10 people who were within 3 feet of the index case:

- four wore N95 respirators
- one wore a surgical mask with face shield
- two did not wear a mask, but did wear gloves
- three did not wear a mask, and no other personal protective equipment use was reported

Two of the 10 people who were within 3 feet of the index case became ill and were confirmed as secondary cases. The index case and both secondary cases were positive for

meningococcal serogroup C. Both of the secondary cases wore gloves while attending the index case, but did not wear a mask:

1. A 30 year old man who was a police officer began experiencing symptoms (sore throat and nausea that progressed to muscle pain with fever and vomiting) 2 days after attending the scene. He was hospitalised for 5 days, and blood and cerebrospinal fluid samples were culture positive for *N. meningitidis*. He had adjusted the body and head of the index case to assist with their breathing and then left the room where the index case was found.
2. A 47 year old man who was a respiratory therapist had assisted with suction of the airway of the index case and placement of a tube into their airway. He reported symptoms (weakness, chills and fatigue) 5 days after coming into contact with the index case, and blood and cerebrospinal fluid samples were culture positive for *N. meningitidis*. He was hospitalised for 11 days before being discharged.

None of the other 10 contacts, including the 5 who wore either an N95 respirator or surgical mask with face shield, contracted meningococcal disease. However, as none of these were tested for infection, the effect of the N95 respirators and surgical mask on reducing transmission is unclear.

Post-exposure prophylaxis was offered to 7 of the 10 close contacts between 4 to 8 days after exposure. Neither of the 2 secondary cases were offered post-exposure prophylaxis. The provision of post-exposure prophylaxis to some but not all close contacts would have an impact on outcomes and conclusions that could be drawn on the effectiveness of face masks from this report.

Health inequalities

There was no evidence identified on any of the population subgroups identified in the protocol for whom the outcome of meningococcal disease may differ, including those in early years and educational settings, those who work in or who have visited higher risk congregate workplaces or entertainment venues, or those from different ethnic groups (see [Annexe A](#) for full list).

Limitations

This systematic evidence summary used streamlined systematic methods to accelerate the systematic evidence summary 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.

As per the protocol, critical appraisal was not performed due to the rapid completion of this work. This restricts the interpretation of the findings, but the main limitations of the included study have been highlighted.

The included study is an outbreak report, which are generally considered lower quality evidence. This evidence was limited by having a very small sample size and it was also unlikely that all cases related to the outbreak were identified – asymptomatic or mild cases may have been missed, particularly as close contacts were not tested for infection. The use of other personal protective equipment by close contacts was not clearly or consistently reported in the report. Some, but not all contacts were offered post-exposure prophylaxis, which would have an impact on the outcome.

There were inconsistencies in reporting (in particular the use of personal protective equipment and administration of post-exposure prophylaxis) within the included outbreak report which should be considered when interpreting the findings.

The available evidence on the effectiveness of PHSM when implemented to reduce or prevent transmission of meningococcal infection was very limited. This is likely to be due to the established public health response of contact tracing with rapid deployment of antibiotics to close contacts which lowers the risk of transmission. It may also be that asymptomatic carriage of *N. meningitidis* in the population is common, making it difficult to identify a single source of transmission.

Evidence gaps

Evidence was limited to evidence for meningococcal serogroup C. No evidence was identified for meningococcal serogroups A, B, W, X, or Y.

Evidence for face masks was limited to one study which does not provide enough information to determine effectiveness. In addition, the evidence identified relates to the use of N95 respirators and surgical masks with face shields when used in an occupational context as part of personal protective equipment. No evidence was identified on the use of cloth face masks or use of face masks in the community rather than in an occupational context.

No evidence was identified for the following PHSM:

- contact tracing and quarantine
- isolation of cases
- hand and respiratory hygiene
- cleaning and disinfection
- ventilation
- physical distancing

- reducing informal social contact
- modifications or restrictions on formal public gatherings (including mass gatherings)
- modifications in early years or educational settings

No evidence was identified in children or young people.

Conclusion

This systematic evidence summary identified one study that reported some evidence on the use of face masks as part of occupational personal protective equipment on transmission of meningococcal infection.

As per the review protocol, critical appraisal was not performed, which restricts the interpretation of the findings. However, important limitations have been highlighted, most notably the small sample size in the outbreak report and the lack of testing for meningococcal infection in all of the contacts identified in the study. The provision of post-exposure prophylaxis to some, but not all close contacts is likely to have had an impact on the outcome and the conclusions that may be drawn on the effectiveness of face masks from this report. In addition, there were inconsistencies on the reporting of personal protective equipment and administration of post-exposure prophylaxis which affect conclusions that can be drawn from this report.

From the identified evidence, it is not possible to conclude on the effectiveness of PHSM for reducing or preventing transmission of meningococcal infection.

Acknowledgments

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

Disclaimer

UKHSA's rapid 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. Note that these:

- 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 evidence summary is shared externally, 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. Materna B and others. '[Occupational transmission of Neisseria meningitidis: California, 2009](#)' MMWR - Morbidity and Mortality Weekly Report 2010: volume 59, issue 45, pages 1,480 to 1,483

Annexe A. Protocol

Review question

The review question is:

1. What is the effectiveness of public health and social measures (PHSM) implemented to reduce transmission of meningococcal infection?

A search for primary evidence to answer this review question will be conducted up to 3 April 2026.

Eligibility criteria

Table A.1 Inclusion and exclusion criteria

	Included	Excluded
Population	Humans (any age): • children (aged up to and including 17 years) ○ 0 to 4 years, 5 to 11 years, 12 to 17 years • adults (18 years and over) ○ young adults 18 to 25 years	Animals
Context	Outbreaks of meningococcal disease (all serogroups A, B, C, W, X and Y; laboratory-confirmed)	
Settings	Any	
Intervention or exposure	PHSM implemented to reduce transmission of meningococcal infection, limited to: Active case finding and contact identification measures • contact tracing and quarantine • isolation of cases Personal protective measures • hand and respiratory hygiene • face masks	• contact tracing without any action taken for contacts (no quarantine) • lockdowns, or stay-at-home orders • restrictions on public transport • international travel and border restrictions • shielding

	Included	Excluded
	Environmental measures - cleaning and disinfection - ventilation Social measures - physical distancing - reducing informal social contact - modifications or restrictions on formal public gatherings, including mass gatherings - modifications in early years and educational settings	
Outcomes	The following measures of human-to-human transmission of meningococcal infection: - reproduction number - number of new cases - incidence of infection - secondary attack rate - serial interval - generational interval - carriage of <i>N. meningitidis</i> Morbidity outcomes related to confirmed meningococcal disease Health care use: - visits to health provider - visits to emergency care - admission to hospital - admission to intensive care Mortality	Proxy measures of effectiveness (such as change in blood pressure as a measure of morbidity)
Language	English	Any other language
Date of publication	Up to 3 April 2026	
Study design	Experimental studies (randomised-controlled trials, quasi-experimental studies, cross-over designs, before-and-after studies)	Systematic or narrative reviews Modelling studies Cross-sectional studies

	Included	Excluded
	Observational studies: case-control, and cohort studies Outbreak reports	Case reports Case series Qualitative or mixed methods studies
Publication type	Peer-reviewed published research Preprints	Editorials Letters News articles Grey literature Clinical trial registry records Conference abstracts

Identification of studies

The following databases will be searched for studies published up to 3 April 2026: OVID Medline, OVID Embase, and Web of Science Preprint Citation Index. The [search strategy](#) is presented below.

Screening

Title and abstract screening will be undertaken in duplicate by 2 reviewers for at least 10% of the eligible studies, with the remainder completed by one reviewer. Disagreement will be 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.

Data extraction

Summary information for each study will be extracted and reported in tabular form. Information to be extracted will include exposure, country, study period, study design, participants, vaccination status, setting, PHSM, any cointervention received (including medical countermeasures), results, and any relevant contextual data. This will be undertaken by one reviewer and checked by a second.

Risk of bias assessment

Risk of bias of included studies will not be formally assessed in this systematic evidence summary due to time constraints but important limitations of the evidence will be highlighted.

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 for whom the outcome of meningococcal disease may differ will be considered, where evidence is available:

- those in early years and educational settings, (including nurseries, schools, further education colleges, sixth form, SEN schools, universities), considering difference by year group (both school and university)
- those who take part in behaviours that may increase transmission rates (vaping, kissing, sharing social spaces, social networks)
- children (aged under 18 years) who remain unvaccinated (under one year of age who are eligible for MenB vaccination but did not receive it, children who are unvaccinated for any other reason)
- those who reside in potentially high-risk settings for disease transmission including in education (boarding schools, university halls), and other residential settings such as children's homes, adult social care settings, prisons and places of detention, asylum and migrant settings, homeless settings
- those in different ethnic groups
- by deprivation
- those who work in or who have visited higher risk congregate workplaces or entertainment venues (warehouses, factories, nightclubs, sex on premises venues, music venues, bars, student parties, religious venues, choir practices, other crowded indoor social settings)

Search strategy

Ovid MEDLINE(R) ALL (1 January 1946 to 6 April 2026)

1. exp Meningococcal Infections/ (12,167)
2. exp Meningitis, Meningococcal/ (5,803)
3. Meningitis, Bacterial/ (8,194)
4. (meningococc* adj5 (infect* or disease* or strain* or meningit*)).tw,kf. (9,334)
5. invasive meningococc*.tw,kf. (1,699)

6. meningococcosis.tw,kf. (14)
7. (meningit* and (septic?em* or sepsis or bacter?em*)).tw,kf. (9,266)
8. (meningococc* and (septic?em* or sepsis or bacter?em*)).tw,kf. (1,980)
9. exp Neisseria meningitidis/ (10,644)
10. neisseria mening*.tw,kf. (9,644)
11. "N. meningitidis".tw,kf. (3,193)
12. (meningococc* adj2 A).tw,kf. (2,167)
13. (meningit* adj3 A).tw,kf. (11,550)
14. (meningococc* adj2 B).tw,kf. (1,729)
15. (meningit* adj3 B).tw,kf. (2,270)
16. (meningococc* adj2 C).tw,kf. (1,390)
17. (meningit* adj3 C).tw,kf. (989)
18. (meningococc* adj2 W).tw,kf. (138)
19. (meningit* adj3 W).tw,kf. (144)
20. (meningococc* adj2 X).tw,kf. (34)
21. (meningit* adj3 X).tw,kf. (77)
22. (meningococc* adj2 Y).tw,kf. (132)
23. (meningit* adj3 Y).tw,kf. (186)
24. exp Sepsis/ and (Meningitis/ or Meningitis, Bacterial/) (2,102)
25. serogroup* A.tw,kf. (1,634)
26. serogroup* B.tw,kf. (2,469)
27. serogroup* C.tw,kf. (1,482)
28. serogroup* W-135.tw,kf. (68)
29. serogroup* X.tw,kf. (118)
30. serogroup* Y.tw,kf. (298)
31. MenA.tw,kf. (2,021)
32. MenB.tw,kf. (726)
33. MenC.tw,kf. (455)
34. MenW.tw,kf. (140)
35. MenX.tw,kf. (72)
36. MenY.tw,kf. (108)
37. or/1-36 (46485)
38. Contact Tracing/ (6,816)
39. ((contact* or source* or infection* or patient* or case*) adj2 (screen* or notificat* or trac* or investig* or find* or identif*)).tw,kf. (635,278)
40. (NPI* or ((non-pharm* or nonpharm*) adj intervention*) or "public health measure*" or (prevent* adj2 measure*)).tw,kf. (86,503)
41. Social Isolation/ (18,165)
42. ((social* or physical* or case or cases) adj5 isolat*).tw,kf. (56,930)
43. Quarantine/ (6,969)
44. quarantin*.tw,kf. (15,209)
45. Physical Distancing/ (2,586)
46. ((physical* or social*) adj distan*).tw,kf. (17,223)

47. ((social* or societal* or gathering* or meeting* or event* or visit*) adj3 (reduc* or restrict* or prohibit* or limit* or ban* or cancel*)).tw,kf. (55,192)
48. (tier* adj2 restric*).tw,kf. (30)
49. cohorting.tw,kf. (645)
50. exp Disinfectants/ or Disinfection/ (94,810)
51. disinfect*.tw,kf. (44,800)
52. clean*.tw,kf. (136,816)
53. decontaminat*.tw,kf. (18,935)
54. deep clean*.tw,kf. (91)
55. exp Hand Hygiene/ (8,715)
56. (hand wash* or handwash*).tw,kf. (7,593)
57. hand saniti*.tw,kf. (1,203)
58. ((hand or personal or respiratory) adj hygiene).tw,kf. (10,787)
59. (facemask* or mask*).tw,kf. (121,827)
60. Masks/ (8,337)
61. (face adj2 (cover* or protect*)).tw,kf. (1,325)
62. (mouth adj2 (cover* or protect*)).tw,kf. (412)
63. (nose adj2 (cover* or protect*)).tw,kf. (175)
64. (respirator or respirators).tw,kf. (7,416)
65. ((universit* or college* or school* or playschool* or nursery or nurseries or education*) adj3 clos*).tw,kf. (4,988)
66. (playschool* adj3 clos*).tw,kf. (0)
67. (early year* adj3 clos*).tw,kf. (5)
68. (universit* adj3 reduc* attend*).tw,kf. (0)
69. (college* adj3 reduc* attend*).tw,kf. (0)
70. (school* adj3 reduc* attend*).tw,kf. (2)
71. (nursery adj3 reduc* attend*).tw,kf. (0)
72. (nurseries adj3 reduc* attend*).tw,kf. (0)
73. (playschool* adj3 reduc* attend*).tw,kf. (0)
74. (education* adj3 reduc* attend*).tw,kf. (0)
75. (work* adj3 clos*).tw,kf. (6,728)
76. (work* adj3 reduc* attend*).tw,kf. (3)
77. (home* adj3 work*).tw,kf. (12,839)
78. ((hospitalit* or restaurant* or cafe* or venue* or shop* or retail* or hotel* or leisure or gym* or cinema*) adj3 clos*).tw,kf. (533)
79. ((entertainment or nightclub or club or clubs or event or events or dance or dancing or concert* or performance* or pub or pubs or bar or bars) adj3 clos*).tw,kf. (4,995)
80. ((reduc* or limit* or ban or bans or banning) adj5 social contact*).tw,kf. (494)
81. ((reduc* or limit* or ban or bans or banning) adj5 gathering*).tw,kf. (450)
82. ((ventilation or ventilated) and (transmission* or distanc* or dispers* or aerosol* or airborne or air qualit* or indoor air)).tw,kf. (10,701)
83. Ventilation/ (6,636)
84. (air flow* or airflow* or aerodynamic* or air condition*).tw,kf. (44,311)

85. Air Conditioning/ (2,982)
86. (air filter* or air purif* or air filtration).tw,kf. (3,668)
87. Air Filters/ (764)
88. (air chang* or air exchang*).tw,kf. (2,190)
89. (air adj3 (recondition* or re condition*)).tw,kf. (1)
90. (air adj3 replac*).tw,kf. (458)
91. (indoor air adj3 qualit*).tw,kf. (3,790)
92. HVAC.tw,kf. (796)
93. Air Microbiology/ (8,999)
94. Mass Gatherings/ (189)
95. mass gathering*.tw,kf. (1,390)
96. or/38-95 (1,334,941)
97. 37 and 96 (3,713)
98. limit 97 to (comment or editorial or letter or news or newspaper article) (42)
99. 97 not 98 (3,671)

Embase (1 January 1974 to 3 April 2026)

1. exp meningococcosis/ (15,187)
2. exp epidemic meningitis/ (3,790)
3. bacterial meningitis/ (20,324)
4. (meningococc* adj5 (infect* or disease* or strain* or meningit*)).tw,kf. (10,794)
5. invasive meningococc*.tw,kf. (2,032)
6. meningococcosis.tw,kf. (10)
7. (meningit* and (septic?em* or sepsis or bacter?em*)).tw,kf. (12,899)
8. (meningococc* and (septic?em* or sepsis or bacter?em*)).tw,kf. (2,533)
9. exp Neisseria meningitidis/ (17,764)
10. neisseria mening*.tw,kf. (11,200)
11. "N. meningitidis".tw,kf. (3,735)
12. (meningococc* adj2 A).tw,kf. (2,708)
13. (meningit* adj3 A).tw,kf. (14,272)
14. (meningococc* adj2 B).tw,kf. (2,179)
15. (meningit* adj3 B).tw,kf. (2,676)
16. (meningococc* adj2 C).tw,kf. (1,684)
17. (meningit* adj3 C).tw,kf. (1,250)
18. (meningococc* adj2 W).tw,kf. (166)
19. (meningit* adj3 W).tw,kf. (176)
20. (meningococc* adj2 X).tw,kf. (41)
21. (meningit* adj3 X).tw,kf. (96)
22. (meningococc* adj2 Y).tw,kf. (160)
23. (meningit* adj3 Y).tw,kf. (209)
24. exp sepsis/ and (Meningitis/ or Meningitis, Bacterial/) (13,308)
25. serogroup* A.tw,kf. (1,929)
26. serogroup* B.tw,kf. (2,844)

27. serogroup* C.tw,kf. (1,690)
28. serogroup* W-135.tw,kf. (82)
29. serogroup* X.tw,kf. (140)
30. serogroup* Y.tw,kf. (350)
31. MenA.tw,kf. (2,771)
32. MenB.tw,kf. (924)
33. MenC.tw,kf. (576)
34. MenW.tw,kf. (152)
35. MenX.tw,kf. (87)
36. MenY.tw,kf. (129)
37. or/1-36 (72,089)
38. contact examination/ (9,881)
39. ((contact* or source* or infection* or patient* or case*) adj2 (screen* or notificat* or trac* or investig* or find* or identif*)).tw,kf. (1,080,772)
40. (NPI* or ((non-pharm* or nonpharm*) adj intervention*) or "public health measure*" or (prevent* adj2 measure*)).tw,kf. (117,489)
41. exp social isolation/ (42000)
42. ((social* or physical* or case or cases) adj5 isolat*).tw,kf. (77,118)
43. exp quarantine/ (17,145)
44. quarantin*.tw,kf. (15,725)
45. social distancing/ (14,567)
46. ((physical* or social*) adj distan*).tw,kf. (18,540)
47. ((social* or societal* or gathering* or meeting* or event* or visit*) adj3 (reduc* or restrict* or prohibit* or limit* or ban* or cancel*)).tw,kf. (82,009)
48. (tier* adj2 restric*).tw,kf. (38)
49. cohorting.tw,kf. (1013)
50. exp disinfectant agent/ or disinfection/ (746,783)
51. disinfect*.tw,kf. (53,270)
52. clean*.tw,kf. (178,595)
53. decontaminat*.tw,kf. (23,189)
54. deep clean*.tw,kf. (192)
55. hand disinfection/ (1,097)
56. exp hand washing/ (24,221)
57. (hand wash* or handwash*).tw,kf. (9,989)
58. hand saniti*.tw,kf. (1,645)
59. ((hand or personal or respiratory) adj hygiene).tw,kf. (16,073)
60. (facemask* or mask*).tw,kf. (161,753)
61. mask/ or cloth mask/ or exp face mask/ or exp filtering facepiece respirator/ or surgical mask/ (35,665)
62. (face adj2 (cover* or protect*)).tw,kf. (1,495)
63. (mouth adj2 (cover* or protect*)).tw,kf. (457)
64. (nose adj2 (cover* or protect*)).tw,kf. (263)
65. (respirator or respirators).tw,kf. (7,658)

66. ((universit* or college* or school* or playschool* or nursery or nurseries or education*) adj3 clos*).tw,kf. (5,635)
67. (playschool* adj3 clos*).tw,kf. (0)
68. (early year* adj3 clos*).tw,kf. (8)
69. (universit* adj3 reduc* attend*).tw,kf. (0)
70. (college* adj3 reduc* attend*).tw,kf. (0)
71. (school* adj3 reduc* attend*).tw,kf. (3)
72. (nursery adj3 reduc* attend*).tw,kf. (0)
73. (nurseries adj3 reduc* attend*).tw,kf. (0)
74. (playschool* adj3 reduc* attend*).tw,kf. (0)
75. (education* adj3 reduc* attend*).tw,kf. (1)
76. (work* adj3 clos*).tw,kf. (10,274)
77. (work* adj3 reduc* attend*).tw,kf. (2)
78. (home* adj3 work*).tw,kf. (16,294)
79. ((hospitalit* or restaurant* or cafe* or venue* or shop* or retail* or hotel* or leisure or gym* or cinema*) adj3 clos*).tw,kf. (602)
80. ((entertainment or nightclub or club or clubs or event or events or dance or dancing or concert* or performance* or pub or pubs or bar or bars) adj3 clos*).tw,kf. (6,347)
81. ((reduc* or limit* or ban or bans or banning) adj5 social contact*).tw,kf. (619)
82. ((reduc* or limit* or ban or bans or banning) adj5 gathering*).tw. (534)
83. ((ventilation or ventilated) and (transmission* or distanc* or dispers* or aerosol* or airborne or air qualit* or indoor air)).tw,kf. (15,951)
84. Ventilation/ (25,974)
85. (air flow* or airflow* or aerodynamic* or air condition*).tw,kf. (61,857)
86. air conditioning/ (25,974)
87. (air filter* or air purif* or air filtration).tw,kf. (4,387)
88. exp air filter/ (3,311)
89. (air chang* or air exchang*).tw,kf. (3,024)
90. (air adj3 (recondition* or re condition*).tw,kf. (4)
91. (air adj3 replac*).tw,kf. (559)
92. (indoor air adj3 qualit*).tw,kf. (5,185)
93. HVAC.tw,kf. (995)
94. microbiology/ and ("air and air related phenomena"/ or exp air/) (399)
95. mass gathering/ (609)
96. mass gathering*.tw,kf. (1,531)
97. or/38-96 (2,609,920)
98. 37 and 97 (7,083)
99. limit 98 to (conference abstract or conference paper or "conference review" or editorial or letter) (1,609)
100. 98 not 99 (5,474)
101. limit 100 to "clinical trial (clinicaltrials.gov)" (126)
102. 100 not 101 (5,348)

Web of Science Preprints Citation Index (1990 to current)

Date of search: 7 April 2026

TS=((meningococc* NEAR/4 (infect* or disease* or strain* or meningit*)) OR TS=("invasive meningococc*") OR TS=(meningococcosis) OR TS=((meningit* and (septicsem* or sepsis or bactersem*))) OR TS=((meningococc* and (septicsem* or sepsis or bactersem*))) OR TS=("neisseria mening*") OR TS=("N. meningitidis") OR TS=((meningococc* NEAR/1 A)) OR TS=((meningit* NEAR/2 A)) OR TS=((meningococc* NEAR/1 B)) OR TS=((meningit* NEAR/2 B)) OR TS=((meningococc* NEAR/1 C)) OR TS=((meningit* NEAR/2 C)) OR TS=((meningococc* NEAR/1 W)) OR TS=((meningit* NEAR/2 W)) OR TS=((meningococc* NEAR/1 X)) OR TS=((meningit* NEAR/2 X)) OR TS=((meningococc* NEAR/1 Y)) OR TS=((meningit* NEAR/2 Y)) OR TS=("serogroup* A") OR TS=("serogroup* B") OR TS=("serogroup* C") OR TS=("serogroup* W-135") OR TS=("serogroup* X") OR TS=("serogroup* Y") OR TS=(MenA) OR TS=(MenB) OR TS=(MenC) OR TS=(MenW) OR TS=(MenX) OR TS=(MenY)
AND

TS((((contact* or source* or infection* or patient* or case*) NEAR/1 (screen* or notificat* or trac* or investig* or find* or identif*))) OR TS=(NPI*) OR TS=((non-pharm* or nonpharm*) NEAR/0 intervention*) OR TS=("public health measure*" or (prevent* NEAR/2 measure*)) OR TS((((social* or physical* or case or cases) NEAR/4 isolat*)) OR TS=(quarantin*) OR TS((((physical* or social*) NEAR/0 distan*)) OR TS((((social* or societal* or gathering* or meeting* or event* or visit*) NEAR/2 (reduc* or restrict* or prohibit* or limit* or ban* or cancel*))) OR TS=((tier* NEAR/1 restric*)) OR TS=(cohorting) OR TS=(disinfect*) OR TS=(clean*) OR TS=(decontaminat*) OR TS=("deep clean*") OR TS=("hand wash*" or handwash*) OR TS=("hand saniti*") OR TS((((hand or personal or respiratory) NEAR/0 hygiene)) OR TS=((facemask* or mask*)) OR TS=((face NEAR/1 (cover* or protect*))) OR TS=((mouth NEAR/1 (cover* or protect*))) OR TS=((nose NEAR/1 (cover* or protect*))) OR TS=((respirator or respirators)) OR TS((((universit* or college* or school* or playschool* or nursery or nurseries or education*) NEAR/2 clos*)) OR TS=((playschool* NEAR/2 clos*)) OR TS(("early year*" NEAR/2 clos*)) OR TS=((universit* NEAR/2 "reduc* attend*")) OR TS=((college* NEAR/2 "reduc* attend*")) OR TS=((school* NEAR/2 "reduc* attend*")) OR TS=((nursery NEAR/2 "reduc* attend*")) OR TS=((nurseries NEAR/2 "reduc* attend*")) OR TS=((playschool* NEAR/2 "reduc* attend*")) OR TS=((education* NEAR/2 "reduc* attend*")) OR TS=((work* NEAR/2 clos*)) OR TS=((work* NEAR/2 "reduc* attend*")) OR TS=((home* NEAR/2 work*)) OR TS((((hospitalit* or restaurant* or cafe* or venue* or shop* or retail* or hotel* or leisure or gym* or cinema*) NEAR/2 clos*)) OR TS((((entertainment or nightclub or club or clubs or event or events or dance or dancing or concert* or performance* or pub or pubs or bar or bars) NEAR/2 clos*)) OR TS((((reduc* or limit* or ban or bans or banning) NEAR/4 "social contact*")) OR TS((((reduc* or limit* or ban or bans or banning) NEAR/4 gathering*)) OR TS((((ventilation or ventilated) and (transmission* or distanc* or dispers* or aerosol* or airborne or "air qualit*" or "indoor air*")) OR TS(("air flow*" or airflow* or aerodynamic* or "air condition*") OR TS(("air filter*" or "air purif*" or "air filtration") OR TS(("air chang*" or "air exchang*")) OR TS=((air

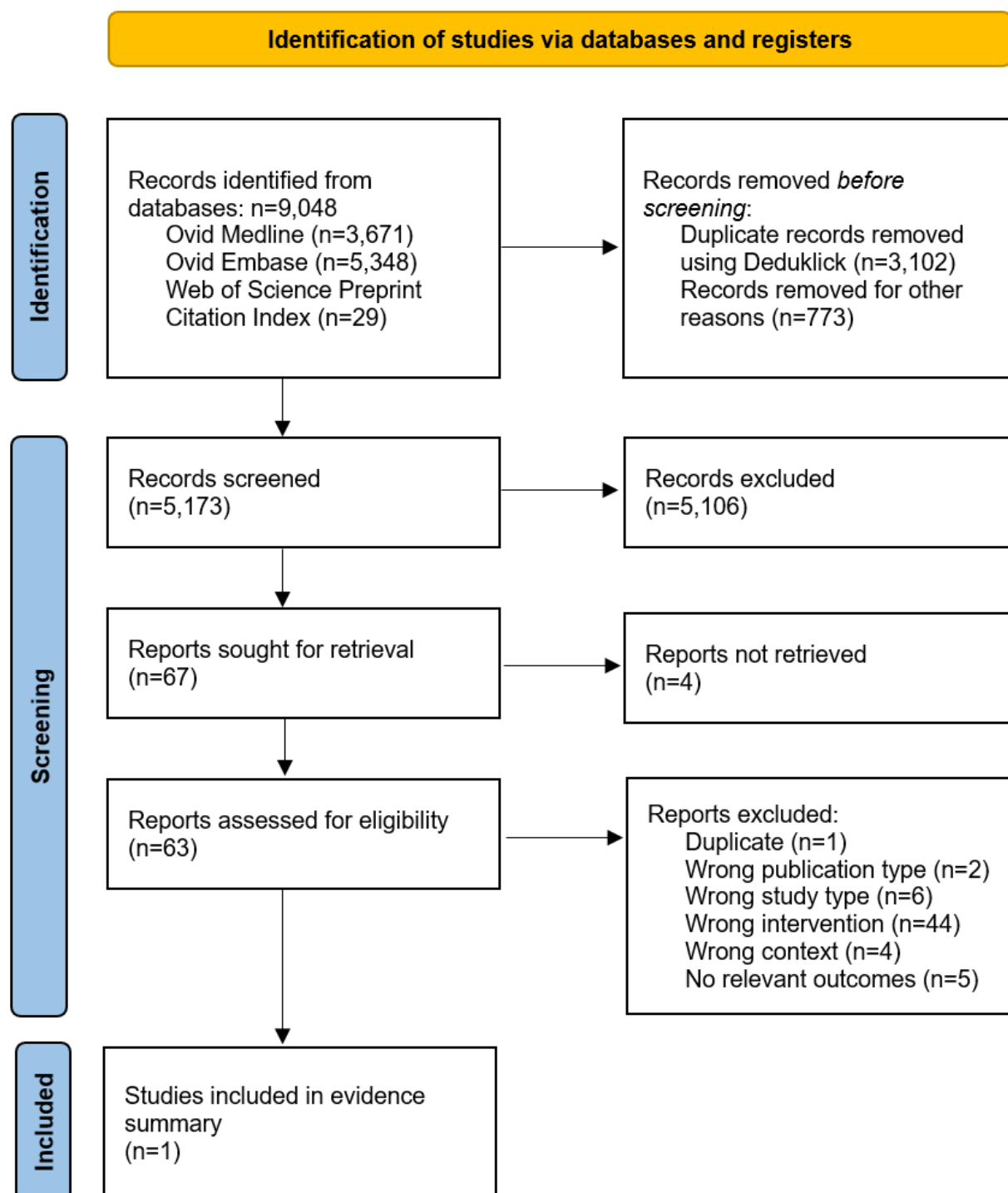
Effectiveness of public health and social measures (PHSM) when implemented to reduce or prevent transmission of meningococcal infection: a systematic evidence summary

NEAR/2 (recondition* or "re condition*")) OR TS=((air NEAR/2 replac*)) OR TS=(("indoor air" NEAR/2 qualit*)) OR TS=(HVAC) OR TS=("mass gathering*")

29 results

Annexe B. Study selection flowchart

Figure B.1. PRISMA diagram



Text version of Figure B.1. PRISMA diagram

A PRISMA diagram showing the flow of studies through this evidence summary, ultimately including one study.

From identification of studies via databases and registers, n=9,048 records identified from databases:

- Ovid Medline (n=3,671)
- Ovid Embase (n=5,348)
- Web of Science Preprint Citation Index (n=29)

From these, records removed before screening:

- duplicate records removed using Deduklick (n=3,102)
- records removed for other reasons (n=773)

5,173 records were screened at title and abstract, of which n=5,102 were excluded, leaving n=67 papers sought for retrieval, of which n=4 were not retrieved.

No studies were identified from identification of studies via other methods.

Of the n=63 papers assessed for eligibility, n=62 reports were excluded:

- duplicate (n=1)
- wrong publication type (n=2)
- wrong study type (n=6)
- wrong context (n=4)
- wrong intervention (n=44)
- no relevant outcomes (n=5)

n=1 papers included in the evidence summary.

Annexe C. Excluded full texts

Duplicate (1 study)

Anonymous. '[From the Centers for Disease Control and Prevention. Exposure to patients with meningococcal disease on aircraft--United States, 1999-2001](#)' JAMA 2001: volume 286, issue 2, pages 160 to 161

Wrong publication type (2 studies)

Anonymous. 'Is there a risk of infection during air travel? [URL not available]' Pharmaceutical Journal 2005: volume 274, page 432

Checketts MR. '[Wash & go - But with what? skin antiseptic solutions for central neuraxial block](#)' Anaesthesia 2012: volume 67, pages 819 to 822

Wrong study type (6 studies)

Coldiron ME and others. '[Ciprofloxacin for contacts of cases of meningococcal meningitis as an epidemic response: study protocol for a cluster-randomized trial](#)' Trials [Electronic Resource] 2017: volume 18, issue 1, page 294

Delbos V and others. '[Meningococcal carriage during a clonal meningococcal B outbreak in France](#)' European Journal of Clinical Microbiology and Infectious Diseases 2013: volume 32, pages 1,451 to 1,459

Farr W and others. '[Suspected meningococcal meningitis on an aircraft carrier](#)' Military Medicine 2004: volume 169, issue 9, pages 684 to 686

Granerod J and others. '[Clusters of meningococcal disease in educational establishments in the United Kingdom: April 2001 to March 2002](#)' Communicable Disease and Public Health 2004: volume 7, issue 1, pages 51 to 55

Riley LK. '[Bacterial meningitis exposure during an international flight: lessons for communicable pathogens](#)' Aviation Space and Environmental Medicine 2006: volume 77, issue 7, pages 758 to 760

Wilder-Smith A. '[W135 meningococcal carriage in association with the Hajj pilgrimage 2001: the Singapore experience](#)' International Journal of Antimicrobial Agents 2003: volume 21, issue 2, pages 112 to 115

Wrong context (4 studies)

Al-Jasser FS and others. '[Patterns of diseases and preventive measures among domestic hajjis from Central, Saudi Arabia \[complete republication\]](#)' Eastern Mediterranean Health Journal 2013: volume 19, pages S34 to S41

Memish ZA and others. '[Mass gathering and globalization of respiratory pathogens during the 2013 Hajj](#)' Clinical Microbiology and Infection 2015: volume 21, pages 571.e1 to 571.e8

Ng PC and others. '[Combined use of alcohol hand rub and gloves reduces the incidence of late onset infection in very low birthweight infants](#)' Archives of Disease in Childhood Fetal and Neonatal Edition 2004: volume 89, issue 4, pages F336 to F340

Philips BJ and others. '[Surgical face masks are effective in reducing bacterial contamination caused by dispersal from the upper airway](#)' British Journal of Anaesthesia 1992: volume 69, issue 4, pages 407 to 408

Wrong intervention (44 studies)

Acheson P and others. '[A cluster of four cases of meningococcal disease in a single nuclear family](#)' Archives of Disease in Childhood 2012: volume 97, issue 3, pages 248 to 249

Anonymous. '[Clusters of meningococcal disease in university students](#)' Communicable Disease Report. CDR Weekly 1997: volume 7, issue 44, pages 393, 396

Applegate AO and others. '[Notes from the Field: Meningococcal Disease in an International Traveler on Eculizumab Therapy - United States, 2015](#)' MMWR - Morbidity and Mortality Weekly Report 2016: volume 65, issue 27, pages 696 to 697

Bassi C and others. '[A cluster of invasive meningococcal disease \(IMD\) caused by Neisseria meningitidis serogroup W among university students, France, February to May 2017](#)' Euro Surveillance: Bulletin Europeen sur les Maladies Transmissibles = European Communicable Disease Bulletin 2017: volume 22, issue 28, page 13

Biswas HH and others. '[Notes from the Field: Outbreak of Serogroup B Meningococcal Disease at a University - California, 2016](#)' MMWR - Morbidity and Mortality Weekly Report 2016: volume 65, issue 20, pages 520 to 521

Brooks R and others. '[Increased case-fatality rate associated with outbreaks of Neisseria meningitidis infection, compared with sporadic meningococcal disease, in the United States, 1994-2002](#)' Clinical Infectious Diseases 2006: volume 43, issue 1, pages 49 to 54

Buxton JA and others. '[The use of the Internet to inform young international travellers of contact with a case of meningococcal meningitis](#)' Canada Communicable Disease Report 2002: volume 28, issue 5, pages 37 to 40

Cardenosa N and others. '[Carriers of Neisseria meningitidis in household contacts of meningococcal disease cases in Catalonia \(Spain\)](#)' European Journal of Epidemiology 2001: volume 17, issue 9, pages 877 to 884

Ceyhan M and others. '[Acquisition of meningococcal serogroup W-135 carriage in Turkish Hajj pilgrims who had received the quadrivalent meningococcal polysaccharide vaccine](#)' Clinical and Vaccine Immunology 2013: volume 20, pages 66 to 68

Crawford E and others. '[Notes from the Field: Pediatric Death from Meningococcal Disease in a Family of Romani Travelers - Sarasota, Florida, 2015](#)' MMWR - Morbidity and Mortality Weekly Report 2016: volume 65, issue 37, page 1,017

Davis LC and others. '[Meningococcal disease in a backpackers hostel in Scotland: a risk assessment for prophylaxis](#)' Euro Surveillance: Bulletin Europeen sur les Maladies Transmissibles = European Communicable Disease Bulletin 2009: volume 14, issue 31, page 6

Domo NR and others. '[Uncommon mixed outbreak of pneumococcal and meningococcal meningitis in Jirapa District, Upper West Region, Ghana, 2016](#)' Ghana Medical Journal 2017: volume 51, issue 4, pages 149 to 155

Eberhart-Phillips J and others. '[Assessment of the risk of transmission of N meningitidis in a classroom setting](#)' New Zealand Medical Journal 1995: volume 108, issue 1,005, pages 318 to 319

Farries JS and others. '[Meningococcal infections in Bolton, 1971-74](#)' Lancet 1975: volume 2, issue 7,925, pages 118 to 120

Ferson M and others. '[Unusual cluster of mild invasive serogroup C meningococcal infection in a university college](#)' Communicable Diseases Intelligence 1999: volume 23, issue 10, pages 261 to 264

Filice GA and others. '[Group A meningococcal disease in skid rows: Epidemiology and implications for control](#)' American Journal of Public Health 1984: volume 74, pages 253 to 254

Guilmette P and others. '[A cluster of Neisseria meningitidis cases in Quebec, January 1991](#)' Canada Diseases Weekly Report 1991: volume 17, issue 52, pages 295 to 296

Hodgson A and others. '[Risk factors for meningococcal meningitis in northern Ghana](#)' Transactions of the Royal Society of Tropical Medicine and Hygiene 2001: volume 95, pages 477 to 480

Jacquinet S and others. '[Outbreak of invasive meningococcal disease caused by a meningococcus serogroup B in a nursery school, Wallonia, Belgium, 2018](#)' Euro Surveillance: Bulletin Européen sur les Maladies Transmissibles = European Communicable Disease Bulletin 2022: volume 27, issue 9, page 3

Juels C and others. '[Meningococcal disease in California. Epidemiology and management](#)' Western Journal of Medicine 1978: volume 128, issue 3, pages 195 to 202

Kriz P and others. '[Genetic and antigenic characteristics of Neisseria meningitidis strains isolated in the Czech Republic in 1997-1998](#)' European Journal of Clinical Microbiology and Infectious Diseases 2000: volume 19, issue 6, pages 452 to 429

Lawler J and others. '[Suspected cluster of Neisseria meningitidis W invasive disease in an elderly care home: do new laboratory methods aid public health action? United Kingdom, 2015](#)' Euro Surveillance: Bulletin Européen sur les Maladies Transmissibles = European Communicable Disease Bulletin 2019: volume 24, issue 23, page 6

Linde H and others. '[Six different strains of Neisseria meningitidis in a case with meningococcal sepsis and five contact persons in a boys' home](#)' Infection 2000: volume 28, issue 3, pages 157 to 160

Mandal S and others. '[Prolonged university outbreak of meningococcal disease associated with a serogroup B strain rarely seen in the United States](#)' Clinical Infectious Diseases 2013: volume 57, issue 3, pages 344 to 348

Mayoral Cortes JM and others. '[Community cluster of meningococcal disease by Neisseria meningitidis serogroup C in Andalusia, Spain, March to May 2011](#)' Eurosurveillance 2012: volume 17, issue 36, 20120906

McMahan DA and others. '[Notes from the Field: Expanded Chemoprophylaxis Offered in Response to a Case of Meningococcal Meningitis in an Elementary School - Indiana, 2015](#)' MMWR - Morbidity and Mortality Weekly Report 2016: volume 65, issue 20, page 522

Mutonga DM and others. '[Epidemiology and risk factors for serogroup X meningococcal meningitis during an outbreak in western Kenya, 2005-2006](#)' American Journal of Tropical Medicine and Hygiene 2009: volume 80, issue 4, pages 619 to 624

Nnadi C and others. '[Large Outbreak of Neisseria meningitidis Serogroup C - Nigeria, December 2016-June 2017](#)' MMWR - Morbidity and Mortality Weekly Report 2017: volume 66, issue 49, pages 1,352 to 1,356

O'Connor L and others. '[A prolonged outbreak of invasive meningococcal disease in an extended Irish Traveller family across three Health Service Executive \(HSE\) areas in Ireland,](#)

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[2010 to 2013'](#) Euro Surveillance: Bulletin Europeen sur les Maladies Transmissibles = European Communicable Disease Bulletin 2015: volume 20, issue 21, page 28

Palmer SR and others. '[Meningococcal disease in Wales: clinical features, outcome and public health management](#)' Journal of Infection 1992: volume 25, issue 3, pages 321 to 328

Pearson N and others. '[Antibiotic prophylaxis for bacterial meningitis: overuse and uncertain efficacy](#)' Journal of Public Health Medicine 1995: volume 17, issue 4, pages 455 to 458

Perron L and others. '[Four cases of Neisseria meningitidis infection linked to frequenting a bar--Quebec](#)' Canada Diseases Weekly Report 1991: volume 17, issue 52, pages 294 to 295

Puleston R and others. '[An unusual transmission event of Neisseria meningitidis serogroup W135 type 2a in a healthcare setting, England, 2012](#)' Euro Surveillance: Bulletin Europeen sur les Maladies Transmissibles = European Communicable Disease Bulletin 2012: volume 17, issue 44, page 1

Raja NS and others. '[Invasive meningococcal disease in the University of Malaya Medical Centre, Kuala Lumpur, Malaysia](#)' Journal of Postgraduate Medicine 2006: volume 52, issue 1, page 23 to 29; discussion 29

Robinson M and others. '[Statewide Outbreak of Neisseria meningitidis Serogroup Y, Sequence Type 1466 - Virginia, 2022-2024](#)' MMWR - Morbidity and Mortality Weekly Report 2024: volume 73, issue 43, pages 973 to 977

Anonymous. '[Prophylaxis for holiday contacts of single cases of meningococcal disease](#)' Communicable Disease Report. CDR Weekly 1998: volume 8, issue 35, page 307

Smilovic V and others. '[Familial epidemic of meningococcal disease](#)' Croatian Medical Journal 1998: volume 39, issue 1, pages 62 to 65

Soeters HM and others. '[University-based outbreaks of meningococcal disease caused by serogroup B, United States, 2013-2018](#)' Emerging Infectious Diseases 2019: volume 25, pages 434 to 440

Stewart A and others. '[Public health action and mass chemoprophylaxis in response to a small meningococcal infection outbreak at a nursery in the West Midlands, England](#)' Perspectives in Public Health 2013: volume 133, issue 2, pages 104 to 109

Stone SC and others. '[Exposure to patients with meningococcal disease on aircraft--United States, 1999-2001](#)' Annals of Emergency Medicine 2001: volume 38, issue 5, pages 598 to 599

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Strobel AG and others. '[Meningococcal C Disease Outbreak Caused by Multidrug-Resistant Neisseria meningitidis, Fiji](#)' Emerging Infectious Diseases 2025: volume 31, issue 1, pages 32 to 40

Valinsky L and others. '[A cluster of invasive meningococcal disease revealed by the characterization of a novel serogroup B meningococcal clone](#)' Epidemiology & Infection 2016: volume 144, issue 1, pages 183 to 188

Wall R and others. '[Meningococcal infection: evidence for school transmission](#)' Journal of Infection 1991: volume 23, issue 2, pages 155 to 159

White K and others. '[Meningococcal disease and death in rural Alberta. December 1991](#)' Canadian Journal of Public Health. Revue Canadienne de Sante Publique 1992: volume 83, issue 2, pages 141 to 142

No relevant outcomes (5 studies)

Anonymous. '[Outbreak of meningococcal disease associated with an elementary school -- Oklahoma, March 2010](#)' MMWR - Morbidity and Mortality Weekly Report 2012: volume 61, issue 13, pages 217 to 221

Ching SJ and others. '[Outbreak of Neisseria meningitidis Conjunctivitis in Military Trainees - Texas, February-May 2025](#)' MMWR - Morbidity and Mortality Weekly Report 2025: volume 74, issue 33, pages 516 to 521

Cohen MS and others. '[Possible nosocomial transmission of group Y Neisseria meningitidis among oncology patients](#)' Annals of Internal Medicine 1979: volume 91, issue 1, pages 7 to 12

Doedeh J and others. '[Rapid Field Response to a Cluster of Illnesses and Deaths - Sinoe County, Liberia, April-May, 2017](#)' MMWR - Morbidity and Mortality Weekly Report 2017: volume 66, issue 42, pages 1,140 to 1,143

Sekiya N and others. '[Serogroup B invasive meningococcal disease \(IMD\) outbreak at a Japanese high school dormitory: An outbreak investigation report from the first IMD outbreak in decades](#)' Vaccine 2021: volume 39, issue 15, pages 2,177 to 2,182

Annexe D. Data extraction tables

Table D.1. Summary of evidence on effectiveness of PHSM when implemented to reduce or prevent transmission of meningococcal disease

Study	Country, time period	Population	Serogroup/serotype	Intervention	Co-intervention	Outcomes
Materna and others, 2010 (1) Outbreak report	USA, December 2009	Index case: 36-year-old man, <i>N. meningitidis</i> confirmed in blood and cerebrospinal fluid Twenty-three close contacts were identified, of whom 10 people were reported as being within 3 feet of the index case when providing care.	<i>N. meningitidis</i> serogroup C ST-11 clonal complex	Of the 10 close contacts who were within 3 feet of the index case: • four wore N95 respirators, use of other personal protective equipment was not reported • one wore a surgical mask with face shield, use of other personal protective equipment was not reported • two did not wear a mask but reported wearing gloves • three did not wear a mask, and no other personal protective equipment use was reported [a]	Postexposure prophylaxis was offered to 7 out of 10 close contacts (regimen not described) [a]	In the 5 cases who wore face masks while in close contact with the patient, there was no reported onward transmission. There were 2 secondary cases (both reported wearing gloves but no face mask, no provision of postexposure prophylaxis [note 1]): 1. A 30 year old man who was a police officer began experiencing symptoms (sore throat and nausea that progressed to muscle pain with fever and vomiting) 2 days after attending the scene. He was hospitalised, and blood and cerebrospinal fluid samples were culture positive for <i>N. meningitidis</i> . He was hospitalised for 5 days before being discharged. He had adjusted the body and head of the index case to assist with their breathing and then left the room where the index case was. 2. A 47 year old man who was a respiratory therapist had assisted with suction of the airway of the index case and placement of a tube into their airway. He reported symptoms (weakness, chills and fatigue) 5 days after coming into contact with the index case, and blood and cerebrospinal fluid samples were culture positive for <i>N. meningitidis</i> . He was hospitalised for 11 days before being discharged.

Note 1: there are inconsistencies in the reporting of the use of personal protective equipment and the administration of postexposure prophylaxis within this outbreak report. Information has been extracted from the text, but these inconsistencies should be noted in any conclusions drawn from this report.

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UK Health Security Agency (UKHSA) prevents, prepares for and responds to infectious diseases and environmental, radiological and chemical hazards, to keep all our communities safe, save lives and protect livelihoods. We provide scientific and operational leadership, working with local, national and international partners to protect the public's health.

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