

The burden of human metapneumovirus (hMPV) disease in older and high-risk adults in developed countries: a systematic literature review

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Supplementary Materials

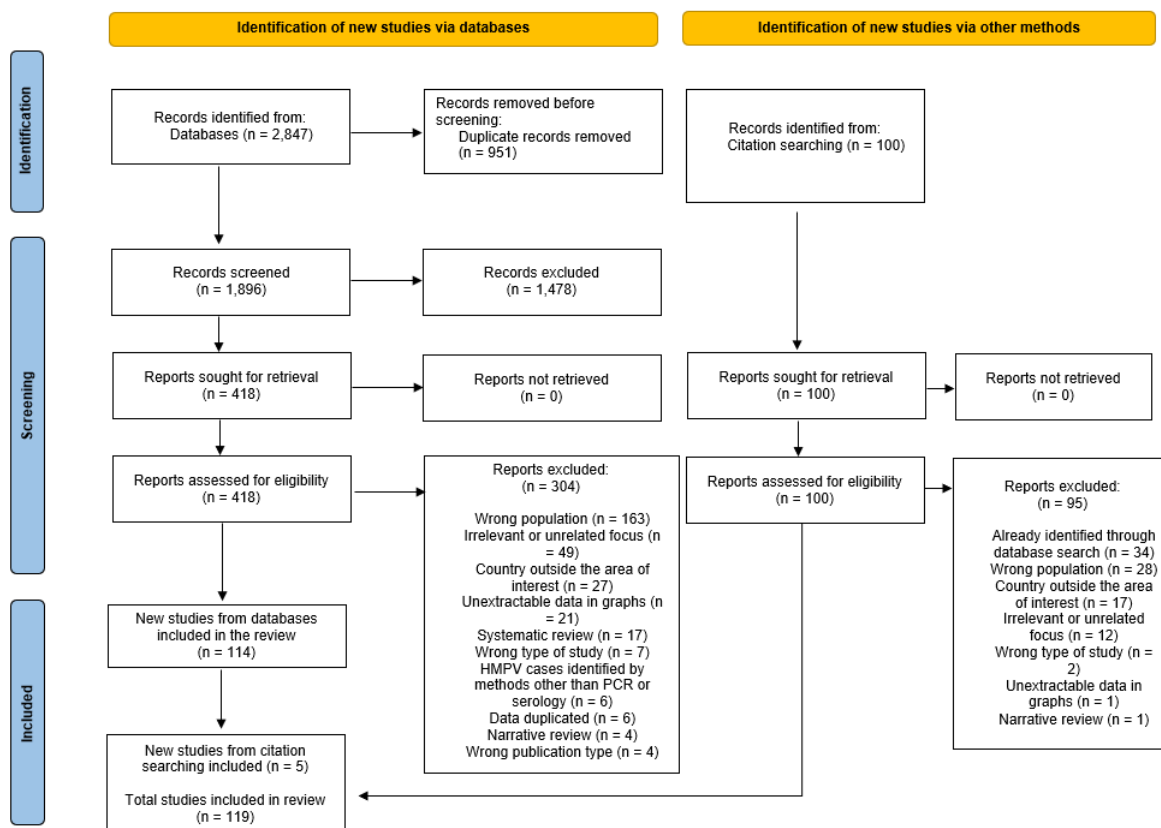
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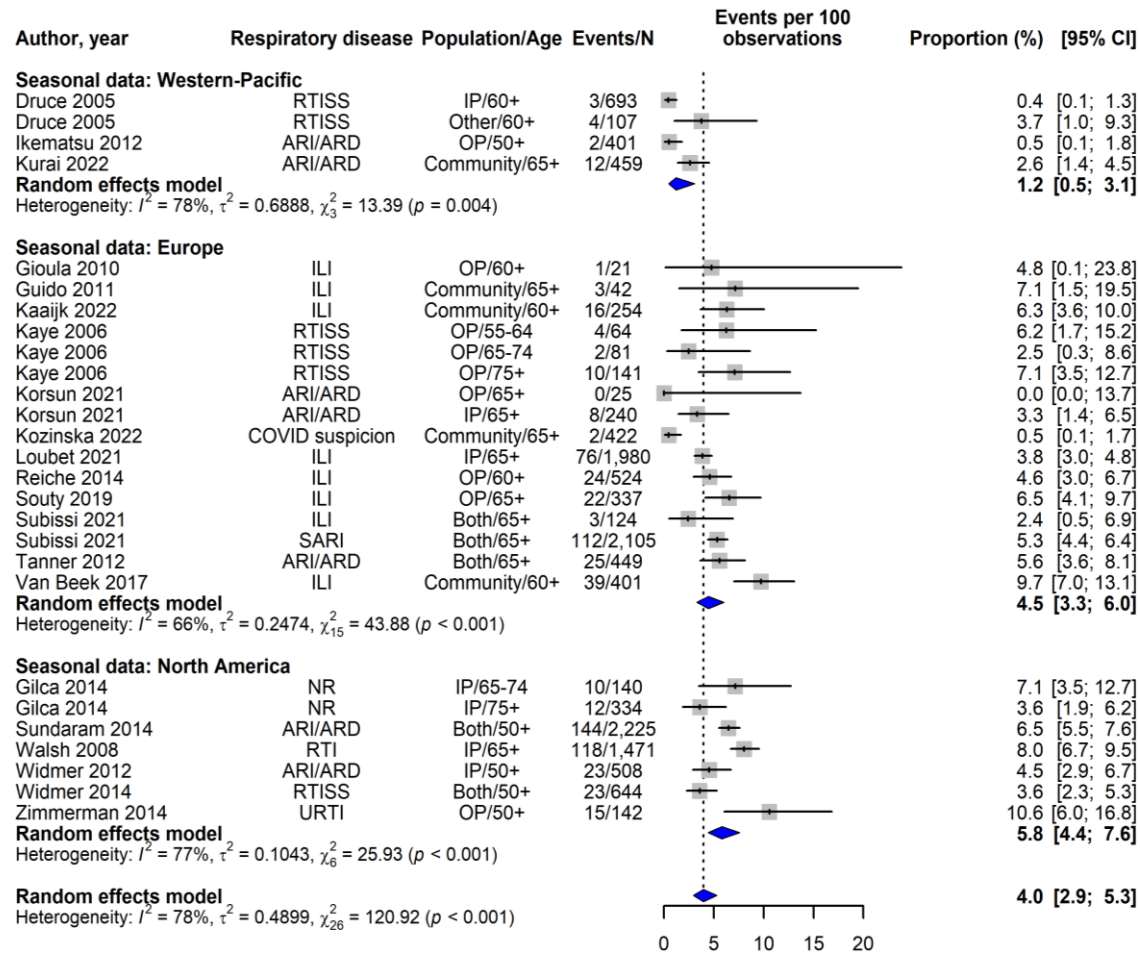
Supplementary figures

Fig. S1. PRISMA flow diagram.



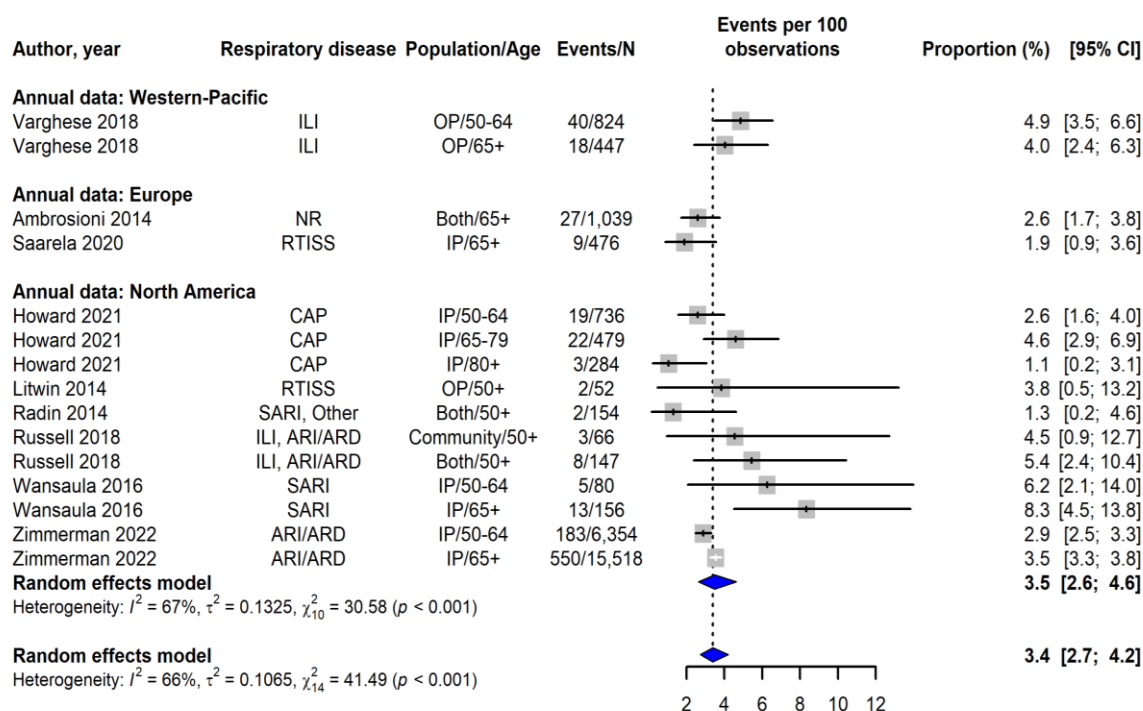
HMPV, human metapneumovirus; PCR, polymerase chain reaction

Fig. S2. Seasonal proportion of symptomatic respiratory infections attributable to hMPV among older adults per region.



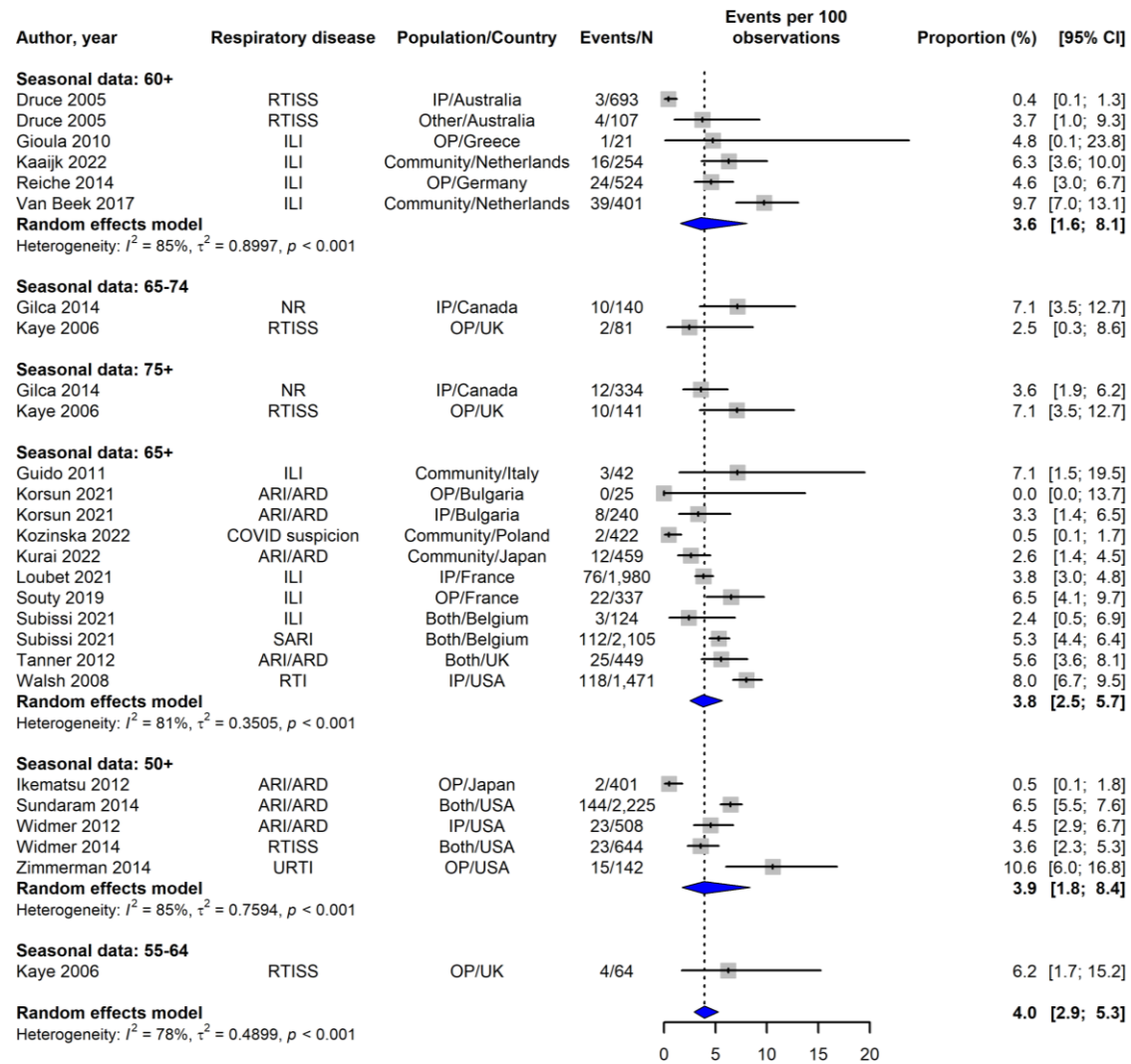
ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CI: Confidence interval; hMPV: Human metapneumovirus; ILI: Influenza-Like Illness; IP: Inpatient; NR: Not Reported; OP: Outpatient; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms; SARI: Severe Acute Respiratory Infection; URTI: Upper Respiratory Tract Infection. Druce 2005: this study has been categorised as "Other" in the forest plot due to the absence of specific information regarding the surveillance method (community-based or medically attended). The study, titled "Victoria-wide Influenza Surveillance Program," does not provide clarity on this aspect. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings.

Fig. S3. Annual proportion of symptomatic respiratory infections attributable to hMPV among older adults per region.



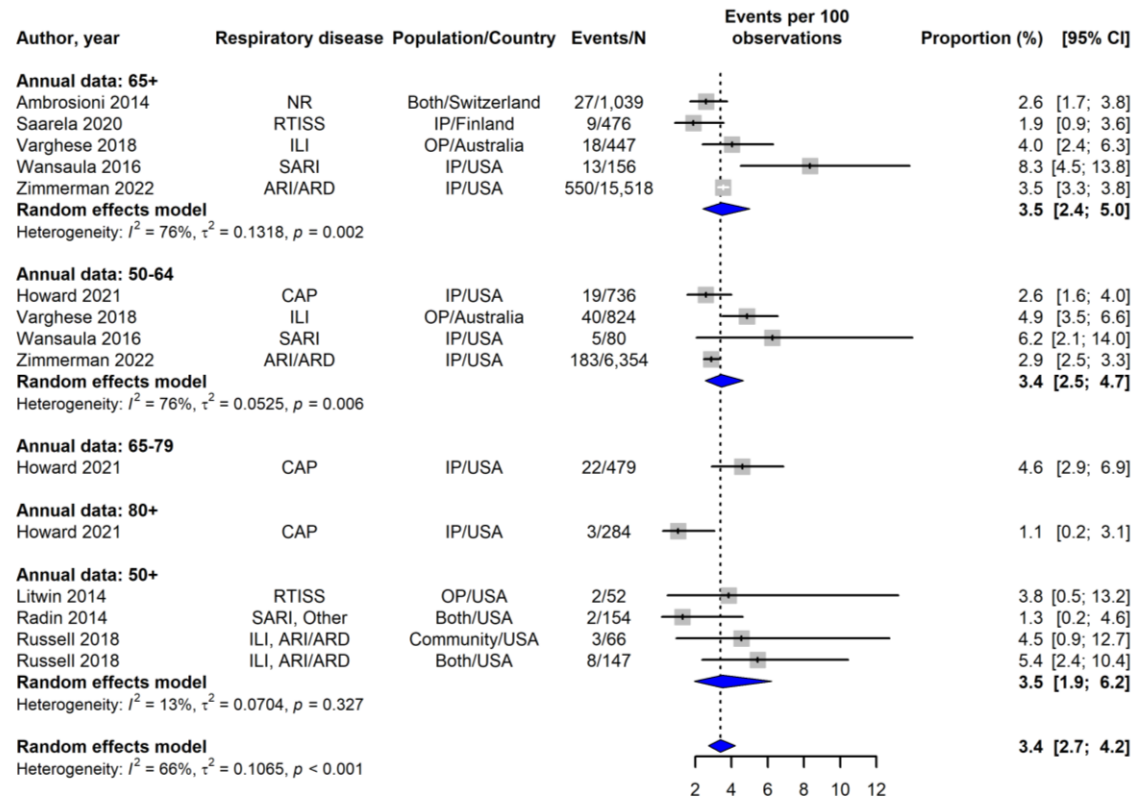
ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CI: Confidence interval; hMPV: Human metapneumovirus; ILI: Influenza-Like Illness; IP: Inpatient; NR: Not Reported; OP: Outpatient; RTISS: Respiratory Tract Infection Signs and Symptoms; SARI: Severe Acute Respiratory Infection. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings.

Fig. S4. Seasonal proportion of symptomatic respiratory infections attributable to hMPV among older adults per age group.



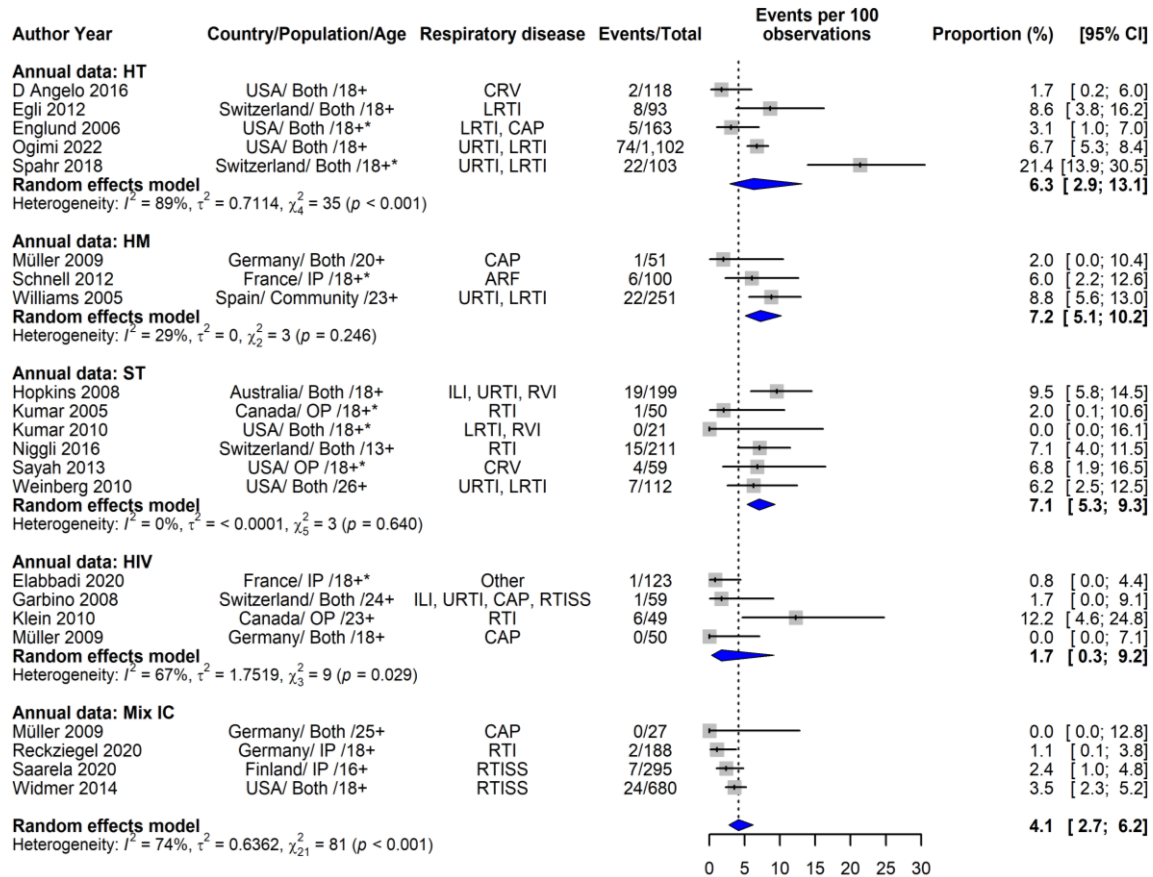
ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CI: Confidence interval; hMPV: Human metapneumovirus; ILI: Influenza-Like Illness; IP: Inpatient; NR: Not Reported; OP: Outpatient; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms; SARI: Severe Acute Respiratory Infection; URTI: Upper Respiratory Tract Infection. Druce 2005: this study has been categorised as "Other" in the forest plot due to the absence of specific information regarding the surveillance method (community-based or medically attended). The study, titled "Victoria-wide Influenza Surveillance Program," does not provide clarity on this aspect. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings.

Fig. S5. Annual proportion of symptomatic respiratory infections attributable to hMPV among older adults per age group.



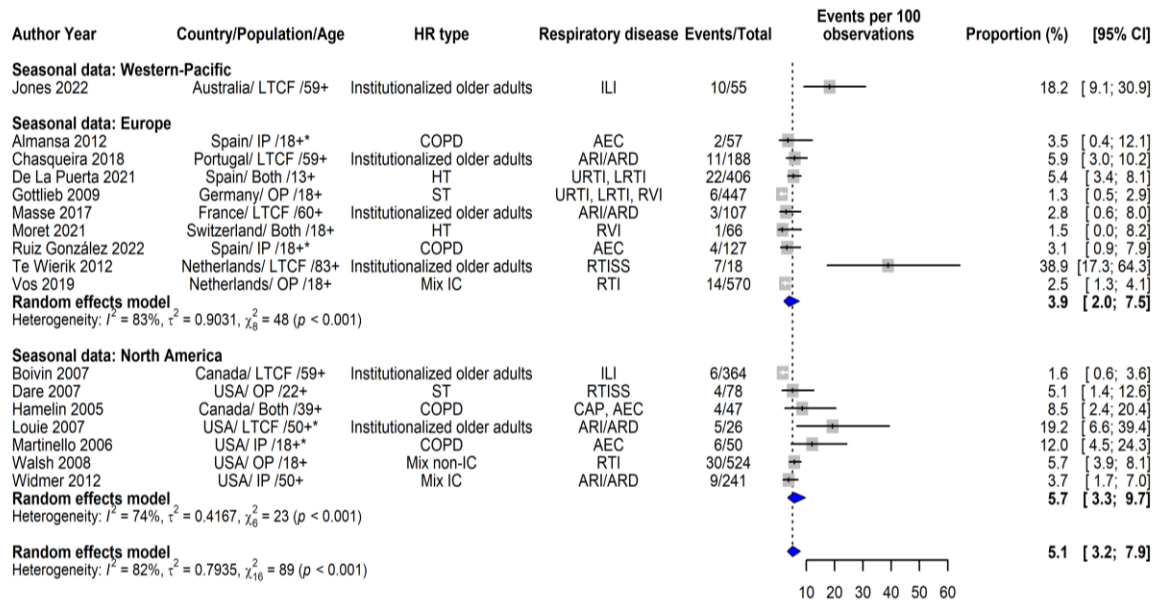
ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CI: Confidence interval; hMPV: Human metapneumovirus; ILI: Influenza-Like Illness; IP: Inpatient; NR: Not Reported; OP: Outpatient; RTISS: Respiratory Tract Infection Signs and Symptoms; SARI: Severe Acute Respiratory Infection. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings.

Fig. S6. Annual proportion of symptomatic respiratory infections attributable to hMPV among patients with immunosuppression.



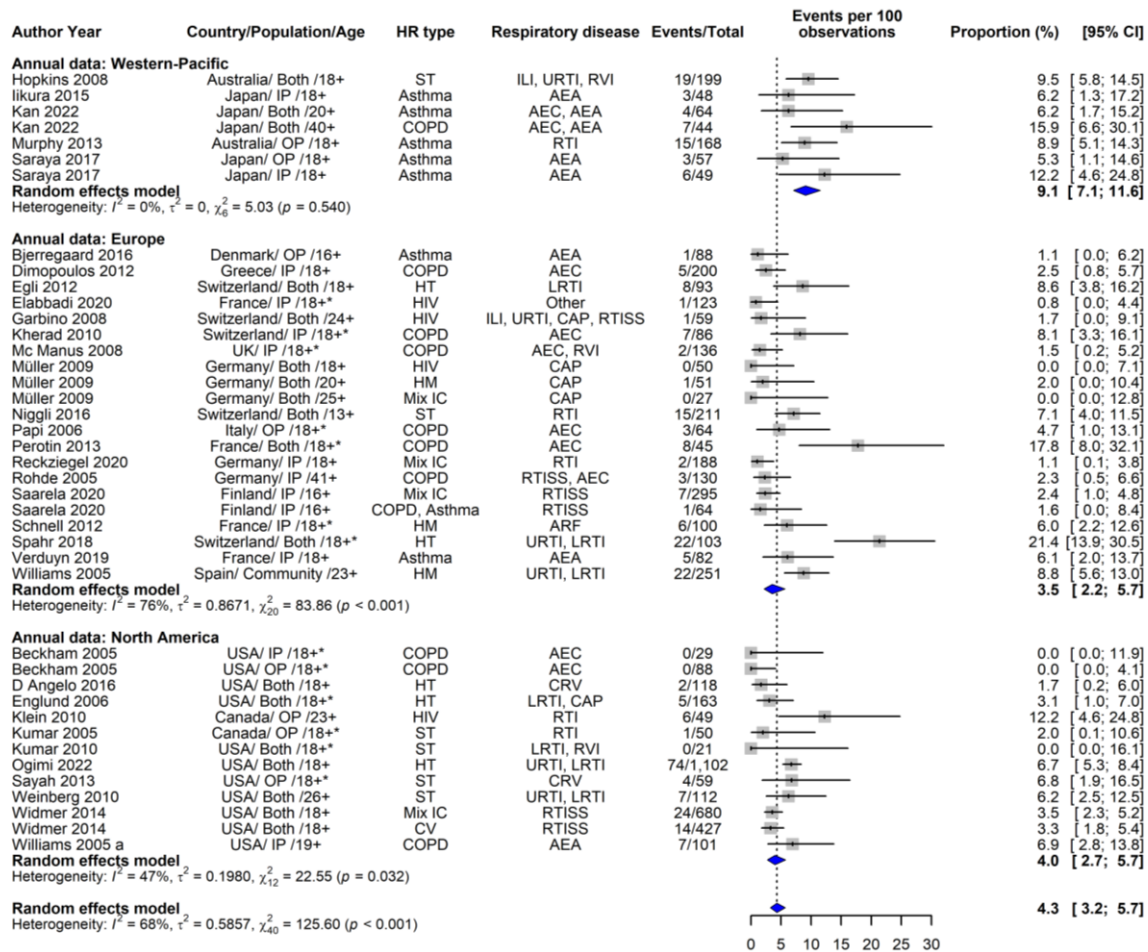
CAP: Community-Acquired Pneumonia; CI: Confidence interval; CRV: Community Respiratory Viruses; HM: Haematological Malignancies; HT: Haematopoietic transplant; hMPV: Human metapneumovirus; ILI: Influenza-Like Illness; IP: Inpatient; LRTI: Lower Respiratory Tract Infection; OP: Outpatient; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms; RVI: Respiratory Viral Infection; ST: Solid transplant; URTI: Upper Respiratory Tract Infection. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. Saarela 2020: Previously or currently treated cancer (except skin cancer other than melanoma), immunosuppressive medication as a minimum 5 mg of daily prednisolone, primary immune deficiency requiring immunoglobulin treatment, human immunodeficiency virus infection, liver cirrhosis, organ transplantation, splenectomy; Widmer 2014: Immunodeficiency (Transplant, cancer, splenectomy, HIV/AIDS, steroid use, chemotherapy, immunosuppression) and cardiovascular disease.

Fig. S7. Seasonal proportion of symptomatic respiratory infections attributable to hMPV among high-risk populations per region.



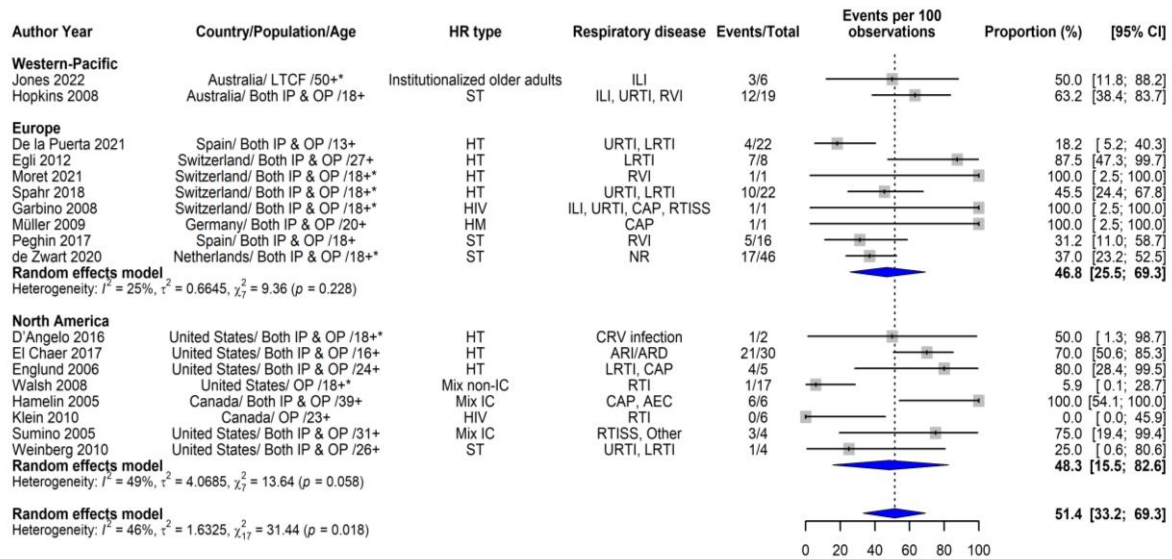
AEC: Acute Exacerbation of COPD; ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CI: Confidence interval; COPD: Chronic Obstructive Pulmonary Disease; HR: High Risk; HT: Haematopoietic transplant; hMPV: Human metapneumovirus; IC: Immunocompromised; ILI: Influenza-Like Illness; IP: Inpatient; LTCF: Long-Term Care Facility; LRTI: Lower Respiratory Tract Infection; OP: Outpatient; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms; RVI: Respiratory Viral Infection; ST: Solid transplant; URTI: Upper Respiratory Tract Infection. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. Widmer 2014: Immunodeficiency (Transplant, cancer, splenectomy, human immunodeficiency virus/acquired immunodeficiency syndrome, steroid use, chemotherapy, immunosuppression) and cardiovascular disease; Vos 2019: Immunocompromised status.

Fig. S8. Annual proportion of symptomatic respiratory infections attributable to hMPV among high-risk populations per region.



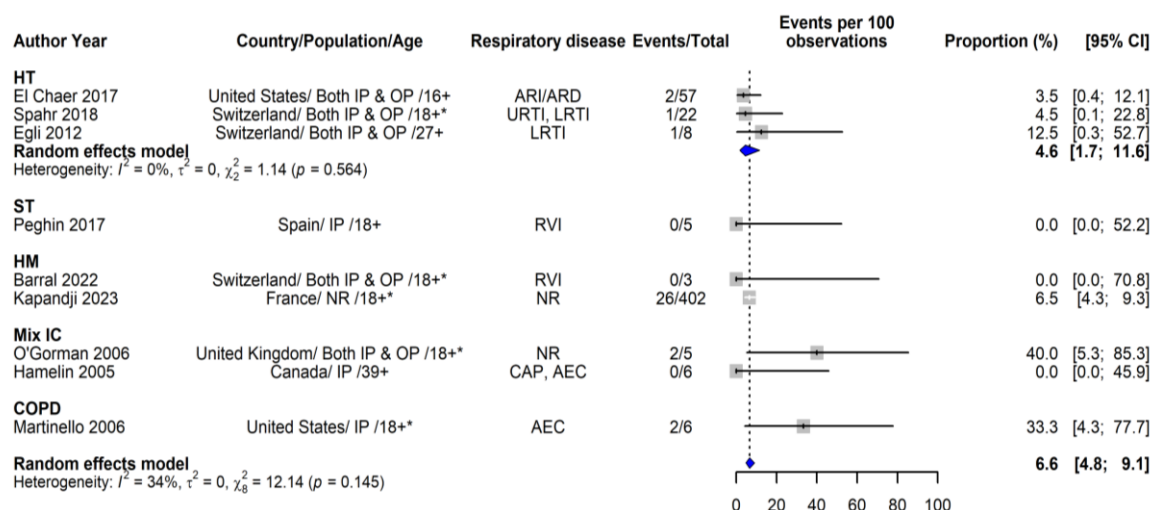
AEA: Acute Exacerbation of Asthma; AEC: Acute Exacerbation of COPD; ARF: Acute Respiratory Failure; CAP: Community-Acquired Pneumonia; CI: Confidence interval; COPD: Chronic Obstructive Pulmonary Disease; CRV: Community Respiratory Viruses; CV: Cardiovascular Disease; hMPV: Human metapneumovirus; HIV: Human Immunodeficiency Virus; HM: Haematological Malignancies; HR: High Risk; HT: Haematopoietic transplant; IC: Immunocompromised; ILI: Influenza-Like Illness; IP: Inpatient; LRTI: Lower Respiratory Tract Infection; OP: Outpatient; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms; RVI: Respiratory Viral Infection; ST: Solid transplant; URTI: Upper Respiratory Tract Infection. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. Saarela 2020: Previously or currently treated cancer (except skin cancer other than melanoma), immunosuppressive medication as a minimum 5 mg of daily prednisolone, primary immune deficiency requiring immunoglobulin treatment, HIV infection, liver cirrhosis, organ transplantation, splenectomy; Widmer 2014: Immunodeficiency (Transplant, cancer, splenectomy, HIV/acquired immunodeficiency syndrome, steroid use, chemotherapy, immunosuppression) and cardiovascular disease.

Fig. S9. Proportion of hospitalisations among hMPV-positive high-risk patients by region.



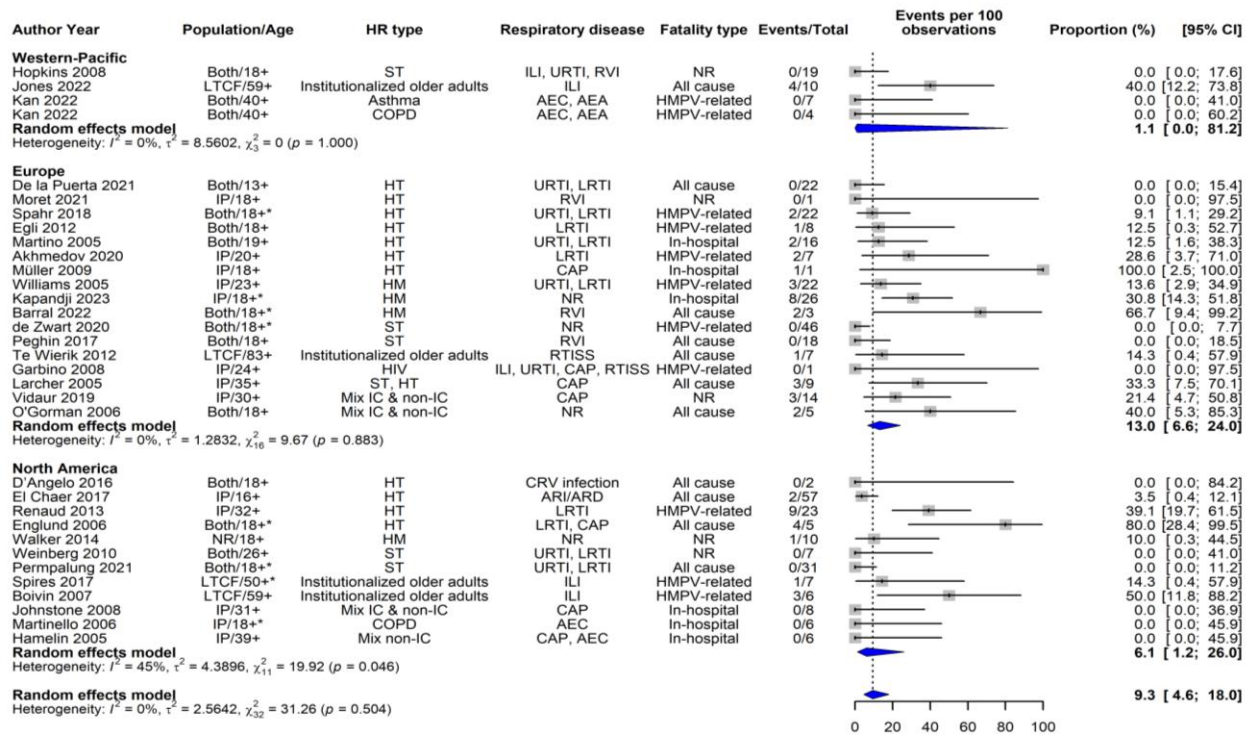
AEC: Acute Exacerbation of Chronic Obstructive Pulmonary Disease (COPD); ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CI: Confidence interval; CRV infection: Community Respiratory Viruses infection; HM: Haematological Malignancies; HR: High Risk; HT: Haematopoietic Transplant; hMPV: Human metapneumovirus; IC: Immunocompromised; ILI: Influenza-Like Illness; IP: Inpatient; LTCF: Long-Term Care Facility; LRTI: Lower Respiratory Tract Infection; NR: Not Reported; OP: Outpatient; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms; RVI: Respiratory Viral Infection; ST: Solid transplant; URTI: Upper Respiratory Tract Infection. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. Walsh 2008: congestive heart failure and lung diseases; Sumino 2005: Leukaemia, lung and heart transplant recipients; Hamelin 2005: COPD, Asthma, cardiac heart failure.

Fig. S10. Intensive care unit admission proportion among hMPV-positive high-risk adults by type of high-risk population.



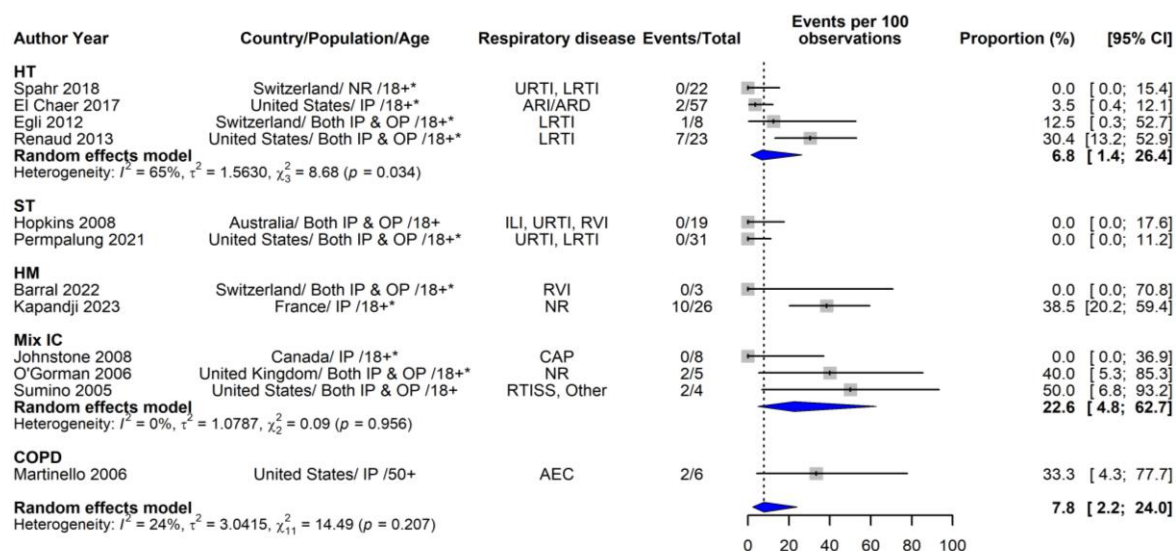
AEC: Acute Exacerbation of COPD; ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CI: Confidence interval; COPD: Chronic Obstructive Pulmonary Disease; HM: Haematological Malignancies; HR: High Risk; HT: Haematopoietic transplant; hMPV: Human metapneumovirus; IC: Immunocompromised; IP: Inpatient; LRTI: Lower Respiratory Tract Infection; NR: Not Reported; OP: Outpatient; RVI: Respiratory Viral Infection; ST: Solid transplant; URTI: Upper Respiratory Tract Infection. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. Mix IC Hamelin 2005: COPD, Asthma, cardiac heart failure; O'Gorman 2006: COPD, Rheumatoid arthritis, polymyalgia rheumatica, and cardiac pacemaker.

Fig. S11. Case fatality rate among hMPV-positive high-risk adults by region.



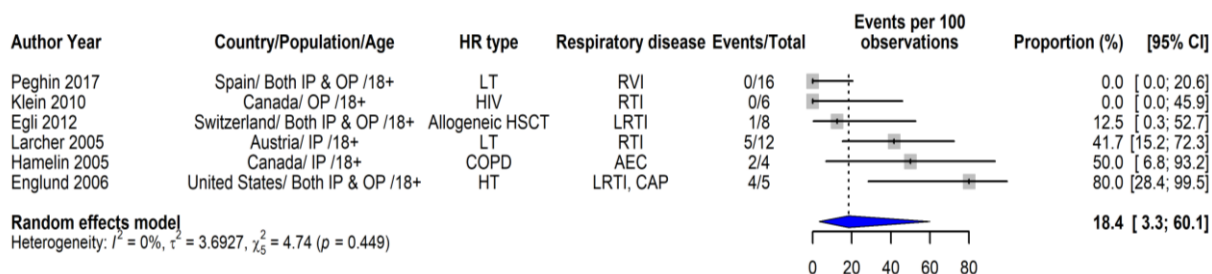
AEA: Acute Exacerbation of Asthma; AEC: Acute Exacerbation of COPD; ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CI: Confidence interval; COPD: Chronic Obstructive Pulmonary Disease; CRV infection: Community Respiratory Viruses infection; HM: Haematological Malignancies; HIV: Human Immunodeficiency Virus; HT: Haematopoietic transplant; hMPV: Human metapneumovirus; IC: Immunocompromised; ILI: Influenza-Like Illness; IP: Inpatient; LTCF: Long-Term Care Facility; LRTI: Lower Respiratory Tract Infection; NR: Not Reported; OP: Outpatient; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms; RVI: Respiratory Viral Infection; ST: Solid Transplant; URTI: Upper Respiratory Tract Infection. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. Kan 2022: Asthma/COPD; Vidaur 2019: COPD, Asthma, Non-Hodgkin lymphoma, Multiple myeloma, Heart transplant, Chemotherapy, Pancreas and kidney transplant and Systemic lupus erythematosus; Johnstone 2008: COPD, Asthma, Immunocompromised status: HIV, Congestive heart failure or ischemic heart disease and cancer; Martinello 2006: COPD; Hamelin 2005: COPD, asthma and cardiac heart failure; O'Gorman 2006: COPD, Rheumatoid arthritis, polymyalgia rheumatica, and cardiac pacemaker.

Fig. S12. Proportion of hMPV-positive high-risk adults requiring mechanical ventilation by type of high-risk population.



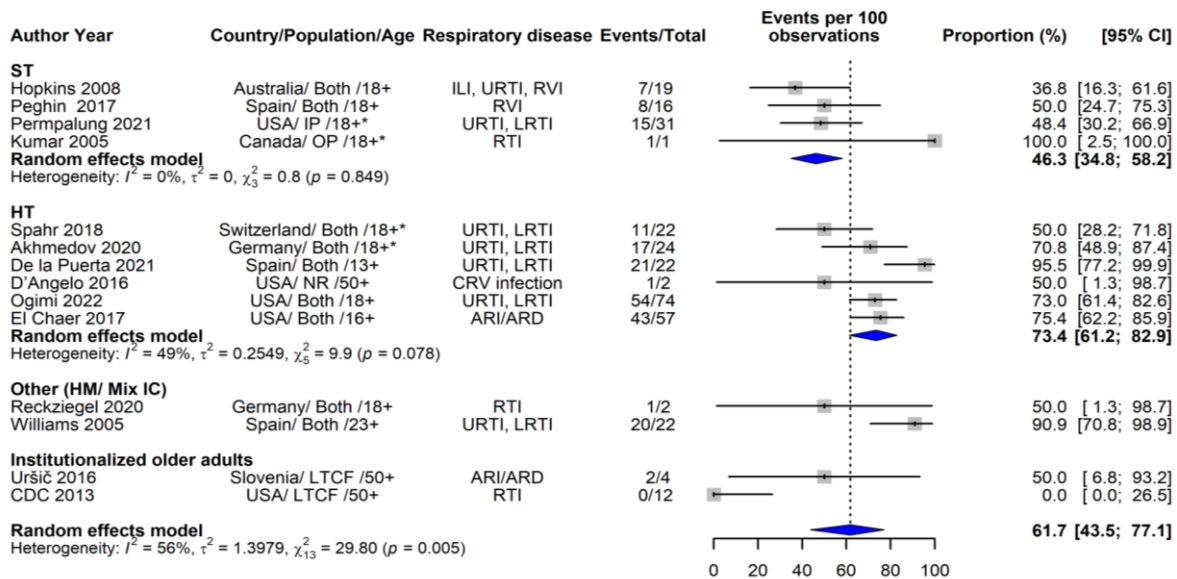
Note: For age categories marked with an asterisk (), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. Both' indicates instances that required medical attention in both outpatient and inpatient settings. AEC: Acute Exacerbation of COPD; ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CI: Confidence interval; COPD: Chronic Obstructive Pulmonary Disease; HM: Haematological Malignancies; HT: Haematopoietic Transplant; hMPV: Human metapneumovirus; IC: Immunocompromised; ILI: Influenza-Like Illness; IP: Inpatient; LRTI: Lower Respiratory Tract Infection; NR: Not Reported; OP: Outpatient; Other: Other Respiratory Diseases; RTISS: Respiratory Tract Infection Signs and Symptoms; RVI: Respiratory Viral Infection; ST: Solid Transplant; URTI: Upper Respiratory Tract Infection. Mix IC: includes haematological malignancies and malignancies, organ, and stem-cell transplantation or with autoimmune disorders combined).

Fig. S13. Proportion of hMPV-positive high-risk adults presenting pneumonia.



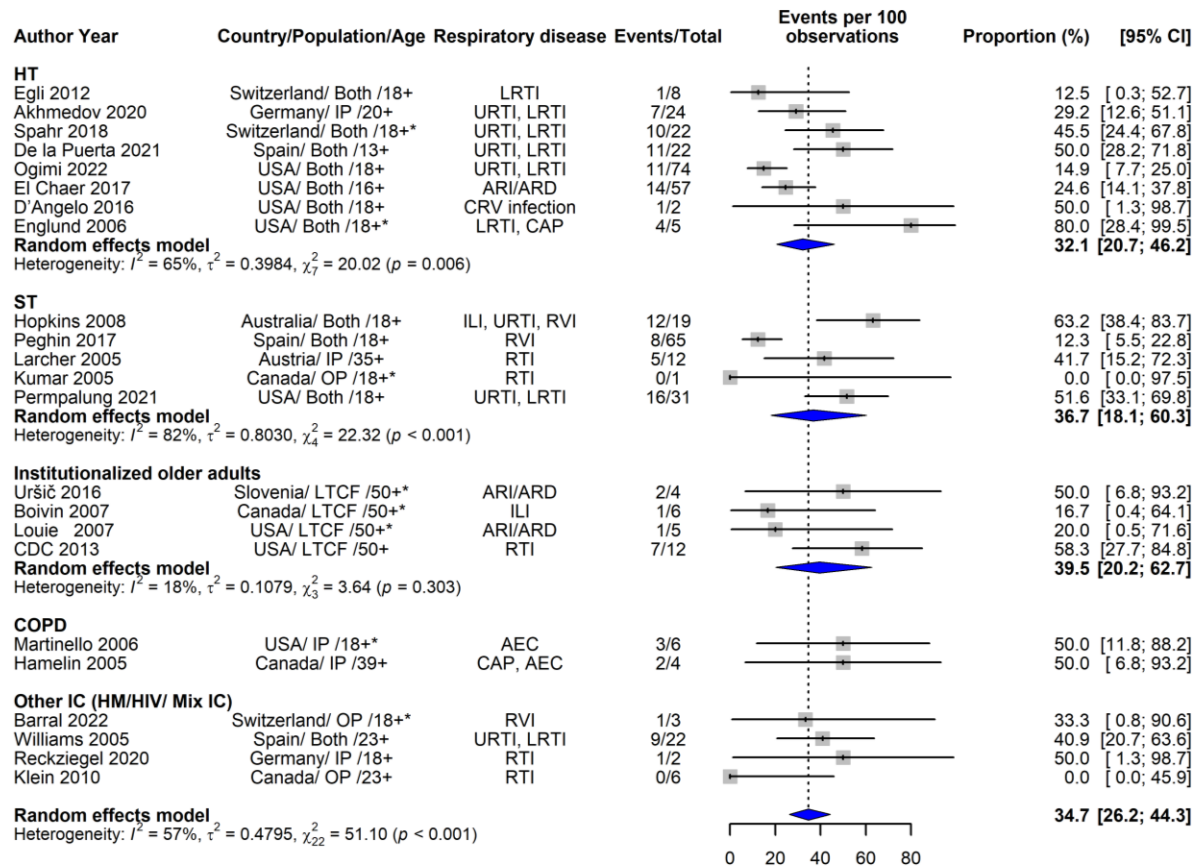
AEC: Acute Exacerbation COPD, Allogeneic HSCT: Allogeneic Haematopoietic Stem-Cell Transplant; CAP: Community-Acquired Pneumonia; CI: Confidence Interval, COPD: Chronic Obstructive Pulmonary Disease; HIV: Human Immunodeficiency Virus; HR: High Risk, HT: Haematopoietic Transplant; hMPV: Human metapneumovirus; IP: Inpatient; LT: Lung Transplant, LRTI: Low Respiratory Tract Infection; OP: Outpatient; RTI: Respiratory Tract Infection; RVI: Respiratory Viral Infection. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings.

Fig. S14. Proportion of upper respiratory tract infection in hMPV-positive high-risk adults by high-risk group.



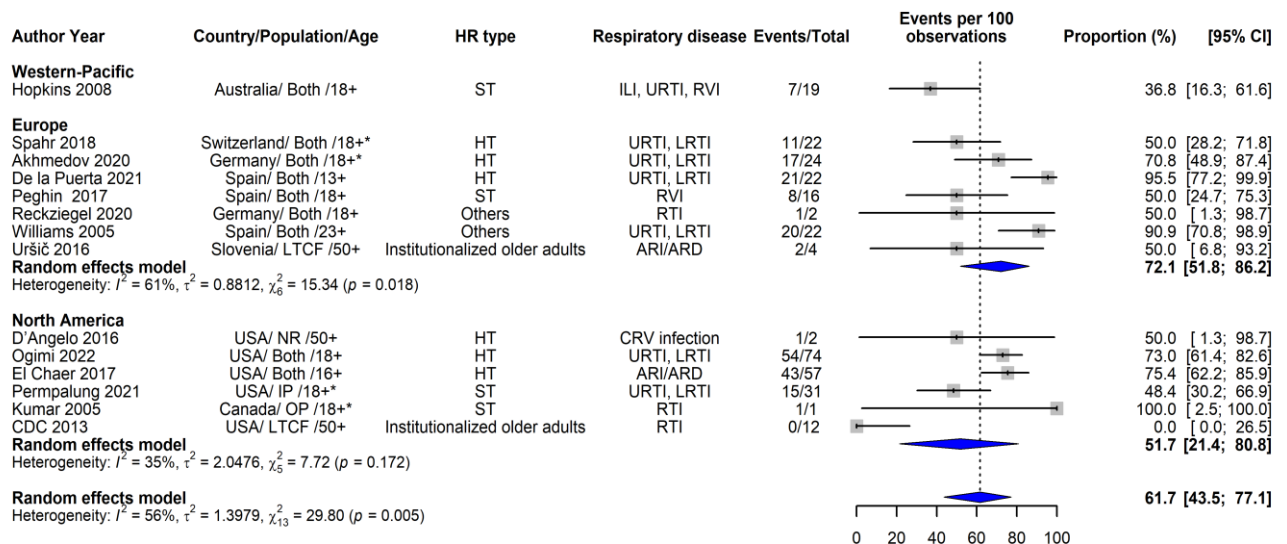
ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CI: Confidence Interval; CRV infection: Community Respiratory Viruses infection; IC: Immunocompromised; ILI: Influenza-Like Illness; IP: Inpatient; LTCF: Long-Term Care Facility; LRTI: Lower Respiratory Tract Infection; NR: Not Reported; OP: Outpatient; RTI: Respiratory Tract Infection; RVI: Respiratory Viral Infection; URTI: Upper Respiratory Tract Infection; HM: Haematological Malignancies; HT: Haematopoietic Transplant; hMPV: Human metapneumovirus ST: Solid Transplant. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. Reckziegel 2020: haematological malignancies; Williams 2005: Malignancies, organ, and stem-cell transplantation or with autoimmune disorders; D'Angelo 2016: Medically attended but not reported inpatient/outpatient.

Fig. S15. Proportion of lower respiratory tract infection in hMPV-positive high-risk adults by high-risk group.



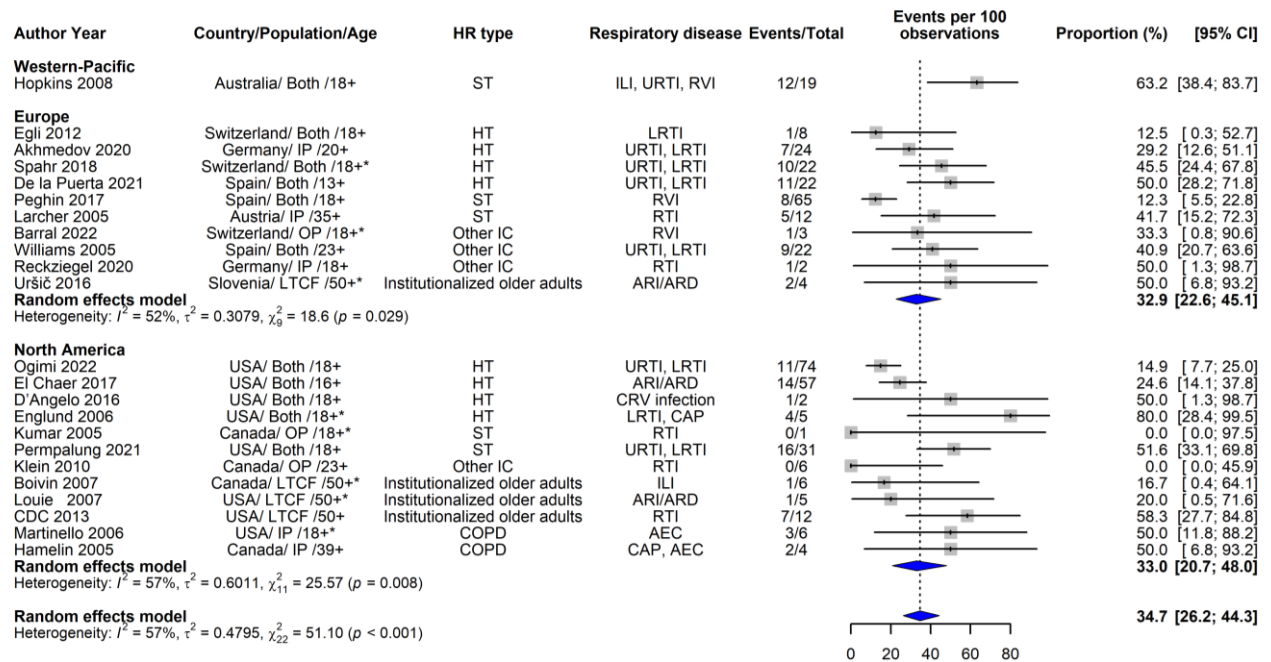
AEC: Acute Exacerbation COPD; ARI: Acute Respiratory Infection; ARD: Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CI: Confidence Interval; COPD: Chronic Obstructive Pulmonary Disease; CRV: Community Respiratory Virus; HIV: Human Immunodeficiency Virus; HM: Haematological Malignancies; HT: Haematopoietic Transplant; hMPV: Human metapneumovirus; IC: Immunocompromised; ILI: Influenza-Like Illness; LTCF: Long-Term Care Facilities; LRTI: Lower Respiratory Tract Infection; RTI: Respiratory Tract Infection; RVI: Respiratory Viral Infection; ST: Solid Transplant; URTI: Upper Respiratory Tract Infection. *Note: for age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. D'Angelo 2016: Medically attended but not reported; Barral 2022: haematological malignancies – before transplantation; Williams 2005: haematological malignancies; Reckziegel 2020: Malignancies, organ and stem-cell transplantation or with autoimmune disorders; Klein 2010: HIV.

Fig. S16. Proportion of upper respiratory tract infection in hMPV-positive high-risk adults by region.



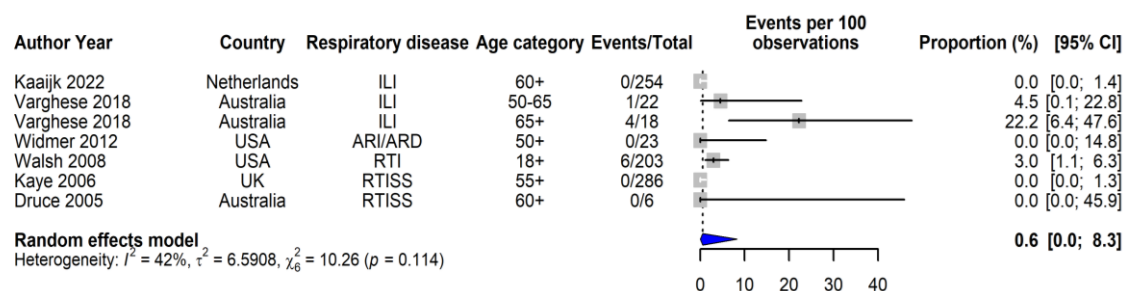
ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CI: Confidence Interval; CRV infection: Community Respiratory Viruses infection; HT: Haematopoietic Transplant; hMPV: Human metapneumovirus; ILI: Influenza-Like Illness; IP: Inpatient; LTCF: Long-Term Care Facility; LRTI: Lower Respiratory Tract Infection; NR: Not Reported; OP: Outpatient; RTI: Respiratory Tract Infection; RVI: Respiratory Viral Infection; ST: Solid Transplant; URTI: Upper Respiratory Tract Infection. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. Reckziegel 2020: haematological malignancies; Williams 2005: Malignancies, organ and stem-cell transplantation or with autoimmune disorders; D'Angelo 2016: Medically attended but not reported inpatient/outpatient.

Fig. S17. Proportion of lower respiratory tract infection in hMPV-positive high-risk adults by region.



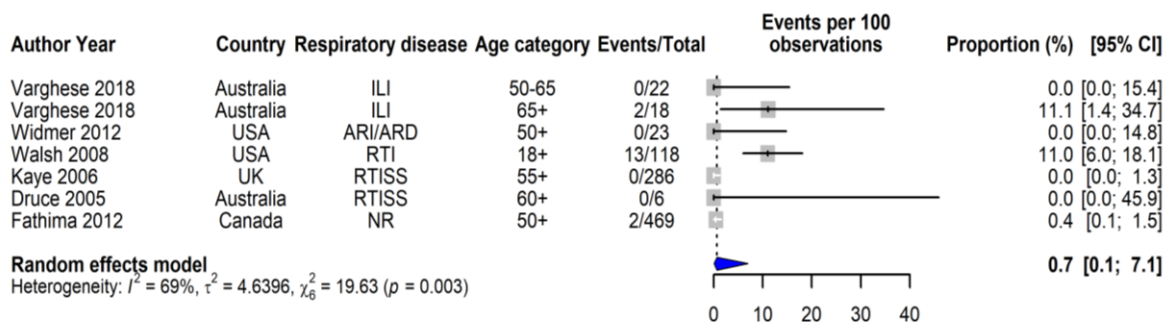
AEC: Acute Exacerbation of COPD; ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CI: Confidence Interval; COPD: Chronic Obstructive Pulmonary Disease; CRV infection: Community Respiratory Viruses infection; HR: High Risk; HT: Haematopoietic Transplant; hMPV: Human metapneumovirus; IC: Immunocompromised; ILI: Influenza-Like Illness; IP: Inpatient; LTCF: Long-Term Care Facility; LRTI: Lower Respiratory Tract Infection; NR: Not Reported; OP: Outpatient; RVI: Respiratory Viral Infection; RTI: Respiratory Tract Infection; ST: Solid transplant; URTI: Upper Respiratory Tract Infection. *Note: for age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered. 'Both' indicates studies where the population receiving medical attention included cases from outpatient and inpatient settings. D'Angelo 2016: Medically attended but not reported; Barral 2022: haematological malignancies – before transplantation; Williams 2005: haematological malignancies; Reckziegel 2020: Malignancies, organ and stem-cell transplantation or with autoimmune disorders; Klein 2010: human immunodeficiency virus.

Fig. S18. Proportion of hMPV-positive older adults coinfecting with influenza virus.



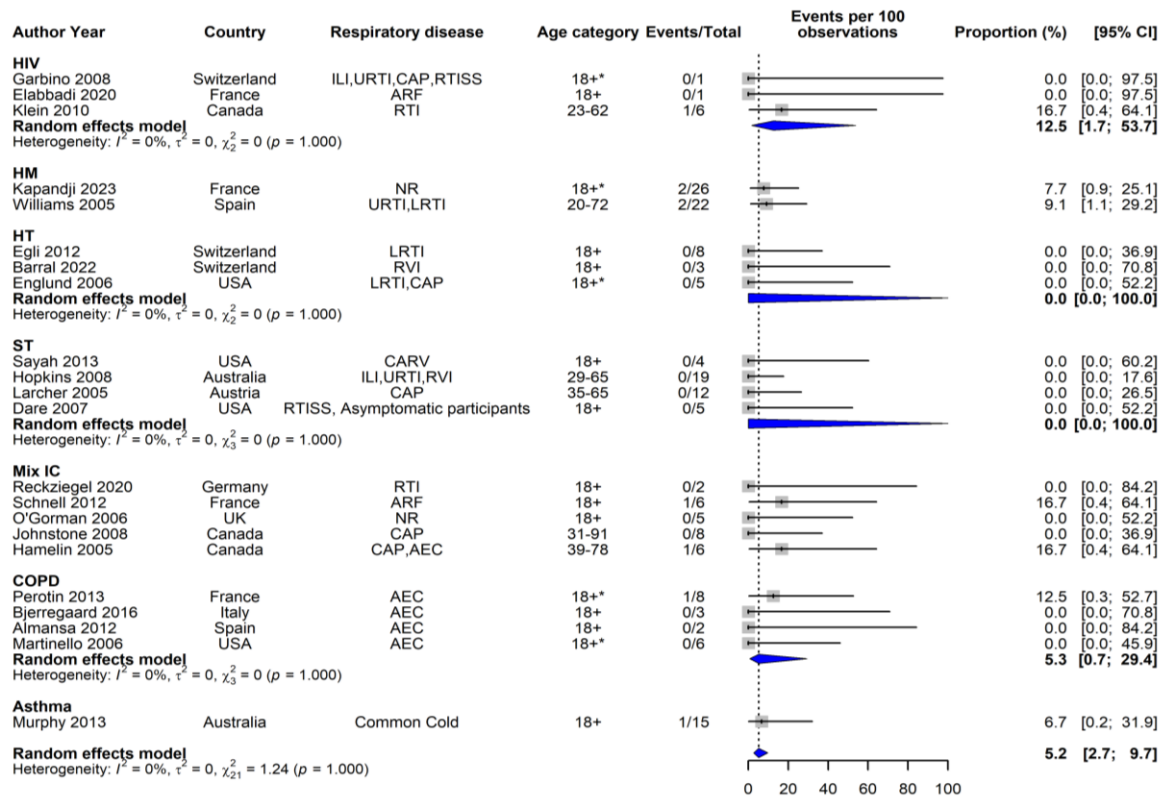
ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CI: Confidence Interval; hMPV: Human metapneumovirus; ILI: Influenza-Like Illness; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms. For Varghese 2018, the first row represents patients aged 50-65 years, while the second row describes the population aged ≥ 65 years.

Fig. S19. Proportion of hMPV-positive older adults coinfecting with RSV.



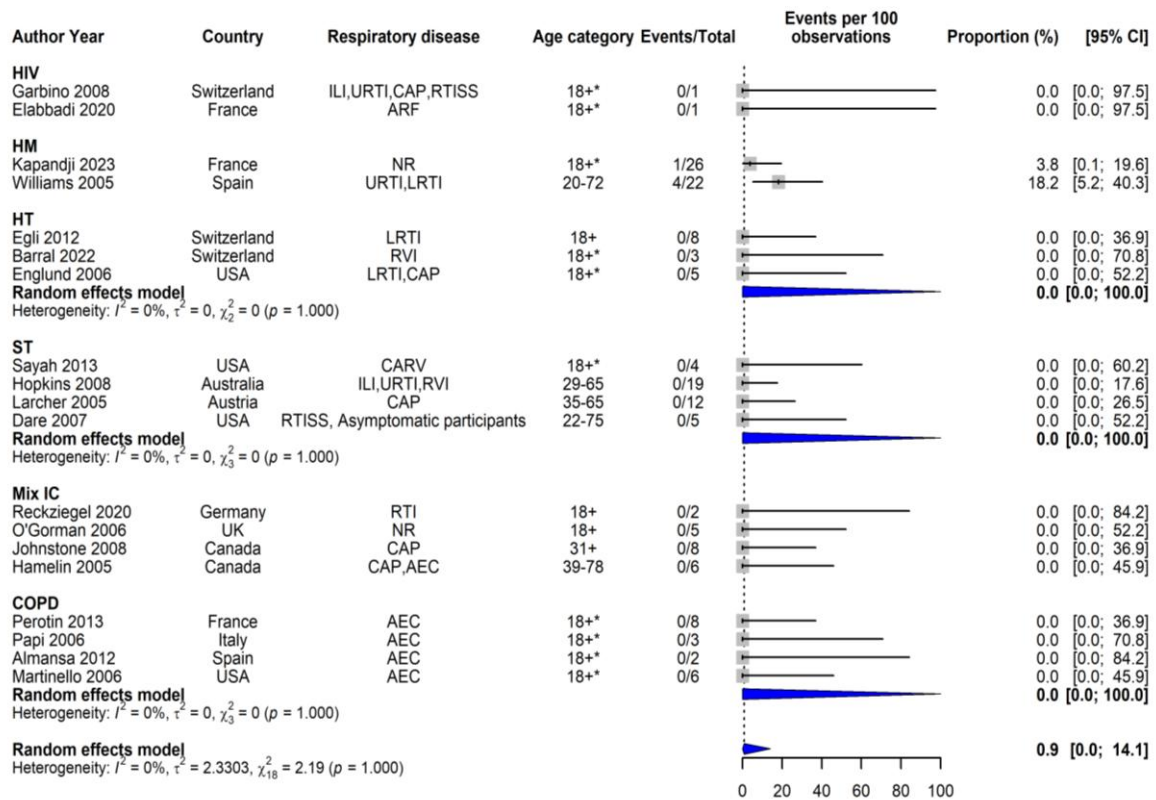
ARD: Severe Acute Respiratory Disease; ARI: Acute respiratory infection; CI: Confidence Interval; hMPV: Human metapneumovirus; ILI: Influenza-Like Illness; NR: Not Reported; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms. For Varghese 2018, the first row represents patients aged 50-65 years, while the second row describes the population aged ≥ 65 years.

Fig. S20. Proportion of hMPV-positive high-risk adults coinfectd with influenza virus by type of high-risk population.



AEC: Acute Exacerbation of COPD; ARF: Acute Respiratory Failure; ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; CAP: Community-Acquired Pneumonia; CARV: Community-Acquired Respiratory Virus; CI: Confidence Interval; COPD: Chronic Obstructive Pulmonary Disease; HIV: Human Immunodeficiency Virus; HM: Haematological Malignancies; HT: Haematopoietic Transplant; hMPV: Human metapneumovirus; IC: Immunocompromised; ILI: Influenza-Like Illness; LRTI: Lower Respiratory Tract Infection; NR: Not Reported; RVI: Respiratory Viral Infection; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms; ST: Solid Transplant; URTI: Upper Respiratory Tract Infection. Mixed IC groups included: Reckziegel 2020: Malignancies, organ/stem-cell transplantation or autoimmune disorders; Schnell 2012: patients with presence of a disease or treatment known to impair the immune system; O'Gorman 2006: COPD, rheumatoid arthritis, polymyalgia rheumatica, cardiac pacemaker; Johnstone 2008: COPD, asthma, HIV, congestive heart failure/ischemic heart disease, cancer; Hamelin 2005: COPD, asthma, and cardiac heart failure. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered.

Fig. S21. Proportion of hMPV-positive high-risk adults coinfecting with RSV by type of high-risk population.



AEC: Acute Exacerbation of COPD; ARF: Acute Respiratory Failure; CAP: Community-Acquired Pneumonia; CARV: Community-Acquired Respiratory Virus; CI: Confidence Interval; COPD: Chronic Obstructive Pulmonary Disease; HIV: Human Immunodeficiency Virus; HM: Haematological Malignancies; HT: Haematopoietic Transplant; hMPV: Human metapneumovirus; IC: Immunocompromised; ILI: Influenza-Like Illness; LRTI: Lower Respiratory Tract Infection; NR: Not Reported; RVI: Respiratory Viral Infection; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms; ST: Solid Transplant; URTI: Upper Respiratory Tract Infection. Mixed IC groups included: Reckziegel 2020: Malignancies, organ/stem-cell transplantation or autoimmune disorders; O'Gorman 2006: COPD, rheumatoid arthritis, polymyalgia rheumatica, cardiac pacemaker; Johnstone 2008: COPD, asthma, HIV, congestive heart failure/ischemic heart disease, cancer; Hamelin 2005: COPD, asthma, and cardiac heart failure.

Supplementary tables

Table S1. Search strings.

PubMed search string	Results
#1 HMPV "metapneumovirus"[MeSH] OR metapneumovirus*[tiab] OR hMPV*[tiab]	
#2 Geographical scope Europe[MeSH] OR Europe*[tw] OR Scandinavia*[tw] OR Scandinavia*[ad] OR Mediterranean[tw] OR Mediterranean[ad] OR Europe*[ad] OR Baltic[tw] OR Baltic[ad] OR UK[ad] OR "United Kingdom"[ad] OR England[ad] OR Engl*[ad] OR British[ad] OR UK[tw] OR "United Kingdom"[tw] OR England[tw] OR Engl*[tw] OR British[tw] OR Italy[ad] OR Italian[ad] OR Italy[tw] OR Italian[tw] OR Spain[ad] OR Spanish[ad] OR Spain[tw] OR Spanish[tw] OR German*[ad] OR Germany[tw] OR German*[tw] OR France[ad] OR French[ad] OR France[tw] OR French[tw] OR Belgium[ad] OR Belgian[ad] OR Belgium[tw] OR Belgian[tw] OR Austria*[tw] OR Austria*[ad] OR Denmark[tw] OR Denmark[ad] OR Danish[tw] OR Danish[ad] OR Finland[tw] OR Finland[ad] OR Finnish[tw] OR Finnish[ad] OR Ireland*[tw] OR Irish*[tw] OR Ireland*[ad] OR Irish*[ad] OR Netherlands[tw] OR Netherlands[ad] OR Dutch[tw] OR Dutch[ad] OR Portugal[tw] OR Portugal[ad] OR Portuguese[ad] OR Portuguese[tw] OR Sweden[tw] OR Sweden[ad] OR Swedish[tw] OR Swedish[ad] OR Switzerland[tw] OR Switzerland[ad] OR Swiss[tw] OR Swiss[ad] OR Bulgaria*[tw] OR Bulgaria*[ad] OR Croat*[tw] OR Croat*[ad] OR Cyprus[tw] OR Cyprus[ad] OR Cypriot*[ad] OR Cypriot*[tw] OR Czech[tw] OR Czech[ad] OR Estonia*[tw] OR Estonia*[ad] OR Greece[tw] OR Greece[ad] OR Greek[tw] OR Greek[ad] OR Hungary*[tw] OR Hungary*[ad] OR Iceland*[tw] OR Iceland*[ad] OR Latvi*[tw] OR Latvi*[ad] OR Liechtenstein*[tw] OR Liechtenstein*[ad] OR Lithuania*[tw] OR Lithuania*[ad] OR Luxembourg*[tw] OR Luxembourg*[ad] OR Malta[tw] OR Malta[ad] OR Maltese[tw] OR Maltese[ad] OR Norway[ad] OR Norway[tw] OR Norwegian*[ad] OR Norwegian*[tw] OR Svalbard*[tw] OR Svalbard*[ad] OR Poland*[tw] OR Polish*[tw] OR Poland*[ad] OR Polish*[ad] OR Romania*[tw] OR Romania*[ad] OR Roumania*[tw] OR Roumania*[ad] OR Rumania*[tw] OR Rumania*[ad] OR Slovak*[tw] OR Slovak*[ad] OR Slovenia*[tw] OR Slovenia*[ad] OR "United States"[ad] OR USA[ad] OR US[ad] OR U.S.A.[ad] OR America*[ad] OR United States[tw] OR USA[tw] OR US[tw] OR U.S.A.[tw] OR America*[tw] OR Alabama[ad] OR Alaska[ad] OR Arizona[ad] OR Arkansas[ad] OR California[ad] OR Colorado[ad] OR Connecticut[ad] OR Delaware[ad] OR Florida[ad] OR Georgia[ad] OR Hawaii[ad] OR Idaho[ad] OR Illinois[ad] OR Indiana[ad] OR Iowa[ad] OR Kansas[ad] OR Kentucky[ad] OR Louisiana[ad] OR Maine[ad] OR Maryland[ad] OR Massachusetts[ad] OR Michigan[ad] OR Minnesota[ad] OR Mississippi[ad] OR Missouri[ad] OR Montana[ad] OR Nebraska[ad] OR Nevada[ad] OR New Hampshire[ad] OR New Jersey[ad] OR New Mexico[ad] OR New York[ad] OR North Carolina[ad] OR North Dakota[ad] OR Ohio[ad] OR Oklahoma[ad] OR Oregon[ad] OR Pennsylvania[ad] OR Rhode Island[ad] OR South Carolina[ad] OR South Dakota[ad] OR Tennessee[ad] OR Texas[ad] OR Utah[ad] OR Vermont[ad] OR Virginia[ad] OR Washington[ad] OR West Virginia[ad] OR Wisconsin[ad] OR Wyoming[ad] OR Alabama[tw] OR Alaska[tw] OR Arizona[tw] OR Arkansas[tw] OR California[tw] OR Colorado[tw] OR Connecticut[tw] OR Delaware[tw] OR Florida[tw] OR Georgia[tw] OR Hawaii[tw] OR Idaho[tw] OR Illinois[tw] OR Indiana[tw] OR Iowa[tw] OR Kansas[tw] OR Kentucky[tw] OR Louisiana[tw] OR Maine[tw] OR Maryland[tw] OR Massachusetts[tw] OR Michigan[tw] OR Minnesota[tw] OR Mississippi[tw] OR Missouri[tw] OR Montana[tw] OR Nebraska[tw] OR Nevada[tw] OR New Hampshire[tw] OR New Jersey[tw] OR New Mexico[tw] OR New York[tw] OR North Carolina[tw] OR North Dakota[tw] OR Ohio[tw] OR Oklahoma[tw] OR Oregon[tw] OR Pennsylvania[tw] OR Rhode Island[tw] OR South Carolina[tw] OR South Dakota[tw] OR Tennessee[tw] OR Texas[tw] OR Utah[tw] OR Vermont[tw] OR Virginia[tw] OR Washington[tw] OR West Virginia[tw] OR Wisconsin[tw] OR Wyoming[tw] OR Australia*[tw] OR Australia*[ad] OR Canad*[tw] OR Canad*[ad] OR Japan*[tw] OR Japan*[ad] OR New Zealand*[tw] OR New Zealand*[ad]	
#3 Studies focusing on children only (child*[ti] OR newborn*[ti] OR neonat*[ti] OR infan*[ti] OR toddler*[ti] OR preschool[ti] OR schoolchild*[ti] OR adolescent*[ti] OR teen*[ti] OR pediater*[ti] OR paediatr*[ti] OR juven*[ti] OR youth*[ti] NOT (adult*[ti] OR "middle aged"[ti] OR "middle age"[ti] OR elderly[ti] OR elders[ti] OR community-dwelling[ti] OR geriatric[ti]))	
#4 Studies focusing on animals only Animals[Mesh] NOT (Humans[Mesh] AND Animals[Mesh])	
#5 Non-pertinent publication types case reports[pt] OR editorial[pt] OR letter[pt] OR news[pt] OR comment[pt]	
Other limits: - Abstract available - Publications since 2001/01/01	
Final search strategy: #1 AND #2 NOT (#3 OR #4 OR #5)	1181

Embase search	
#1 HMPV 'Metapneumovirus'/exp OR metapneumovirus*:ti,ab OR hMPV*:ti,ab	
#2 Geographical scope 'Europe'/exp OR Europe*:ti,ab,ad OR Scandinavia*:ti,ab,ad OR Mediterranean*:ti,ab,ad OR Baltic*:ti,ab,ad OR UK*:ti,ab,ad OR 'United Kingdom':ti,ab,ad OR England*:ti,ab,ad OR Engl*:ti,ab,ad OR British*:ti,ab,ad OR Italy*:ti,ab,ad OR Italian*:ti,ab,ad OR Spain*:ti,ab,ad OR Spanish*:ti,ab,ad OR Germany*:ti,ab,ad OR German*:ti,ab,ad OR France*:ti,ab,ad OR French*:ti,ab,ad OR Belgium*:ti,ab,ad OR Belgian*:ti,ab,ad OR Austria*:ti,ab,ad OR Denmark*:ti,ab,ad OR Danish*:ti,ab,ad OR Finland*:ti,ab,ad OR Finnish*:ti,ab,ad OR Ireland*:ti,ab,ad OR Irish*:ti,ab,ad OR Netherlands*:ti,ab,ad OR Dutch*:ti,ab,ad OR Portugal*:ti,ab,ad OR Portuguese*:ti,ab,ad OR Sweden*:ti,ab,ad OR Swedish*:ti,ab,ad OR Switzerland*:ti,ab,ad OR Swiss*:ti,ab,ad OR Bulgaria*:ti,ab,ad OR Croat*:ti,ab,ad OR Cyprus*:ti,ab,ad OR Cypriot*:ti,ab,ad OR Czech*:ti,ab,ad OR Estonia*:ti,ab,ad OR Greece*:ti,ab,ad OR Greek*:ti,ab,ad OR Hungar*:ti,ab,ad OR Iceland*:ti,ab,ad OR Latvi*:ti,ab,ad OR Liechtenstein*:ti,ab,ad OR Lithuania*:ti,ab,ad OR Luxembourg*:ti,ab,ad OR Malta*:ti,ab,ad OR Maltese*:ti,ab,ad OR Norway*:ti,ab,ad OR Norwegian*:ti,ab,ad OR Svalbard*:ti,ab,ad OR Poland*:ti,ab,ad OR Polish*:ti,ab,ad OR Romania*:ti,ab,ad OR Roumania*:ti,ab,ad OR Rumania*:ti,ab,ad OR Slovak*:ti,ab,ad OR Slovenia*:ti,ab,ad OR 'United States':ad OR USA:ad OR US:ad OR "U.S.A.":ad OR America*:ad OR "United States":ti,ab OR USA:ti,ab OR US:ti,ab OR "U.S.A.":ti,ab OR America*:ti,ab OR Alabama:ad OR Alaska:ad OR Arizona:ad OR Arkansas:ad OR California:ad OR Colorado:ad OR Connecticut:ad OR Delaware:ad OR Florida:ad OR Georgia:ad OR Hawaii:ad OR Idaho:ad OR Illinois:ad OR Indiana:ad OR Iowa:ad OR Kansas:ad OR Kentucky:ad OR Louisiana:ad OR Maine:ad OR Maryland:ad OR Massachusetts:ad OR Michigan:ad OR Minnesota:ad OR Mississippi:ad OR Missouri:ad OR Montana:ad OR Nebraska:ad OR Nevada:ad OR "New Hampshire":ad OR "New Jersey":ad OR "New Mexico":ad OR "New York":ad OR "North Carolina":ad OR "North Dakota":ad OR Ohio:ad OR Oklahoma:ad OR Oregon:ad OR Pennsylvania:ad OR "Rhode Island":ad OR "South Carolina":ad OR "South Dakota":ad OR Tennessee:ad OR Texas:ad OR Utah:ad OR Vermont:ad OR Virginia:ad OR Washington:ad OR "West Virginia":ad OR Wisconsin:ad OR Wyoming:ad OR Alabama:ti,ab OR Alaska:ti,ab OR Arizona:ti,ab OR Arkansas:ti,ab OR California:ti,ab OR Colorado:ti,ab OR Connecticut:ti,ab OR Delaware:ti,ab OR Florida:ti,ab OR Georgia:ti,ab OR Hawaii:ti,ab OR Idaho:ti,ab OR Illinois:ti,ab OR Indiana:ti,ab OR Iowa:ti,ab OR Kansas:ti,ab OR Kentucky:ti,ab OR Louisiana:ti,ab OR Maine:ti,ab OR Maryland:ti,ab OR Massachusetts:ti,ab OR Michigan:ti,ab OR Minnesota:ti,ab OR Mississippi:ti,ab OR Missouri:ti,ab OR Montana:ti,ab OR Nebraska:ti,ab OR Nevada:ti,ab OR "New Hampshire":ti,ab OR "New Jersey":ti,ab OR "New Mexico":ti,ab OR "New York":ti,ab OR "North Carolina":ti,ab OR "North Dakota":ti,ab OR Ohio:ti,ab OR Oklahoma:ti,ab OR Oregon:ti,ab OR Pennsylvania:ti,ab OR "Rhode Island":ti,ab OR "South Carolina":ti,ab OR "South Dakota":ti,ab OR Tennessee:ti,ab OR Texas:ti,ab OR Utah:ti,ab OR Vermont:ti,ab OR Virginia:ti,ab OR Washington:ti,ab OR "West Virginia":ti,ab OR Wisconsin:ti,ab OR Wyoming:ti,ab OR Australia*:ti,ab OR Australia*:ad OR Canad*:ti,ab OR Canad*:ad OR Japan*:ti,ab OR Japan*:ad OR "New Zealand":ti,ab OR "New Zealand":ad	
#3 Studies focusing on children only (child*:ti OR newborn*:ti OR neonat*:ti OR infan*:ti OR toddler*:ti OR preschool:ti OR schoolchild*:ti OR adolescen*:ti OR teen*:ti OR pediater*:ti OR paediatr*:ti OR juven*:ti OR youth*:ti) NOT (adult*:ti OR "middle aged":ti OR "middle age":ti OR elderly:ti OR elders:ti OR "community-dwelling":ti OR geriatric:ti)	
#4 Studies focusing on animals only 'animal'/exp NOT ('human'/exp AND 'animal'/exp)	
#5 Only pertinent publication types [article]/lim OR [article in press]/lim OR [review]/lim Other limits: - Abstract available - Publications since 2001/01/01	
Final search strategy: #1 AND #2 AND #5 NOT (#3 OR #4)	

Table S2. Outcome definitions.

Outcome	Definition
Incidence of HMPV infection (symptomatic and asymptomatic ¹)	The number of new cases of HMPV infection (symptomatic and asymptomatic) among the total population at-risk (per population/per person-years)
Proportion of HMPV infection (symptomatic and asymptomatic ¹)	The number of HMPV infection cases (symptomatic and asymptomatic) among the total population
Proportion of symptomatic respiratory infections (URTI ² and LRTI ³) within HMPV infection ^{31,32}	• Proportion of symptomatic respiratory infections (URTI) within HMPV infection: The number of symptomatic respiratory infections (URTI) divided by the total number of HMPV infections. • Proportion of symptomatic respiratory infections (LRTI) within HMPV infection: The number of symptomatic respiratory infections (LRTI) divided by the total number of HMPV infections
HMPV-related signs and symptoms ⁴	The specific signs and symptoms associated with HMPV infection, which may include fever, tachypnoea, O2 saturation <90%, cough, sore throat, difficulty breathing, fatigue, and other respiratory or systemic manifestations
Hospitalisation rate	The number of hospitalised hMPV cases in relation to the total population (per population/per person-years)
HMPV-related hospitalisation: LoS, ICU, and readmission	The number of HMPV cases that are hospitalised, admitted to the ICU or readmitted out of all HMPV cases, and the duration of hospitalisation or ICU stay (mean/median)
HMPV-related outpatient and emergency department consultations	The proportion of visits to outpatient clinics or emergency departments specifically attributed to HMPV infection
Occurrence of complications and sequelae after HMPV infection ⁵	The proportion of HMPV patients that develop complications or long-term consequences following HMPV infection, limited to community-acquired pneumonia

¹ Definitions used will be extracted from the articles and handled in data synthesis/analysis.

² Symptomatic infections that involve the upper respiratory tract infections involve the nose, sinuses, pharynx, larynx, or large airways.

³ Symptomatic infections that involve the lower respiratory system, or lower respiratory tract, including the trachea, the bronchi and bronchioles, or the alveoli, which make up the lungs.

⁴ Additional signs & symptoms will be added if identified.

⁵ Complications following HMPV infection defined as adverse conditions or events that occur as a result of HMPV infection, and sequelae defined as long-term effects that may persist following HMPV infection. Definitions used will be extracted from the articles and handled in data synthesis/analysis.

Outcome	Definition
	(CAP), respiratory failure, acute respiratory distress syndrome (ARDS), cardiopulmonary complications, and the requirement for mechanical ventilation
Case fatality rate	The proportion of deaths among individuals diagnosed with HMPV infection
Mortality rate	The number of deaths in HMPV cases in relation to the total population (per population/per person-years)
Exacerbation of underlying disease ¹ (in high-risk groups)	Worsening or flare-up of pre-existing medical conditions in high-risk individuals due to HMPV infection, such as those with COPD/asthma, cardiovascular diseases, or immunocompromised conditions, because of HMPV infection. This will be included as the proportion of a high-risk population developing an exacerbation due to HMPV infection.
Occurrence of coinfection (with RSV and influenza)	The proportion of HMPV-infected individuals simultaneously infected with respiratory syncytial virus (RSV) or influenza
Seasonality (incl. comparison with RSV and influenza)	Variations in the occurrence of HMPV infection across different seasons and comparison with the seasonal patterns of RSV and influenza reported in the same study
Transmission from children to adults	Evaluating the potential for HMPV transmission from infected children to adults and the role of children in the spread of the infection within the community

Table S3. Inclusion criteria.

Parameter	Inclusion Criteria
Population	- General population of adults aged 50 years and older⁶ - High-risk adults aged 18 years and older (i.e., COPD, asthma, immunocompromised status, dementia, frailty status (according to a frailty score index)^{33,34} and cardiovascular diseases (e.g., CHD). The immunocompromised status will include ³⁵: - Solid or haematologic malignancies that are actively treated - Solid organ transplant recipients - Haematologic transplant or CAR-T-cell therapy recipients - Primary immunodeficiency disorders - HIV - Active treatment with high-dose corticosteroids and other immunosuppressive drugs
Intervention	None
Comparison	- Older adults 50 years (if possible by age group)* - High-risk adults aged ≥18 years (if possible by age group)* - By category of high-risk group (i.e., COPD, asthma, immunocompromised status, dementia, frailty status, cardiovascular diseases, malignancies) - By region (North America, Europe or Western Pacific) - By population (community-based or medically attended) <i>*The age groups for comparison will be determined by the availability of data, preferably in deciles.</i>
Outcomes	- Incidence and proportion of HMPV infection (symptomatic and asymptomatic) - Proportion of symptomatic respiratory infections (URTI and LRTI) within HMPV infection - HMPV-related signs and symptoms - HMPV-related hospitalisation (proportion of hospitalisations, hospitalisation rate), also including: - LoS - ICU admission - readmission - HMPV-related outpatient and emergency department consultations - Occurrence of complications and sequelae after HMPV infection (CAP, respiratory failure, ARDS, cardiopulmonary complications, need for mechanical ventilation) - Mortality/CFR due to HMPV - Exacerbation of underlying disease (in high-risk groups, see population) - Occurrence of coinfection (with RSV, influenza) - Seasonality (incl. comparison with RSV and influenza) - Transmission from children to adults - Risk factors for progression to severe disease
Publication period	Studies dating from 2001 to date of search inclusive

⁶ Include studies with an average population age of 50 years or older.

Parameter	Inclusion Criteria
Study design	Included: • Peer-reviewed observational studies on the above HMPV outcomes, including cohort, case-control and surveillance reports • Interventional trials (if epidemiological data can be extracted from a relevant control group) • Studies of point-of-care testing (if from a clearly defined unbiased sample) • Validation studies of laboratory assays based on systematic testing or testing of an unbiased sample of routinely received specimens • Longitudinal studies of high-risk groups (as defined above), including studies of pharmaceutical interventions • Longitudinal and surveillance studies in long-term care facilities, reporting annual or seasonal incidence of HMPV (as opposed to reporting the attack rate during an outbreak) Excluded: • Literature review articles (reference lists will be scanned to identify relevant articles) • Reports on hospital-acquired infections • Case reports • In vitro studies • Genetic studies • Seroprevalence studies • Studies on HMPV subtype identification only • Animal studies • Immunogenicity, safety, and human challenge studies • Environmental studies • Economic and quality of life studies • Modelling studies • Knowledge, attitude and perception studies • Studies in travellers & children • Studies lacking clearly defined denominator data (such as data on the follow-up time) • Studies lacking clearly defined study populations Studies not reporting data in those aged ≥ 50 (general population older adults) or in high-risk groups aged ≥ 18 (for instance, if data are only reported for all adults over 18 years of age and separate estimates for those aged 50 and over or high-risk groups are not reported)
Language	No language restriction
Other	Included: • Studies from developed countries, including Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, UK, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia, Iceland, Norway, Switzerland, Australia, Canada, Japan, New Zealand, USA • PCR-confirmed HMPV (primary endpoint) or serologically confirmed HMPV (secondary endpoint) Excluded: • Studies from countries outside the geographical scope of interest • HMPV cases identified through other methodologies than PCR or serology

Table S4. Risk of bias assessment.

A. Risk of bias checklists

JBI Prevalence checklist

#	Question	Response
1	Was the sample frame appropriate to address the target population?	Yes/No/Unclear/Not applicable
2	Were study participants sampled in an appropriate way?	
3	Was the sample size adequate?	
4	Were the study subjects and the setting described in detail?	
5	Was the data analysis conducted with sufficient coverage of the identified sample?	
6	Were valid methods used for the identification of the condition?	
7	Was the condition measured in a standard, reliable way for all participants?	
8	Was there appropriate statistical analysis?	
9	Was the response rate adequate, and if not, was the low response rate managed appropriately?	

JBI Cohort checklist

#	Question	Response
1	Were the two groups similar and recruited from the same population?	Yes/No/Unclear/Not applicable
2	Were the exposures measured similarly to assign people to both exposed and unexposed groups?	
3	Was the exposure measured in a valid and reliable way?	
4	Were confounding factors identified?	
5	Were strategies to deal with confounding factors stated?	
6	Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?	
7	Were the outcomes measured in a valid and reliable way?	
8	Was the follow up time reported and sufficient to be long enough for outcomes to occur?	
9	Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	
10	Were strategies to address incomplete follow up utilised?	
11	Was appropriate statistical analysis used?	

JBI Case series checklist

#	Question	Response
1	Were there clear criteria for inclusion in the case series?	Yes/No/Unclear/Not applicable
2	Was the condition measured in a standard, reliable way for all participants included in the case series?	
3	Were valid methods used for identification of the condition for all participants included in the case series?	
4	Did the case series have consecutive inclusion of participants?	
5	Did the case series have complete inclusion of participants?	
6	Was there clear reporting of the demographics of the participants in the study?	
7	Was there clear reporting of clinical information of the participants?	
8	Were the outcomes or follow up results of cases clearly reported?	
9	Was there clear reporting of the presenting site(s)/clinic(s) demographic information?	
10	Was statistical analysis appropriate?	

JBI Cross-sectional checklist

#	Question	Response
1	Were the criteria for inclusion in the sample clearly defined?	Yes/No/Unclear/Not applicable
2	Were the study subjects and the setting described in detail?	
3	Was the exposure measured in a valid and reliable way?	
4	Were objective, standard criteria used for measurement of the condition?	
5	Were confounding factors identified?	
6	Were strategies to deal with confounding factors stated?	
7	Were the outcomes measured in a valid and reliable way?	
8	Was appropriate statistical analysis used?	

Clarification Note: Green: Signifies affirmative (yes). Red: Indicates negative (no). Yellow: Implies an unclear response. NA (Not Applicable): Indicates that the question is not relevant in this context. The column numbers refer to the corresponding item on the checklist, e.g. number "1" placed in the first column directly matches the first question on the applicable checklist.

B. Risk of bias assessment results

RoB assessment of prevalence studies.

The JBI checklist for prevalence studies was used to assess 66 studies. We identified studies that were limited in generalisability and representativeness, mainly due to the dependence of data on a single centre or a very specific, often narrowly defined, geographic location (32 studies). Potential biases also include convenience samples or a non-detailed description of sampling strategies, which leads to unclear participant selection processes (13 studies). Another recurring concern in these studies was the small sample sizes, frequently below the threshold needed for adequate statistical power (19 studies).

Author Year	1	2	3	4	5	6	7	8	9
Foley 2022	✓	✗	✓	✗	✓	✓	✓		NA
Zimmerman 2022	✓	✓	✓	✗	✗	✓			
Kaaijk 2022	✓	✓	✓	✓					
Kozinska 2022	✗	✓		✗					
Kurai 2022	✗	✗	✓	✗					
Debes 2021	✗	✓		✗					
Subissi 2021	✓	✓	✓	✗					NA
Korsun 2021	✓	✓		✓	✓				✓
De la Puerta 2021	✗	✓							NA
Sieling 2021	✓	✓	✓	✓					NA
Moret 2021	✗	✓	✓	✓					
Reckziegel 2020	✗	✗	✓	✗					✓
Howard 2021	✓	✓	✓	✓					NA
Souty 2019	✓	✓	✓	✓					✗
Varghese 2018	✓	✓	✓	✗					✓
Chasqueira 2018	✗	✓		✗	✗				✗
van Beek 2017	✓	✓	✓	✗					✓
Uršič 2016	✗	✗	✗	✓					✓
Wansaula 2016	✓	✓	✗						
Widmer 2014	✓	✓		✓	NA	✓	✓		✗
Reiche 2014	✓	✓	✓	✗	✓	✗	✗		NA
Walker 2014	✗	✓		✓		✓			NA
Ambrosioni 2014	✗	✓	✓	✗					NA
Litwin 2014	✗	✗	✓	✗	NA				✓
Perotin 2013	✗	✓	✗	✓					✓
Fathima 2012	✓	✓	✓	✗					NA
Tanner 2012	✓	✓		✗					NA
Widmer 2012	✗	✓		✓					✗
Chan 2011	✓	✓	✓		✓				
Guido 2011	✗	✗	✗	✗	✗				NA
Weinberg 2010	✗	✓	✓	✓	✓				✓

Author Year	1	2	3	4	5	6	7	8	9
Gioula 2010									NA
Kumar 2010									
Klein 2010									
Gottlieb 2009									
Walsh 2008									
Falsey 2008									NA
Kaye 2006									
Williams 2005									NA
Kumar 2005									
Beckham 2005									
Druce 2005									
Bastien 2003									NA
Barral 2022									
Permpalung 2021									
Samannodi 2021									
Ponsford 2021									
Elabbadi 2020									
Schneider 2020									NA
Saarela 2020									
Verduyn 2019									NA
Russell 2018									
Visseaux 2017									NA
Bonnin 2016									
Radin 2014									
Fowlkes 2014									
Almansa 2012									NA
Ikematsu 2012									
Dimopoulos 2012									NA
Hernes 2011					NA			NA	
Bjerregaard 2016									NA
Magnusson 2018									
Sayah 2013									NA
Papi 2006									NA
Stockwell 2022									
Martino 2005									

RoB assessment of cohort studies.

Nine studies were assessed using the JBI checklist for cohort studies and some of the concerns include unclear exclusion criteria (1 study), potential collection biases due to the

retrospective nature of some studies (1 study), and limitations arising from focusing on a small panel of viruses (2 study).

Author Year	1	2	3	4	5	6	7	8	9	10	11
Loubet 2021											
Stjärne Aspelund 2018	NA	NA	NA		NA						NA
Peghin 2017	NA				NA						NA
Masse 2017	NA	NA			NA	NA		NA			NA
D'Angelo 2016	NA				NA						NA
Sundaram 2014	NA	NA	NA								NA
Jansen 2013	NA	NA			NA						NA
Murphy 2013											NA
Schnell 2012	NA				NA	NA					NA

RoB assessment of case series.

Thirty-four studies were assessed with JBI Case series checklist the concerns included: lack of clarity regarding which patients were eligible for the study. Ambiguity in inclusion and exclusion criteria (4 studies), limitation in the research methodology, specifically in the diagnostic approach to symptomatic cases (3 studies), non-consecutive or selective nature of sample collection (6 studies), limited demographic and clinical data collection and reporting (11 studies) (only including patients admitted to the ICU, suggesting a restrictive sample selection that could limit the generalisation of the findings to broader populations (1 study) and for not being clear in the description of hospitalisations in the presented data, raising doubts about the consistency and reliability of the reported information (2 studies).

Author year	1	2	3	4	5	6	7	8	9	10
Kapandji 2023	NA					NA			NA	NA
Jones 2022						NA	NA	NA	NA	
de Zwart 2020										
Ciotti 2020								NA		
Akhmedov 2020	NA			NA				NA	NA	
Vidaur 2019		NA	NA	NA					NA	
Spahr 2018				NA	NA	NA	NA			
El Chaer 2017										
Spires 2017		NA				NA	NA	NA	NA	
Niggli 2016										
CDC 2013	NA								NA	
Renaud 2013				NA						
Matsuzaki 2013								NA	NA	
Egli 2012						NA			NA	
Deqail 2012	NA	NA	NA							

Author year	1	2	3	4	5	6	7	8	9	10
Te Wierik 2012										
Müller 2009										
McManus 2008										
Hopkins 2008										
Garbino 2008										
Johnstone 2008										
Louie 2007										
Englund 2006										
Martinello 2006										
Rohde 2005										
Larcher 2005										
Sumino 2005										
Hamelin 2005										
Carr 2005										
Rachow 2020										NA
Pagani 2015									NA	NA
Boivin 2007										NA
O'Gorman 2006										
Dare 2007										

RoB assessment of cross-sectional studies.

A total of ten studies were assessed using the JBI checklist for analytical cross-sectional studies. More than 80% of the studies provided clear criteria for sample inclusion, described the study subjects and setting in detail, measured exposure and outcomes validly and reliably, and used appropriate statistical analyses. However, the identification and management of confounding factors was a notable weakness, with only around 50% of studies clearly addressing this aspect.

Author year	1	2	3	4	5	6	7	8
Kan 2022								
Saraya 2017						NA		NA
likura 2015								
Gilca 2014								
Zimmerman 2014								
Kherad 2010								
Williams 2005 ^a								
Ogimi 2022								
Ruiz-González 2022								
Vos 2019								

Table S5. Characteristics of the included studies.

Studies from Europe

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
Austria n=1					
Larcher 2005, Austria (36)	September 2003-March 2004	Department of Pulmonology, Hospital Natters, Natters and Department of Hematology, Innsbruck Medical University, Innsbruck	Hospital	High-risk: Lung and bone marrow transplant	• Coinfection influenza • Coinfection RSV • Complications and sequelae • LRTI • CFR • Seasonality • Signs and symptoms
Belgium n=1					
Subissi 2021, Belgium (37)	2015-2019	A network of GPs widely distributed throughout Belgium, representing ~1.5% of all Belgian GPs and covering more than 1.1% of the population.	GP/Primary care and database	65+ General population	• Incidence symptomatic • Proportion symptomatic
Bulgaria n=1					
Korsun 2021, Bulgaria (38)	October 2016-September 2019	Primary care settings or hospitals from different regions of Bulgaria (not further specified)	Hospital, GP/Primary care	65+ General population	• Complications and sequelae • LRTI • Proportion symptomatic
Denmark n=2					
Schneider 2020, Denmark (39)	February 2018-July 2018	Four hospitals in the capital region of Denmark (three emergency departments and one pediatric emergency department)	Hospital database	65+ General population	• Proportion symptomatic
Bjerregaard 2017, Denmark (40)	July 2013-September 2015	Bispebjerg University Hospital, Copenhagen	Hospital	High-risk: Asthma	• Proportion symptomatic
Finland n=1					
Saarela 2020, Finland (41)	September 2014-October 2015	Internal Medicine Emergency Unit Oulu University Hospital	Hospital	65+ General population High-Risk: COPD, asthma and previously or currently treated cancer (except skin cancer other than melanoma), immunosuppressive medication as a minimum 5 mg of daily prednisolone, primary immune deficiency requiring immunoglobulin treatment, human immunodeficiency virus infection, liver cirrhosis, organ transplantation, splenectomy.	General • Proportion symptomatic High-risk • Proportion symptomatic
France n= 10					
Kapandji 2023, France (42)	1 September 2010-30 June 2018	University hospital, Paris	Specialized Medical Care Centers	High-risk: Onco-hematological malignancies	• Coinfection Influenza • Coinfection RSV • Complications and sequelae • Hospitalization LoS • ICU admission and LoS • CFR • Signs and symptoms
Loubet 2021, France (28)	2012-2018	Five French teaching hospitals (tertiary care hospitals) part of the FLUVAC study	Hospital	65+ General population	• Proportion symptomatic

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
Souty 2019, France (43)	29 September 2015-16 April 2017	French Sentinelles network with a nationwide coverage	GP/Primary care	65+ General population	Proportion symptomatic
Perotin 2013, France (44)	January 2006-December 2008	Department of Respiratory Medicine of Reims	Hospital	High-risk: COPD	- Coinfection Influenza - Coinfection RSV - Proportion symptomatic - Seasonality
Elabbadi 2020, France (45)	April 2011-April 2017	Two ICU of the Paris area (Bichat University Hospital and Tenon University Hospital)	Hospital	High-risk: HIV	- Proportion symptomatic - Coinfection Influenza - Coinfection RSV
Verduyn 2019, France (46)	January 1, 2015-December 31, 2015	Department of Respiratory Medicine of the University Hospital of Tours, and the Department of Respiratory Medicine of the University Center of Reunion, a French island	Hospital	High-risk: Asthma	Proportion symptomatic
Visseaux 2017, France (26)	May 1, 2011-April 30, 2016	Five hospitals (Beaujon, Bichat-Claude Bernard, Louis Mourier, Bretonneau and Adelaïde Hautval), all located in the Paris area	Hospital	50+ General population	Proportion symptomatic
Masse 2017, France (47)	October 2013-April 2017	Nursing homes in Corsica	Nursing Homes or care institutions	High-risk: institutionalized older adults	Proportion symptomatic
Bonnin 2016, France (48)	September 1, 2010-February 21, 2013	Different departments of the University Hospital of Caen	Hospital	65+ General population	Coinfection
Schnell 2012, France (49)	January 2007-July 2009	Teaching hospital, Clermont Ferrand	Hospital	High-risk: Immunocompromised status: Hematological malignancy, lymphoma, leukemia	- Proportion symptomatic - Coinfection Influenza
Germany n=7					
Reckziegel 2020, Germany (50)	September 2009-December 2012	Jena University Hospital	Hospital	High-risk: Malignancies, organ and stem-cell transplantation or with autoimmune disorders	- Coinfection Influenza - Coinfection RSV - URTI - LRTI - Proportion symptomatic - Seasonality
Akhmedov 2020, Germany (51)	2005-2018	Ulm University Hospital	Hospital	High-risk: allogeneic stem-cell transplantation	- URTI - LRTI - CFR
Reiche 2014, Germany (52)	2000-2010	~150 medical practices participating in the Influenza Surveillance Scheme (National German Working Group Influenza)	GP/Primary care	60+ General population	- Proportion symptomatic - LRTI - Complications and sequelae - Signs and symptoms - Bronchitis
Gottlieb 2009, Germany (53)	01 November 2005-30 April 2006	Lung transplant outpatient clinic of Hannover Medical School	Hospital	High-risk: Lung transplant	- Proportion symptomatic - Complications and sequelae - Seasonality
Müller 2009, Germany (54)	January 2003-December 2004	Department of Infectious Disease at the University of Cologne	Hospital	High-risk: chronic myeloid leukemia and allogeneic bone marrow transplantation	- Proportion symptomatic - Complications and sequelae - Hospitalization proportion and LoS - CFR - Signs and symptoms
Rohde 2005, Germany (55)	October 1999-June 2004	University Hospital Bergmannsheil, Bochum	Hospital	High-risk: COPD	Proportion symptomatic
Rachow 2020, Germany (56)	2013-2017	The outpatient clinic of the stem-cell transplantation program (name not reported)	Specialized Medical Care Centers	High-risk: Allo-SCT recipients	Proportion not specified as asymptomatic or symptomatic
Greece n=2					

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
Gioula 2010, Greece (57)	2005-2008	National Influenza Center for North Greece (sentinel surveillance system)	Database	60+ General population	- Proportion symptomatic - Hospitalization proportion
Dimopoulos 2012, Greece (58)	January 2008-December 2009	Emergency Department of a tertiary care hospital ("SOTIRIA" Hospital, Athens)	Hospital	High-risk: COPD	Proportion symptomatic
Ireland n=1					
Carr 2005, Ireland (59)	September 2003-May 2004	St James's Hospital, Dublin	Hospital	High-risk: COPD, asthma, and Immunocompromised status: squamous cell carcinoma of lung and chronic lymphocytic leukemia	Signs and symptoms
Italy n=3					
Ciotti 2020, Italy (60)	October 2016-March 2019	University Hospital Policlinico Tor Vergata (PTV) in Rome	Hospital	65+ General population	- Proportion symptomatic - Signs and symptoms
Guido 2011, Italy (61)	June 2008-May 2009	Apulian population with respiratory tract infections (setting not reported)	Community (Schools or educational settings)	65+ General population	Proportion symptomatic
Papi 2006, Italy (62)	September 2000-August 2002	University of Ferrara	Database	High-risk: COPD	- Proportion symptomatic - Coinfection RSV
Netherlands n=6					
Kaaijk 2022, Netherlands (63)	October 2014-April 2015	Recruitment through general practitioners or the National Civil Registry	Community	60+ General population	- Coinfection Influenza - Proportion symptomatic - Proportion asymptomatic
de Zwart 2020, Netherlands (64)	2008-2018	University Medical Center Groningen	Hospital	High-risk: single-, double-, or heart-lung transplantation	- Hospitalization proportion - CFR - Proportion symptomatic - Signs and symptoms
van Beek 2017, Netherlands (29)	December 2011-May 2013	Recruitment through general practitioners or the National Civil Registry	GP/Primary care and Community	60+ General population	- Incidence symptomatic - Proportion symptomatic - Proportion asymptomatic
Te Wierik 2012, Netherlands (65)	January 2010-March 2010	A residential care facility for elderly in Utrecht	Nursing Homes or care institutions	High-risk: Institutionalized older adults	- Proportion symptomatic - Incidence symptomatic - CFR
Vos 2019, Netherlands (66)	2016-2018	Emergency department of the UMC Utrecht	Hospital	High-risk: Immunocompromised status	Proportion symptomatic
Jansen 2013, Netherlands (67)	November 2008-April 2010	Academic Medical Center, Amsterdam	Hospital	High-risk: patients with chemotherapy-induced significant neutropenia	Proportion asymptomatic
Norway n=2					
Debes 2021, Norway(68)	November 2015-May 2018	A 500-bed hospital in the South-east region of Norway	Hospital database	65+ General population	Proportion symptomatic
Hernes 2011, Norway (69)	13 February 2008-3 February 2009	Department of Internal Medicine, Sorlandet Hospital, Arendal	Hospital	60+ General population	Proportion symptomatic
Poland n=1					
Kozinska 2022, Poland (70)	November 2020-March 2021	Single Drive-Thru Mobile Collection Site in Ostrow Mazowiecka	COVID-19 collection site study	65+ General population	- Proportion symptomatic - Coinfection Influenza - Coinfection RSV
Portugal n=1					
Chasqueira 2018, Portugal (71)	2013-2014	18 elderly care centers in Lisbon	Nursing Homes or care institutions	High-risk: Institutionalized older adults	Proportion symptomatic
Slovenia n=1					

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
Uršič 2016, Slovenia (72)	05 December 2011-31 May 2012	Medium-sized nursing home (name not reported)	Nursing Homes or care institutions	High-risk: Institutionalized older adults	• LRTI • URTI • Proportion symptomatic
Spain n=7					
De la Puerta 2021, Spain (73)	01 February 2018-30 September 2020	CSRV Database of the Hospital Universitari I Politècnic La Fe, Valencia	CSRV Database	High-risk: Allo-HSCT recipients	• Hospitalization proportion • LRTI • URTI • CFR • Proportion symptomatic
Vidaur 2019, Spain (74)	July 2007-June 2017	Computerized records of the Microbiology department, and the medical records of an ICU in the North of Spain (name not reported)	Hospital	High-risk: COPD, asthma, Immunocompromised status: non-Hodgkin lymphoma, Multiple myeloma, Heart transplant, Chemotherapy, Pancreas and kidney transplant and SLE	• Complications and sequelae • CFR
Martino 2005, Spain (75)	September 1999-October 2003	Division of Hematology of the Hospital de la Santa Creu i Sant Pau, Barcelona	Hospital	High-risk: Hematopoietic stem-cell transplant	• CFR • Signs and symptoms
Williams 2005, Spain (76)	1 October 1999-31 July 2004	Division of Clinical Hematology, Hospital de la Santa Creu i Sant Pau, Barcelona	Hospital	High-risk: Hematological malignancy	• Proportion symptomatic • LRTI • URTI • CFR • Seasonality • Coinfection influenza • Coinfection RSV
Ruiz-González 2022, Spain (77)	December 2018-March 2019	Emergency Room at the Arnau de Vilanova University Hospital, Valencia	Hospital	High-risk: COPD	• Proportion symptomatic
Peghin 2017, Spain (78)	September 2009-September 2011	Hospital Universtari Vall d'Hebron, Barcelona	Hospital	High-risk: Lung transplant	• Proportion asymptomatic • Bronchitis • Complications and sequelae • Hospitalization proportion • ICU admission • LRTI • URTI • CFR • Outpatient and emergency department
Almansa 2012, Spain (79)	September 2010-March 2011	Respiratory Medicine and Intensive Care Medicine Services for AECOPD cases (no name available)	Hospital	High-risk: COPD	• Proportion symptomatic • Coinfection Influenza • Coinfection RSV
Sweden n=2					
Stjärne Aspelund 2018, Sweden (80)	May 2012-December 2014	University hospitals (Lund and Gothenburg)	Specialized Medical Care Centers	High-risk: Lung transplant	• Proportion not specified as symptomatic or asymptomatic
Magnusson 2018, Sweden (81)	January 2009-April 2012	Sahlgrenska University Hospital Transplant Center, Gothenburg	Hospital	High-risk: Lung transplant	• Proportion not specified as symptomatic or asymptomatic. • Seasonality
Switzerland n=9					
Moret 2021, Switzerland (82)	01 November 2015-30 April 2017	Department of Oncology, Bern University Hospital	Hospital	High-risk: Autologous hematopoietic stem-cell transplantation	• Hospitalization proportion and LoS • CFR • Proportion symptomatic
Spahr 2018, Switzerland (83)	June 2010-December 2014	University Hospital Basel	Hospital	High-risk: Allogeneic hematopoietic cell transplantation	• Complications and sequelae • Hospitalization proportion • ICU admission

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
					• LRTI • URTI • CFR • Proportion symptomatic
Niggli 2016, Switzerland (84)	January 2012-June 2014	University Hospital of Zurich	Database	High-risk: Lung transplant	• Proportion symptomatic • Signs and symptoms
Ambrosioni 2014, Switzerland (85)	1 January 2011-31 December 2012	The University Hospital of Geneva	Hospital	65+ General population	• Proportion symptomatic
Egli 2012, Switzerland (86)	June 2009-June 2010	Single hospital (name not reported)	Hospital	High-risk: Allogeneic hematopoietic stem-cell transplantation	• Coinfection Influenza • Coinfection RSV • Complications and sequelae • Hospitalization proportion and LoS • ICU admission • LRTI • CFR • Proportion symptomatic • Seasonality • Signs and symptoms
Kherad 2010, Switzerland (87)	June 2007-December 2008	Emergency department and hospitalized (name not reported)	Hospital	High-risk: COPD	• Proportion symptomatic
Garbino 2008, Switzerland (88)	November 2003-November 2006	Three university hospitals of Geneva, Basel and Zurich in the context of the Swiss HIV Cohort Study	Hospital	High-risk: HIV	• Proportion symptomatic • Coinfection Influenza • Coinfection RSV • Hospitalization proportion • CFR
Barral 2022, Switzerland (89)	01 January 2010-31 October 2019	Database of the HUG Laboratory of Virology, Geneva	Database	High-risk: Hematopoietic stem-cell transplant and Hematologic malignancies	• Proportion not specified as symptomatic or asymptomatic. • Complications and sequelae • Hospitalization • ICU admission • LRTI • CFR • Coinfection Influenza • Coinfection RSV
Pagani 2015, Switzerland (90)	2011-2012	Large academic geriatric hospital, Geneva	Hospital	65+ General population	• Proportion symptomatic
UK n=6					
Tanner 2012, UK (91)	September 2009-April 2010	-Hospitals and general practitioners within the West Midlands region of central England -Database: The Health Protection Agency Public Health Laboratory (HPA PHL) Birmingham	Hospital, GP/Primary care, and database	65+ General population	• Proportion symptomatic
Degail 2012, UK (17)	31 July 2010-9 September 2010	Community hospital in the East of England	Hospital	60+ General population	• Proportion symptomatic • CFR
McManus 2008, UK (92)		Mater Hospital Belfast	Hospital	High-risk: COPD	• Proportion symptomatic • Proportion asymptomatic
Kaye 2006, UK (93)	November 2001-February 2003	Four hospitals in the West Midlands region (no names reported)	Hospital	65+ General population	• Proportion symptomatic • Coinfection RSV • Coinfection Influenza
Ponsford 2021, UK (94)	August 2015-January 2018	Immunodeficiency Center for Wales, Cardiff	Hospital	High-risk: Primary antibody deficiency	• Proportion not specified as asymptomatic or symptomatic. • Seasonality
O'Gorman 2006, UK (95)	July 2003-January 2005	Regional Virus Laboratory, Royal Group of Hospitals	Hospital, GP/Primary care	High-Risk: COPD, Immunocompromised status:	• Coinfection RSV • Coinfection Influenza • Hospitalization

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
		Trust, Belfast, Northern Ireland		Rheumatoid arthritis, polymyalgia rheumatica	• ICU admission • Mortality • Signs and symptoms • Complications and sequelae • CFR

Studies from Western Pacific

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
Australia n=6					
Foley 2022, Australia (96)	01 January 2017-02 January 2022	PathWest Laboratory Medicine Western Australia data	Database	65+ General population	• Incidence not specified symptomatic asymptomatic
Jones 2022, Australia (97)	1 July 2018-31 December 2018	Aged-care facilities in Western Sydney	Nursing Homes or care institutions	High-risk: Institutionalized older adults	• Hospitalization proportion • CFR • Proportion symptomatic
Varghese 2018, Australia (98)	01 January 2010-31 December 2013	Australian Sentinel Practices Research Network (ASPREN) as a national infectious disease surveillance system	GP/Primary care	50+ General population	• Coinfection Influenza • Coinfection RSV • Proportion symptomatic
Hopkins 2008, Australia (99)	July 2003-December 2006	Prince Charles Hospital, Brisbane, Queensland	Hospital	High-risk: Lung transplant	• Proportion symptomatic • Coinfection Influenza • Coinfection RSV • Seasonality • Complications and sequelae • Hospitalization proportion • LRTI • URTI • CFR • Outpatient and emergency department
Druce 2005, Australia (100)	May 2002-September 2003	Victoria-wide influenza surveillance program, also including Victorian hospitals	Hospital and database	60+ General population	• Proportion symptomatic • Coinfection Influenza • Coinfection RSV
Murphy 2013, Australia (101)	April 2007-November 2009	Antenatal clinic of John Hunter Hospital, Newcastle	Specialized Medical Care Centers	High-risk: Asthma	• Proportion symptomatic • Coinfection Influenza
Japan n=6					
Kurai 2022, Japan (16)	April 2019-July 2020	Ten study sites in Japan (general practitioner sites, names/locations not reported)	Community	65+ General population	• Hospitalization proportion and LoS • ICU admission • Incidence symptomatic • LRTI • CFR • Proportion symptomatic • Signs and symptoms
Kan 2022, Japan (102)	April 2018-March 2020	National Hospital Organization Fukuoka National Hospital Organization Fukuokahigashi Medical Center National Hospital Organization Omuta National Hospital	Hospital	High-risk: COPD and Asthma	• CFR • Proportion symptomatic
Saraya 2017, Japan (103)	August 2012-May 2015	Kyorin University Hospital, Tokyo	Hospital	High-risk: Asthma	• Outpatient and emergency department

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
					- Proportion symptomatic - Seasonality
Iikura 2015, Japan (104)	May 2011-December 2012	Hospital (name not reported)	Hospital	High-risk: Asthma	Proportion symptomatic
Matsuzaki 2013, Japan (15)	January 2008-May 2010	Yamanobe Pediatric Clinic collaborating with the local health authority of the Yamagata Prefecture for the surveillance of viral diseases in Japan	Hospital	General population	Transmission children to adults
Ikematsu 2012, Japan (105)	November 2008-May 2009	Seventeen outpatient clinics located in four separate areas of Japan, Fukuoka, Ishikawa, Gifu and Tokushima prefectures.	GP/Primary care	50+ General population	Proportion symptomatic

Studies from North America

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
Canada n=8					
Gilca 2014, Canada (106)	8 February 2012-2 February 2013	Three regional hospitals participated in the study during both years, and two hospitals participated during 1 year each (2 community, two academic/tertiary care hospitals)	Hospital	65+ General population	Proportion symptomatic
Klein 2010, Canada (107)	November 2003-April 2006	A large university-based clinic (Montreal Chest Hospital, McGill University Health Center, Montreal)	Hospital	High-risk: HIV	- Proportion symptomatic - Coinfection Influenza - Coinfection RSV - Hospitalization proportion - LRTI - Signs and symptoms - Complications and sequelae
Johnstone 2008, Canada (108)	August 2004-March 2006	5 hospitals in Edmonton	Hospital	High-risk: COPD, asthma, congestive heart failure, ischemic heart disease and cancer	- Coinfection Influenza - Coinfection RSV - Complications and sequelae - CFR - Seasonality - Signs and symptoms
Hamelin 2005, Canada (109)	17 January 2002-06 May 2004	3 university-affiliated hospitals, Quebec	Hospital	High-risk: COPD	- Proportion symptomatic - LRTI - Complications and sequelae - Hospitalization proportion and LoS - ICU admission - CFR
Kumar 2005, Canada (110)	2001-2003	Outpatient clinics at the Toronto General Hospital	Hospital	High-risk: Lung transplant	- Proportion symptomatic - Proportion asymptomatic - LRTI - URTI - Complications and sequelae
Bastien 2003,	October 2001-April 2002	Four provincial public health laboratories (no	Database	50+ General population	Proportion symptomatic

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
Canada (111)		names reported) in Nova Scotia, Manitoba, Saskatchewan, and British Columbia			
Boivin 2007, Canada (112)	1 January 2006-15 February 2006	Long-term care facility in Quebec City	Nursing Homes or care institutions	High-risk: Institutionalized older adults	• Proportion symptomatic • Incidence symptomatic • Complications and sequelae • LRTI • Bronchitis • CFR • Signs and symptoms
Fathima 2012, Canada (113)	01 July 2009-30 June 2012	Web-Based Laboratory Surveillance -Data Integration for Alberta Laboratories (DIAL) platform	Database	50+ General population	• Coinfection
USA n=35					
Zimmerman 2022, USA (114)	01 July 2015-30 June 2019	Pennsylvania Health Care Cost Containment Council (PHC4) and UPMC Health System electronic medical records, Allegheny County (Pittsburgh), Pennsylvania	Other database	50+ General population	• Hospitalization rate • Proportion symptomatic
Sieling 2021, USA (115)	October 2017-September 2019	Academically affiliated hospital system in Northern Manhattan (New York City) including three hospitals: an adult tertiary care hospital, an adult community hospital, and a children's hospital	Hospital	50+ General population	• Hospitalization rate
Howard 2021, USA (5)	January 2010-June 2012	8 hospitals in Chicago, IL; Memphis, TN; Nashville, TN; and Salt Lake City, UT	Hospital	50+ General population	• Proportion symptomatic
El Chaer 2017, USA (116)	April 2012-May 2015	University of Texas MD Anderson Cancer Center (Houston, Texas) Database: The Infection Control database	Hospital	High-risk: Hematopoietic cell transplantation (HCT) in remission	• Complications and sequelae • Hospitalization proportion and LoS • ICU admission • LRTI • URTI • CFR
Spire 2017, USA (117)	5 January 2015-21 January 2015	LTCF in two locker units (A and B) that house residents with dementia (name not reported)	Nursing Homes or care institutions	High-risk: Institutionalized older adults	• Incidence symptomatic • CFR • Proportion symptomatic
Wansaula 2016, USA (118)	October 2010-September 2014	Five acute care hospitals in Arizona: St. Mary's Hospital (adults), St. Joseph's Hospital (adults), Tucson Heart Hospital (adults), Northwest Medical Center (adults), and Sells Indian	Hospital	50+ General population	• Proportion symptomatic

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
		Health Services Clinic (all ages)			
Zimmerman 2014, USA (119)	January 2012-April 2012	University of Pittsburgh site of the Flu vaccine efficacy (VE) study funded by the CDC	GP/Primary care and community	50+ General population	Proportion symptomatic
Widmer 2014, USA (18)	May 2009-April 2010	One academic ED, one academic hospital, and three community hospitals, covering residents of Middle Tennessee, defined as Nashville (Davidson County) and the six surrounding counties (Robertson, Cheatham, Williamson, Rutherford, Wilson, Sumner)	Hospital	50+ General population High-risk: Immunodeficiency (Transplant, cancer, splenectomy, HIV/AIDS, steroid use, chemotherapy, immunosuppression)	General population - Hospitalization rate - Proportion symptomatic - CFR High-risk - Proportion symptomatic
Walker 2014, USA (120)	1 April 2009-31 March 2010	Northwestern Memorial Hospital (NMH) and Prentice Women's Hospital Chicago, IL	Hospital	50+ General population High-risk: immunocompromised (hematological malignancy, organ transplant and hemoteraphy)	- General Proportion symptomatic High-risk - CFR - Proportion symptomatic
CDC 2013, USA (121)	January 2012-February 2012	Two skilled nursing facilities (SNFs) in West Virginia and Idaho	Nursing Homes or care institutions	High-risk: Institutionalized older adults	- Complications and sequelae - Incidence symptomatic - LRTI - URTI
Litwin 2014, USA (122)	14 November 2011-13 November 2012	Adult and pediatric hospital at Georgia Health Sciences University	Hospital	50+ General population	Proportion symptomatic
Renaud 2013, USA (123)	January 2006-February 2011	Fred Hutchinson Cancer Research Center	Hospital	High-risk: HCT Recipients	- Complications and sequelae - CFR - Proportion symptomatic
Widmer 2012, USA (19)	November 2006-April 2009	4 hospitals (academic or community) in Davidson County (Nashville, TN). The number of participating hospitals varied by year and it was based on availability of research staff and funding.	Hospital	50+ General population High-risk: Immunodeficiency (Transplant, cancer, splenectomy, HIV/AIDS, steroid use, chemotherapy, immunosuppression)	General population - Coinfection Influenza - Coinfection RSV - Complications and sequelae - LoS Hospitalization rate - ICU admission and LoS - CFR - Proportion symptomatic 50+ - Seasonality - Signs and symptoms High-risk - Proportion symptomatic
Chan 2011, USA (124)	16 October 2009-1 December 2009	Rhode Island Hospital, a tertiary care center, including Hasbro Children's Hospital, and The Miriam, Newport	Hospital	60+ General population	Proportion symptomatic

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
		and Bradley Hospitals			
Weinberg 2010, USA (125)	September 2005- November 2007	University of Colorado Denver	Hospital	High-risk: Lung transplant	- Proportion symptomatic - Complications and sequelae - Hospitalization proportion - CFR
Kumar 2010, USA (126)	February 2003- December 2005	University of Pittsburgh Medical Center, Pittsburgh, PA	Hospital	High-risk: Lung transplant	- Proportion symptomatic - Proportion asymptomatic - Complications and sequelae
Walsh 2008, USA (4)	1999-2003	Health maintenance organizations, cardiac and pulmonary rehabilitation programs, and the Rochester General Hospital in Rochester, New York	Hospital, GP/Primary care	65+ General population High-risk: COPD, Cardiovascular disease: Congestive heart failure, Other: lung disease	General population - Proportion Asymptomatic - Signs and symptoms - Coinfection - Hospitalization proportion and LoS - Complications and sequelae - ICU admission - CFR - Outpatient and emergency department High-risk - Proportion symptomatic - Signs and symptoms - Coinfection - Hospitalization proportion - Outpatient and emergency department
Falsey 2008, USA (127)	April 1998- August 2000	33 Boston-area LTCFs	GP/Primary care, Nursing Homes or care institutions	High-risk: Institutionalized older adults	Proportion symptomatic
Louie 2007, USA (128)	4 June 2006-8 July 2006	3 LTCFs that report to Sacramento County Department of Health and Human Services and the California Department of Health Services	Nursing Homes or care institutions	High-risk: Institutionalized older adults	- Proportion symptomatic - Incidence symptomatic LRTI
Englund 2006, USA (129)	1995-1999	Referral cancer center (name not reported)	Specialized Medical Care Centers	High-risk: Hematopoietic stem-cell transplant recipients	- Proportion symptomatic - Coinfection Influenza - Coinfection RSV - Complications and sequelae - Hospitalization proportion - LRTI - CFR - Signs and symptoms
Martinello 2006, USA (130)	13 December 2002-06 May 2003	Yale-New Haven, New Haven, Connecticut	Hospital	High-risk: COPD	- Proportion symptomatic - Coinfection RSV - Coinfection Influenza - Hospitalization LoS - ICU admission - LRTI - CFR - Seasonality - Signs and symptoms - Complications and sequelae

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
Williams 2005 A, USA (131)	December 1999-December 2003	Vanderbilt University Medical Center, Nashville, Tennessee	Hospital	High-risk: Asthma	- Proportion symptomatic - Signs and symptoms
Sumino 2005, USA (132)	15 December 2002-1 August 2003	St. Louis Children's Hospital and Barnes-Jewish Hospital at Washington University Medical Center as well as at affiliated community hospital	Hospital	High-risk: COPD, Immunocompromised status: Leukemia, lung and heart transplant recipients	- Complications and sequelae - Hospitalization proportion and LoS - Signs and symptoms
Beckham 2005, USA (133)	September 1991-May 1995	Hospital (no names reported)	Hospital	High-risk: COPD	Proportion symptomatic
Stockwell 2022, USA (134)	December 2012-September 2017	CDC-funded Mobile Surveillance for ARI and ILI in the Community (MoSAIC) study, low-income community in New York City	Database	65+ General population	Incidence symptomatic
Ogimi 2022, USA (135)	April 2008-September 2018	Fred Hutchinson Cancer Research Center (Fred Hutch) and the Seattle Cancer Care Alliance	Hospital database	High-risk: HCT recipients	- Proportion symptomatic - LRTI - URTI
Permpalung 2021, USA (136)	July 2010-June 2019	Johns Hopkins Hospital, Baltimore	Hospital	High-risk: Lung transplant	- Complications and sequelae - Exacerbation - LRTI - URTI - CFR - Signs and symptoms
Samannodi 2021, USA (137)	01 March 2016-30 April 2019	8 hospitals in the Memorial Hermann Health (MHH) System in Houston	Hospital	High-risk: Solid organ transplant	Proportion not specified as symptomatic or asymptomatic.
Russell 2018, USA (138)	January 2013-May 2015	IISP and MoSAIC, New York City	Database	50+ General population	Proportion symptomatic
D'Angelo 2016, USA (139)	January 2009-December 2013	Hospital's HCT database (no name)	Hospital	High-risk: Allogeneic HCT	- Proportion symptomatic - LRTI - URTI - Hospitalization proportion - CFR
Radin 2014, USA (140)	January 2012-December 2013	Three US populations: civilians near the US-Mexico border, Department of Defense (DoD) beneficiaries, and military recruits (no names reported)	Hospital and Community	50+ General population	Proportion symptomatic
Fowlkes 2014, USA (141)	August 2010-July 2011	57 HCP practices in 12 sites, including nine states and three jurisdictions: Florida, Iowa, Minnesota, New Jersey, North Dakota, Oregon, Utah, Virginia, Wisconsin, Los Angeles County,	GP/Primary care	50+ General population	Incidence symptomatic

Author Year	Study period	Setting	Setting categorization	Type of study population	Outcomes
		New York City, and Philadelphia			
Sundaram 2014, USA (27)	2004-2010	Cohort of community-dwelling individuals living in or near the town Marshfield	Hospital	50+ General population	• Proportion symptomatic
Dare 2007, USA (142)	May 2004-April 2005	University of Pittsburgh Medical Center	Hospital	High-risk: Lung transplant	• Proportion symptomatic • Proportion asymptomatic • Coinfection Influenza • Coinfection RSV • Seasonality
Sayah 2013, USA (143)	1 June 2009-31 May 2011	Routine surveillance for Acute rejection and allograft dysfunction following CARV infection, University of California, San Francisco (UCSF)	Database	High-risk: single-, bilateral-, and heart-lung transplant recipients	• Proportion symptomatic • Coinfection influenza • Coinfection RSV

Table S6. Papers excluded during full text selection with reason for exclusion.

Reference citation	Reason of exclusion
Aaron SD, Angel JB, Lunau M, Wright K, Fex C, Le Saux N, Dales RE. Granulocyte inflammatory markers and airway infection during acute exacerbation of chronic obstructive pulmonary disease. <i>Am J Respir Crit Care Med</i> . 2001 Feb;163(2):349-55. doi: 10.1164/ajrccm.163.2.2003122. PMID: 11179105.	Irrelevant or unrelated focus
Abbas S, Raybould JE, Sastry S, de la Cruz O. Respiratory viruses in transplant recipients: more than just a cold. Clinical syndromes and infection prevention principles. <i>Int J Infect Dis</i> . 2017 Sep;62:86-93. doi: 10.1016/j.ijid.2017.07.011. Epub 2017 Jul 22. PMID: 28739424.	Narrative review
Aberle JH, Aberle SW, Redlberger-Fritz M, Sandhofer MJ, Popow-Kraupp T. Human metapneumovirus subgroup changes and seasonality during epidemics. <i>Pediatr Infect Dis J</i> . 2010 Nov;29(11):1016-8. doi: 10.1097/INF.0b013e3181e3331a. PMID: 20489673.	Wrong population
Agca H, Akalin H, Saglik I, Hacimustafaoglu M, Celebi S, Ener B. Changing epidemiology of influenza and other respiratory viruses in the first year of COVID-19 pandemic. <i>J Infect Public Health</i> . 2021 Sep;14(9):1186-1190. doi: 10.1016/j.jiph.2021.08.004. Epub 2021 Aug 8. PMID: 34399190.	Country study outside the geographical area of interest
Akmatov MK, Krebs S, Preusse M, Gatzemeier A, Frischmann U, Schughart K, Pessler F. E-mail-based symptomatic surveillance combined with self-collection of nasal swabs: a new tool for acute respiratory infection epidemiology. <i>Int J Infect Dis</i> . 2011 Nov;15(11):e799-803. doi: 10.1016/j.ijid.2011.07.005. Epub 2011 Aug 17. PMID: 21852171; PMCID: PMC7110865.	Wrong population
Al Sulaiman K, Aljuhani O, Badreldin HA, Korayem GB, Alenazi AA, Alharbi AH, Alghamdi A, Alhubaishi A, Altebainawi AF, Bosaeed M, Alotaibi R, Alawad A, Alnajjar N, Bin Saleh K, Sait WA, Alsohimi S, Alanizy MM, Almuqbil SA, Al Sulaihim I, Vishwakarma R, Alalawi M, Alhassan F, Alghnam S. The clinical outcomes of COVID-19 critically ill patients co-infected with other respiratory viruses: a multicenter, cohort study. <i>BMC Infect Dis</i> . 2023 Feb 6;23(1):75. doi: 10.1186/s12879-023-08010-8. Erratum in: <i>BMC Infect Dis</i> . 2023 Feb 22;23(1):103. doi: 10.1186/s12879-023-08072-8. PMID: 36747136; PMCID: PMC9901824.	Country study outside the geographical area of interest
Amrane S, Tissot-Dupont H, Doudier B, Eldin C, Hocquart M, Mailhe M, Dudouet P, Ormières E, Ailhaud L, Parola P, Lagier JC, Brouqui P, Zandotti C, Ninove L, Luciani L, Boschi C, La Scola B, Raoult D, Million M, Colson P, Gautret P. Rapid viral diagnosis and ambulatory management of suspected COVID-19 cases presenting at the infectious diseases referral hospital in Marseille, France, - January 31st to March 1st, 2020: A respiratory virus snapshot. <i>Travel Med Infect Dis</i> . 2020 Jul-Aug;36:101632. doi: 10.1016/j.tmaid.2020.101632. Epub 2020 Mar 20. PMID: 32205269; PMCID: PMC7102626.	Wrong population
Antalis E, Oikonomopoulou Z, Kottaridi C, Kossyvakis A, Spathis A, Magkana M, Katsouli A, Tsagris V, Papaevangelou V, Mentis A, Tsiodras S. Mixed viral infections of the respiratory tract: an epidemiological study during consecutive winter seasons. <i>J Med Virol</i> . 2018 Apr;90(4):663-670. doi: 10.1002/jmv.25006. Epub 2018 Jan 17. PMID: 29244214; PMCID: PMC7167177.	Unextractable data in graphs (Unavailable or inaccessible data necessary for analysis)
Atabani SF, Wilson S, Overton-Lewis C, Workman J, Kidd IM, Petersen E, Zumla A, Smit E, Osman H. Active screening and surveillance in the United Kingdom for Middle East respiratory syndrome coronavirus in returning travellers and pilgrims from the Middle East: a prospective descriptive study for the period 2013-2015. <i>Int J Infect Dis</i> . 2016 Jun;47:10-4. doi: 10.1016/j.ijid.2016.04.016. Epub 2016 Apr 23. PMID: 27117200; PMCID: PMC7110479.	Wrong population
Barenfanger J, Mueller T, O'Brien J, Drake C, Lawhorn J. Prevalence of human metapneumovirus in central illinois in patients thought to have respiratory viral infection. <i>J Clin Microbiol</i> . 2008 Apr;46(4):1489-90. doi: 10.1128/JCM.02283-07. Epub 2008 Jan 30. PMID: 18234862; PMCID: PMC2292915.	Wrong population
Barnadas C, Schmidt DJ, Fischer TK, Fonager J. Molecular epidemiology of human adenovirus infections in Denmark, 2011-2016. <i>J Clin Virol</i> . 2018 Jul;104:16-22. doi: 10.1016/j.jcv.2018.04.012. Epub 2018 Apr 21. PMID: 29704734; PMCID: PMC7106356.	Wrong population
Barratt K, Anderson TP, Fahey JA, Jennings LC, Werno AM, Murdoch DR. Comparison of the fast track diagnostics respiratory 21 and Seegene Allplex multiplex polymerase chain reaction assays for the detection of respiratory viruses. <i>Br J Biomed Sci</i> . 2017 Apr;74(2):85-89. doi: 10.1080/09674845.2017.1278885. Epub 2017 Feb 15. PMID: 28367738.	Country study outside the geographical area of interest
Bartlow AW, Stromberg ZR, Gleasner CD, Hu B, Davenport KW, Jakhar S, Li PE, Vosburg M, Garimella M, Chain PSG, Erkkila TH, Fair JM, Mukundan H. Comparing variability in diagnosis of upper respiratory tract infections in patients using syndromic, next generation sequencing, and PCR-based methods. <i>PLOS Glob Public Health</i> . 2022 Jul 20;2(7):e0000811. doi: 10.1371/journal.pgph.0000811. PMID: 36962439; PMCID: PMC10022352.	Irrelevant or unrelated focus or scope
Baskaran V, Lawrence H, Lansbury LE, Webb K, Safavi S, Zainuddin NI, Huq T, Eggleston C, Ellis J, Thakker C, Charles B, Boyd S, Williams T, Phillips C, Redmore E, Platt S, Hamilton E, Barr A, Venyo L, Wilson P, Bewick T, Daniel P, Dark P, Jeans AR, McCanny J, Edgeworth JD, Llewelyn MJ, Schmid ML, McKeever TM, Beed M, Lim WS. Co-infection in critically ill patients with COVID-19: an observational cohort study from England. <i>J Med Microbiol</i> . 2021 Apr;70(4):001350. doi: 10.1099/jmm.0.001350. PMID: 33861190; PMCID: PMC8289210.	Wrong population
Bayrakdar F, Altaş AB, Korukluoğlu G. İki ardışık epidemik sezonda ülkemizde dolaşımda olan insan metapnömovirus suşlarının filogenetik çeşitliliği [Phylogenetic variability of human	Wrong population

Reference citation	Reason of exclusion
metapneumovirus strains circulating in Turkey during two consecutive epidemic seasons]. Mikrobiyol Bul. 2016 Jan;50(1):63-72. Turkish. doi: 10.5578/mb.10060. PMID: 27058330.	
Beaird OE, Freifeld A, Ison MG, Lawrence SJ, Theodoropoulos N, Clark NM, Razonable RR, Alangaden G, Miller R, Smith J, Young JA, Hawkinson D, Pursell K, Kaul DR. Current practices for treatment of respiratory syncytial virus and other non-influenza respiratory viruses in high-risk patient populations: a survey of institutions in the Midwestern Respiratory Virus Collaborative. Transpl Infect Dis. 2016 Apr;18(2):210-5. doi: 10.1111/tid.12510. Epub 2016 Mar 29. PMID: 26923867; PMCID: PMC7169710.	Irrelevant or unrelated focus or scope
Beckham JD, Cadena A, Lin J, Piedra PA, Glezen WP, Greenberg SB, Atmar RL. Respiratory viral infections in patients with chronic, obstructive pulmonary disease. J Infect. 2005 May;50(4):322-30. doi: 10.1016/j.jinf.2004.07.011. PMID: 15845430; PMCID: PMC7132437.	Irrelevant or unrelated focus
Bello S, Lasier AB, Mincholé E, Fandos S, Ruiz MA, Vera E, de Pablo F, Ferrer M, Menendez R, Torres A. Prognostic power of proadrenomedullin in community-acquired pneumonia is independent of aetiology. Eur Respir J. 2012 May;39(5):1144-55. doi: 10.1183/09031936.00080411. Epub 2011 Nov 10. PMID: 22075489.	Wrong population
Bénézit F, Loubet P, Galtier F, Pronier C, Lenzi N, Lesieur Z, Jouneau S, Lagathu G, L'Honneur AS, Foulongne V, Vallejo C, Alain S, Duval X, Houhou N, Costa Y, Vanhems P, Amour S, Carrat F, Lina B, Launay O, Tattevin P; FLUVAC Study Group. Non-influenza respiratory viruses in adult patients admitted with influenza-like illness: a 3-year prospective multicenter study. Infection. 2020 Aug;48(4):489-495. doi: 10.1007/s15010-019-01388-1. Epub 2020 Feb 13. PMID: 32056143; PMCID: PMC7095392.	Wrong population
Benkouiten S, Charrel R, Belhouchat K, Drali T, Nougairede A, Salez N, Memish ZA, Al Masri M, Fournier PE, Raoult D, Brouqui P, Parola P, Gautret P. Respiratory viruses and bacteria among pilgrims during the 2013 Hajj. Emerg Infect Dis. 2014 Nov;20(11):1821-7. doi: 10.3201/eid2011.140600. PMID: 25341199; PMCID: PMC4214309.	Wrong population
Benkouiten S, Charrel R, Belhouchat K, Drali T, Salez N, Nougairede A, Zandotti C, Memish ZA, al Masri M, Gaillard C, Parola P, Brouqui P, Gautret P. Circulation of respiratory viruses among pilgrims during the 2012 Hajj pilgrimage. Clin Infect Dis. 2013 Oct;57(7):992-1000. doi: 10.1093/cid/cit446. Epub 2013 Jul 9. PMID: 23839997; PMCID: PMC7108031.	Country study outside the geographical area of interest
Bierbaum S, Königsfeld N, Besazza N, Blessing K, Rücker G, Kontny U, Berner R, Schumacher M, Forster J, Falcone V, van de Sand C, Essig A, Huzly D, Rohde G, Neumann-Haefelin D, Panning M. Performance of a novel microarray multiplex PCR for the detection of 23 respiratory pathogens (SYMP-ARI study). Eur J Clin Microbiol Infect Dis. 2012 Oct;31(10):2851-61. doi: 10.1007/s10096-012-1639-1. Epub 2012 May 30. PMID: 22644053; PMCID: PMC7087590.	Wrong population
Bjerregaard A, Laing IA, Backer V, Sverrild A, Khoo SK, Chidlow G, Sikazwe C, Smith DW, Le Souëf P, Porsbjerg C. High fractional exhaled nitric oxide and sputum eosinophils are associated with an increased risk of future virus-induced exacerbations: A prospective cohort study. Clin Exp Allergy. 2017 Aug;47(8):1007-1013. doi: 10.1111/cea.12935. Epub 2017 May 9. PMID: 28390083; PMCID: PMC7162064.	Wrong population
Blackburn R, Zhao H, Pebody R, Hayward A, Warren-Gash C. Laboratory-Confirmed Respiratory Infections as Predictors of Hospital Admission for Myocardial Infarction and Stroke: Time-Series Analysis of English Data for 2004-2015. Clin Infect Dis. 2018 Jun 18;67(1):8-17. doi: 10.1093/cid/cix1144. PMID: 29324996; PMCID: PMC6005111.	Irrelevant or unrelated focus or scope
Boerger AC, Binnicker MJ. Comparison of the Panther Fusion respiratory panels to routine methods for detection of viruses in upper and lower respiratory tract specimens. Diagn Microbiol Infect Dis. 2020 Jun;97(2):115014. doi: 10.1016/j.diagmicrobio.2020.115014. Epub 2020 Feb 7. PMID: 32192787.	Wrong population
Boivin G, Abed Y, Pelletier G, Ruel L, Moisan D, Côté S, Peret TC, Erdman DD, Anderson LJ. Virological features and clinical manifestations associated with human metapneumovirus: a new paramyxovirus responsible for acute respiratory-tract infections in all age groups. J Infect Dis. 2002 Nov 1;186(9):1330-4. doi: 10.1086/344319. Epub 2002 Oct 8. PMID: 12402203.	Wrong population
Boonyaratanakornkit J, Vivek M, Xie H, Pergam SA, Cheng GS, Mielcarek M, Hill JA, Jerome KR, Limaye AP, Leisenring W, Boeckh MJ, Waghmare A. Predictive Value of Respiratory Viral Detection in the Upper Respiratory Tract for Infection of the Lower Respiratory Tract With Hematopoietic Stem Cell Transplantation. J Infect Dis. 2020 Jan 14;221(3):379-388. doi: 10.1093/infdis/jiz470. PMID: 31541573; PMCID: PMC7107470.	Wrong population
Bouzid D, Casalino E, Mullaert J, Laurent O, Duval X, Lescure FX, Peiffer Smadja N, Tubiana S, Armand Lefèvre L, Descamps D, Fidouh N, Choquet C, Lucet JC, Visseaux B. Added value of rapid respiratory syndromic testing at point of care versus central laboratory testing: a controlled clinical trial. J Antimicrob Chemother. 2021 Sep 23;76(Supplement_3):iii20-iii27. doi: 10.1093/jac/dkab241. PMID: 34555158; PMCID: PMC8460108.	Wrong population
Bouzid D, Mullaert J, Le Hingrat Q, Laurent O, Duval X, Lescure X, Timsit JF, Descamps D, Montravers P, Choquet C, Lucet JC, Casalino E, Visseaux B; ED influenza study group. Characteristics associated with COVID-19 or other respiratory viruses' infections at a single-center emergency department. PLoS One. 2020 Dec 3;15(12):e0243261. doi: 10.1371/journal.pone.0243261. Erratum in: PLoS One. 2021 Jan 27;16(1):e0246458. doi: 10.1371/journal.pone.0246458. PMID: 33270790; PMCID: PMC7714208.	Irrelevant or unrelated focus or scope
Bozio CH, Flanders WD, Finelli L, Bramley AM, Reed C, Gandhi NR, Vidal JE, Erdman D, Levine MZ, Lindstrom S, Ampofo K, Arnold SR, Self WH, Williams DJ, Grijalva CG, Anderson EJ, McCullers JA, Edwards KM, Pavia AT, Wunderink RG, Jain S. Use of Multiple	Irrelevant or unrelated focus or scope

Reference citation	Reason of exclusion
Imputation to Estimate the Proportion of Respiratory Virus Detections Among Patients Hospitalized With Community-Acquired Pneumonia. Open Forum Infect Dis. 2018 Mar 16;5(4):ofy061. doi: 10.1093/ofid/ofy061. PMID: 29946553; PMCID: PMC5890478.	
Branche AR, Walsh EE, Vargas R, Hulbert B, Formica MA, Baran A, Peterson DR, Falsey AR. Serum Procalcitonin Measurement and Viral Testing to Guide Antibiotic Use for Respiratory Infections in Hospitalized Adults: A Randomized Controlled Trial. J Infect Dis. 2015 Dec 1;212(11):1692-700. doi: 10.1093/infdis/jiv252. Epub 2015 Apr 24. PMID: 25910632; PMCID: PMC4633755.	Wrong population
Brendish NJ, Malachira AK, Armstrong L, Houghton R, Aitken S, Nyimbili E, Ewings S, Lillie PJ, Clark TW. Routine molecular point-of-care testing for respiratory viruses in adults presenting to hospital with acute respiratory illness (ResPOC): a pragmatic, open-label, randomised controlled trial. Lancet Respir Med. 2017 May;5(5):401-411. doi: 10.1016/S2213-2600(17)30120-0. Epub 2017 Apr 6. PMID: 28392237; PMCID: PMC7164815.	Wrong population
Brittain-Long R, Andersson LM, Olofsson S, Lindh M, Westin J. Seasonal variations of 15 respiratory agents illustrated by the application of a multiplex polymerase chain reaction assay. Scand J Infect Dis. 2012 Jan;44(1):9-17. doi: 10.3109/00365548.2011.598876. Epub 2011 Aug 26. PMID: 21867470.	Unextractable data in graphs (Unavailable or inaccessible data necessary for analysis)
Brittain-Long R, Andersson LM, Olofsson S, Lindh M, Westin J. Seasonal variations of 15 respiratory agents illustrated by the application of a multiplex polymerase chain reaction assay. Scand J Infect Dis. 2012 Jan;44(1):9-17. doi: 10.3109/00365548.2011.598876. Epub 2011 Aug 26. PMID: 21867470.	Wrong population
Brittain-Long R, Westin J, Olofsson S, Lindh M, Andersson LM. Access to a polymerase chain reaction assay method targeting 13 respiratory viruses can reduce antibiotics: a randomised, controlled trial. BMC Med. 2011 Apr 26;9:44. doi: 10.1186/1741-7015-9-44. PMID: 21521505; PMCID: PMC3108322.	Wrong population
Brottet E, Jaffar-Bandjee MC, Li-Pat-Yuen G, Filleul L. Etiology of Influenza-Like Illnesses from Sentinel Network Practitioners in Réunion Island, 2011-2012. PLoS One. 2016 Sep 21;11(9):e0163377. doi: 10.1371/journal.pone.0163377. PMID: 27654509; PMCID: PMC5031398.	Wrong population
Bruning, Andrea H.L. MD, PhD*; de Kruijf, Wilhelmina B. MD†; van Weert, Henk C.P.M. MD, PhD‡; Vrakking, Anja MD§; de Jong, Menno D. MD, PhD*; Wolthers, Katja C. MD, PhD*; Pajkrt, Dasja MD, PhD†. Respiratory Viruses in a Primary Health Care Facility in Amsterdam, the Netherlands. Infectious Diseases in Clinical Practice 26(4):p 211-215, July 2018. DOI: 10.1097/IPC.0000000000000604	Wrong population
Brunstein J, Thomas E. Direct screening of clinical specimens for multiple respiratory pathogens using the Genaco Respiratory Panels 1 and 2. Diagn Mol Pathol. 2006 Sep;15(3):169-73. doi: 10.1097/01.pdm.0000210430.35340.53. PMID: 16932073.	Irrelevant or unrelated focus or scope
Brunstein JD, Cline CL, McKinney S, Thomas E. Evidence from multiplex molecular assays for complex multipathogen interactions in acute respiratory infections. J Clin Microbiol. 2008 Jan;46(1):97-102. doi: 10.1128/JCM.01117-07. Epub 2007 Oct 31. PMID: 17977985; PMCID: PMC2224244.	Wrong population
Brunstein JD, Cline CL, McKinney S, Thomas E. Evidence from multiplex molecular assays for complex multipathogen interactions in acute respiratory infections. J Clin Microbiol. 2008 Jan;46(1):97-102. doi: 10.1128/JCM.01117-07. Epub 2007 Oct 31. PMID: 17977985; PMCID: PMC2224244.	Wrong population
Budge PJ, Griffin MR, Edwards KM, Williams JV, Verastegui H, Hartinger SM, Johnson M, Klemenc JM, Zhu Y, Gil AI, Lanata CF, Grijalva CG; RESPIRA-PERU Group. A household-based study of acute viral respiratory illnesses in Andean children. Pediatr Infect Dis J. 2014 May;33(5):443-7. doi: 10.1097/INF.0000000000000135. PMID: 24378948; PMCID: PMC4223552.	Wrong population
Byington CL, Ampofo K, Stockmann C, Adler FR, Herbener A, Miller T, Sheng X, Blaschke AJ, Crisp R, Pavia AT. Community Surveillance of Respiratory Viruses Among Families in the Utah Better Identification of Germs-Longitudinal Viral Epidemiology (BIG-LoVE) Study. Clin Infect Dis. 2015 Oct 15;61(8):1217-24. doi: 10.1093/cid/civ486. Epub 2015 Aug 4. PMID: 26245665; PMCID: PMC4583580.	Wrong population
Calderaro A, De Conto F, Buttrini M, Piccolo G, Montecchini S, Maccari C, Martinelli M, Di Maio A, Ferraglia F, Pinardi F, Montagna P, Arcangeletti MC, Chezzi C. Human respiratory viruses, including SARS-CoV-2, circulating in the winter season 2019-2020 in Parma, Northern Italy. Int J Infect Dis. 2021 Jan;102:79-84. doi: 10.1016/j.ijid.2020.09.1473. Epub 2020 Oct 2. PMID: 33017694; PMCID: PMC7530558.	Wrong population
Callahan ZY, Smith TK, Ingersoll C, Gardner R, Korgenski EK, Sloan CD. Comparative Seasonal Respiratory Virus Epidemic Timing in Utah. Viruses. 2020 Feb 29;12(3):275. doi: 10.3390/v12030275. PMID: 32121465; PMCID: PMC7150790.	Wrong population
Camargo CA Jr, Ginde AA, Clark S, Cartwright CP, Falsey AR, Niewoehner DE. Viral pathogens in acute exacerbations of chronic obstructive pulmonary disease. Intern Emerg Med. 2008 Dec;3(4):355-9. doi: 10.1007/s11739-008-0197-0. Epub 2008 Sep 30. PMID: 18825480.	Irrelevant or unrelated focus
Camargo CA Jr, Ginde AA, Clark S, Cartwright CP, Falsey AR, Niewoehner DE. Viral pathogens in acute exacerbations of chronic obstructive pulmonary disease. Intern Emerg Med. 2008 Dec;3(4):355-9. doi: 10.1007/s11739-008-0197-0. Epub 2008 Sep 30. PMID: 18825480.	Irrelevant or unrelated focus
Camargo CA Jr, Ginde AA, Clark S, Cartwright CP, Falsey AR, Niewoehner DE. Viral pathogens in acute exacerbations of chronic obstructive pulmonary disease. Intern Emerg	Irrelevant or unrelated focus or scope

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Med. 2008 Dec;3(4):355-9. doi: 10.1007/s11739-008-0197-0. Epub 2008 Sep 30. PMID: 18825480.	
Campbell AP, Chien JW, Kuypers J, Englund JA, Wald A, Guthrie KA, Corey L, Boeckh M. Respiratory virus pneumonia after hematopoietic cell transplantation (HCT): associations between viral load in bronchoalveolar lavage samples, viral RNA detection in serum samples, and clinical outcomes of HCT. J Infect Dis. 2010 May 1;201(9):1404-13. doi: 10.1086/651662. PMID: 20350162; PMCID: PMC2853730.	Wrong population
Campbell AP, Guthrie KA, Englund JA, Farney RM, Minerich EL, Kuypers J, Corey L, Boeckh M. Clinical outcomes associated with respiratory virus detection before allogeneic hematopoietic stem cell transplant. Clin Infect Dis. 2015 Jul 15;61(2):192-202. doi: 10.1093/cid/civ272. Epub 2015 Apr 5. Erratum in: Clin Infect Dis. 2015 Nov 15;61(10):1635. doi: 10.1093/cid/civ800. PMID: 25847977; PMCID: PMC4565994.	Wrong population
Campbell AP, Kuypers J, Englund JA, Guthrie KA, Corey L, Boeckh M. Self-collection of foam nasal swabs for respiratory virus detection by PCR among immunocompetent subjects and hematopoietic cell transplant recipients. J Clin Microbiol. 2013 Jan;51(1):324-7. doi: 10.1128/JCM.02871-12. Epub 2012 Nov 7. PMID: 23135933; PMCID: PMC3536199.	Wrong population
Carrat F, Leruez-Ville M, Tonnellier M, Baudel JL, Deshayes J, Meyer P, Maury E, Galimand J, Rouzioux C, Offenstadt G. A virologic survey of patients admitted to a critical care unit for acute cardiorespiratory failure. Intensive Care Med. 2006 Jan;32(1):156-9. doi: 10.1007/s00134-005-2861-4. Epub 2005 Nov 19. PMID: 16328219; PMCID: PMC7079937.	Wrong population
Cattoir L, Vankeerberghen A, Boel A, Van Vaerenbergh K, De Beenhouwer H. Epidemiology of RSV and hMPV in Belgium: a 10-year follow-up. Acta Clin Belg. 2019 Aug;74(4):229-235. doi: 10.1080/17843286.2018.1492509. Epub 2018 Jul 20. PMID: 30029583.	Unextractable data in graphs (Unavailable or inaccessible data necessary for analysis)
Checovich MM, Barlow S, Shult P, Reisdorf E, Temte JL. Evaluation of Viruses Associated With Acute Respiratory Infections in Long-Term Care Facilities Using a Novel Method: Wisconsin, 2016–2019. J Am Med Dir Assoc. 2020 Jan;21(1):29-33. doi: 10.1016/j.jamda.2019.09.003. Epub 2019 Oct 19. PMID: 31636034; PMCID: PMC7106273.	Wrong population
Chen X, Zhang ZY, Zhao Y, Liu EM, Zhao XD. Acute lower respiratory tract infections by human metapneumovirus in children in Southwest China: a 2-year study. Pediatr Pulmonol. 2010 Aug;45(8):824-31. doi: 10.1002/ppul.21264. PMID: 20583291; PMCID: PMC7168118.	Country outside the area of interest
Choe YJ, Smit MA, Mermel LA. Comparison of Common Respiratory Virus Peak Incidence Among Varying Age Groups in Rhode Island, 2012-2016. JAMA Netw Open. 2020 May 1;3(5):e207041. doi: 10.1001/jamanetworkopen.2020.7041. PMID: 32401314; PMCID: PMC7221508.	Wrong publication type (e.g. abstract conference)
Choi SH, Hong SB, Ko GB, Lee Y, Park HJ, Park SY, Moon SM, Cho OH, Park KH, Chong YP, Kim SH, Huh JW, Sung H, Do KH, Lee SO, Kim MN, Jeong JY, Lim CM, Kim YS, Woo JH, Koh Y. Viral infection in patients with severe pneumonia requiring intensive care unit admission. Am J Respir Crit Care Med. 2012 Aug 15;186(4):325-32. doi: 10.1164/rccm.201112-2240OC. Epub 2012 Jun 14. PMID: 22700859.	Country study outside the geographical area of interest
Chow EJ, Mermel LA. Hospital-Acquired Respiratory Viral Infections: Incidence, Morbidity, and Mortality in Pediatric and Adult Patients. Open Forum Infect Dis. 2017 Feb 3;4(1):ofx006. doi: 10.1093/ofid/ofx006. PMID: 28480279; PMCID: PMC5414085.	Wrong population
Chughtai AA, Wang Q, Dung TC, Macintyre CR. The presence of fever in adults with influenza and other viral respiratory infections. Epidemiol Infect. 2017 Jan;145(1):148-155. doi: 10.1017/S0950268816002181. Epub 2016 Oct 3. PMID: 27691995; PMCID: PMC5197931.	Country study outside the geographical area of interest
Çiçek C, Arslan A, Karakuş HS, Yalaz M, Saz EU, Pullukçu H, Çok G. Akut solunum yolu enfeksiyonu olan hastalarda solunum viruslarının prevalansı ve mevsimsel dağılımı, 2002-2014 [Prevalence and seasonal distribution of respiratory viruses in patients with acute respiratory tract infections, 2002-2014]. Mikrobiyol Bul. 2015 Apr;49(2):188-200. Turkish. doi: 10.5578/mb.9024. PMID: 26167819.	Country study outside the geographical area of interest
Civelek-Eser F, Tütüncü EE, Haykır-Solay A, et al. [Evaluation of patients diagnosed with severe acute respiratory tract infection: 2015-2016 influenza season]. Klimik Derg. 2017; 30(3): 114-9. Turkish. DOI: 10.5152/kd.2017.29.	Country study outside the geographical area of interest
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Clark B, Cintron M, Kamboj M, Babady NE. Effect of non-pharmaceutical interventions on the incidence of respiratory viruses at a tertiary cancer care center. J Clin Virol. 2023 Jun;163:105442. doi: 10.1016/j.jcv.2023.105442. Epub 2023 Apr 2. PMID: 37075690; PMCID: PMC10066859.	Unextractable data in graphs (Unavailable or inaccessible data necessary for analysis)
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Heredia-Rodríguez M, Balbás-Álvarez S, Lorenzo-López M, Gómez-Pequera E, Jorge-Monjas P, Rojo-Rello S, Sánchez-De Prada L, Sanz-Muñoz I, Eiros JM, Martínez-Paz P, Gonzalo-Benito H, Tamayo-Velasco Á, Martín-Fernández M, Sánchez-Conde P, Tamayo E, Gómez-Sánchez E. PCR-based diagnosis of respiratory virus in postsurgical septic patients: A preliminary study before SARS-CoV-2 pandemic. <i>Medicine (Baltimore)</i> . 2022 Aug 12;101(32):e29902. doi: 10.1097/MD.00000000000029902. PMID: 35960076; PMCID: PMC9370242.	Wrong population
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Ishiguro T, Takayanagi N, Takahashi T, Yoneda K, Miyahara Y, Tokunaga D, Yoshioka H, Yanagisawa T, Sugita Y, Ubukata K. [A single-center prospective study of viral infection in community-acquired pneumonia in adults]. <i>Nihon Kokyuki Gakkai Zasshi</i> . 2011 Jan;49(1):10-9. Japanese. PMID: 21384676.	Wrong type of study (non-human studies and case report)
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Johnstone J, Majumdar SR, Fox JD, Marrie TJ. Viral infection in adults hospitalized with community-acquired pneumonia: prevalence, pathogens, and presentation. <i>Chest</i> . 2008 Dec;134(6):1141-1148. doi: 10.1378/chest.08-0888. Epub 2008 Aug 8. PMID: 18689592; PMCID: PMC7094572.	HMPV cases identified by methodologies other than PCR or serology

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Keske Ş, Gümüş T, Köymen T, Sandıkçı S, Tabak L, Ergönül Ö. Human metapneumovirus infection: Diagnostic impact of radiologic imaging. <i>J Med Virol</i> . 2019 Jun;91(6):958-962. doi: 10.1002/jmv.25402. Epub 2019 Feb 1. PMID: 30659630; PMCID: PMC7166911.	Wrong population
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Koon K, Sanders CM, Green J, Malone L, White H, Zayas D, Miller R, Lu S, Han J. Co-detection of pandemic (H1N1) 2009 virus and other respiratory pathogens. <i>Emerg Infect Dis</i> . 2010 Dec;16(12):1976-8. doi: 10.3201/eid1612.091697. PMID: 21122236; PMCID: PMC3294579.	Wrong population
Koul PA, Mir H, Akram S, Potdar V, Chadha MS. Respiratory viruses in acute exacerbations of chronic obstructive pulmonary disease. <i>Lung India</i> . 2017 Jan-Feb;34(1):29-33. doi: 10.4103/0970-2113.197099. PMID: 28144057; PMCID: PMC5234194.	Country study outside the geographical area of interest
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Lagacé-Wiens P, Bullard J, Cole R, Van Caeseele P. Seasonality of coronaviruses and other respiratory viruses in Canada: Implications for COVID-19. <i>Can Commun Dis Rep</i> . 2021 Mar 31;47(3):132-138. doi: 10.14745/ccdr.v47i03a02. PMID: 34012336; PMCID: PMC8109286.	Wrong population
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Singh M, Lee SH, Porter P, Xu C, Ohno A, Atmar RL, Greenberg SB, Bandi V, Gern J, Amineva S, Amineva S, Skern T, Smithwick P, Perusich S, Barrow N, Roberts L, Corry DB, Kheradmand F. Human rhinovirus proteinase 2A induces TH1 and TH2 immunity in patients with chronic obstructive pulmonary disease. <i>J Allergy Clin Immunol.</i> 2010 Jun;125(6):1369-1378.e2. doi: 10.1016/j.jaci.2010.02.035. PMID: 20430426; PMCID: PMC2881843.	Irrelevant or unrelated focus or scope
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Author Year Country	Setting	Sample size description	Type of respiratory infection	Type of population	Age category (years)	Study period	Annual vs seasonal	Incidence
Incidence of symptomatic older adults								
Kurai 2022 Japan	Community, nursing Homes, or care institutions	Older adults, either in the community, assisted living, or LTCF	ARI/ARD	Comm* (OP, LTCF)	65+	Apr 2019-July 2020	Annual	12 per 1,000 persons (1-2%)
Fowlkes 2014 USA	GP/Primary care	Catchment population of the Influenza Incidence Surveillance Project (IISP) monitored outpatient	ILI and ARI	Meda (OP)	50-64	Aug 2010-July 2011	Annual	2·1 per 1000 persons (95% CI 0·2-4·4)
			ILI and ARI	Meda (OP)	65+		Annual	0·4 per 1000 persons (95% CI 0·0-1·8)
			ARI	Meda (OP)	50-64		Annual	1·4 per 1000 persons (95% CI 0·0-3·6)
			ARI	Meda (OP)	65+	Annual	0 per 1000 persons	
			ILI	Meda (OP)	50-64	Annual	0·4 per 1000 persons (95% CI 0·0-1·0)	
			ILI	Meda (OP)	65+	Annual	0·2 per 1000 persons (95% CI 0·0-0·6)	
Stockwell 2022 USA	Database: Mobile Surveillance for Acute Respiratory Infections and Influenza-Like Illness in the Community (MoSAIC)	Catchment population of the mobile surveillance	ARI	Comm	65+	Dec 2012- Sept 2017	Annual	0·005 per person-year
Subissi 2021 Belgium	GP/Primary care, other database: (Network of GPs and the sentinel network of six hospitals in Belgium, two in each administrative region of the country)	Catchment population of the Sentinel-based ILI surveillance	ILI, SARI	Meda (IP and OP)	65+	2015- 2019 (Winter)	Seasonal	4·4 per 100,000 person-month 95% CI (3·7- 5·3)
Van Beek 2017 Netherlands	GP/Primary care, Community	Population recruited through their general practitioner or through the Civil Registry	ILI	Comm	60+	Dec 2011-Apr 2012	Seasonal (2011- 2012)	13·7 HMPV cases per 1000 residents - 29/2120 (1·4%)
						Oct 2012-May 2013	Seasonal (2012- 2013)	4·0 HMPV cases per 1000 residents - 10/2506 (0·4%)
Incidence of symptomatic high-risk population								
Dementia								
Spires 2017 USA	Nursing Homes, or care institutions (Outbreak)	Residents from a LTCF	ILI	Meda (LTCF)	Mean (SD): 81·3 (NR)	5 Jan 2015- 21 Jan 2015	Seasonal	170·7 HMPV cases per 1,000 residents
Institutionalised older adults								
CDC 2013 USA	Nursing Homes or care institutions (Outbreak in Idaho)	Residents from a LTCF	RTI	Meda (LTCF)	54-99	Jan 2012	Seasonal	72·2 HMPV cases per 1,000 residents
	Nursing Homes or care institutions (Outbreak in Virginia)				51-97	Feb 2012	Seasonal	75 HMPV cases per 1,000 residents
Louie 2007 USA	Nursing Homes, or care institutions (Outbreak)	Residents from a LTCF	ARI/ARD	Meda (LTCF)	Mean (SD): 70·2 (NR)	4 Jun 2006- 8 Jul 2006	Seasonal	33·7 HMPV cases per 1,000 residents
Boivin 2007 Canada	Nursing Homes or care institutions (Outbreak)	Residents from a LTCF	ILI	Meda (LTCF)	59+	1 Jan 2006- 15 Feb 2006	Seasonal	49·1 HMPV cases per 1,000 residents
Te Wierik 2012 Netherlands	Nursing Homes or care institutions (Outbreak)	Residents from a LTCF	RTISS	Meda (LTCF)	83+	Jan 2010- March 2010 (Winter)	Seasonal	50 HMPV cases per 1,000 residents
Incidence of HMPV in the older adults (not specified as symptomatic or asymptomatic)								

Author Year Country	Setting	Sample size description	Type of respiratory infection	Type of population	Age category (years)	Study period	Annual vs seasonal	Incidence
Foley 2022 Australia	Other database: (Laboratory testing database; PathWest Laboratory Medicine WA data)	Samples from a Laboratory database	NR	NR	65+	2017-2017	Annual	34.4 HMPV cases per 100,000 population (95% CI 29.1-40.6)
						2018-2018	Annual	36.6 HMPV cases per 100,000 population (95% CI 31.2-42.9)
						2019-2019	Annual	59.9 HMPV cases per 100,000 population (95% CI 52.8-67.9)
						2020-2020	Annual	8.3 HMPV cases per 100,000 population (95% CI 6-11.7)
						2021-2021	Annual	92.5 HMPV cases per 100,000 population (95% CI 83.7-102.4)
						2017-2019	Annual	46.3 HMPV cases per 100,000 population (95% CI 40-47.5)

ARI: Acute respiratory infection; Comm: Community-based; GP: General practitioner; ILI: Influenza-Like Illness; IP: Inpatient; LTCF: Long-term care facility; Meda: Medically attended; NA: Not applicable; NR: Not reported; OP: Outpatient; RTISS: Respiratory Tract Infection Signs and Symptoms; SARI: Severe Acute Respiratory Infection; SD: Standard deviation; WA: Western Australia. *99.6% of patients lived at home. Louie 2007 and Spires 2017: No lower limit age was reported

Table S8. Prevalence of hMPV in asymptomatic older and high-risk adults.

Author Year Country	Setting	Sample size description	Study period	Population type	Age category (years)	Annual vs seasonal	n/N (%)
Older adults							
Kaaijk 2022 Netherlands	Community	Asymptomatic controls without ILI symptoms	Oct 2014-April 2015	Comm (NA)	60+	Seasonal	0/205 (0)
van Beek 2017 Netherlands	GP/Primary care, Community	Subgroup of asymptomatic controls	Dec 2011-May 2013	Comm (NA)	60+	Seasonal	1/340 (0.3)
Walsh 2008 USA	Hospital, GP/Primary care	All asymptomatic tested for respiratory virus	Nov 1999-April 2000	Comm (NA)	65+	Seasonal	1/212 (0.5)
			Nov 2000-April 2001	Comm (NA)	65+	Seasonal	3/280 (1.1)
			Nov 2001-April 2002	Comm (NA)	65+	Seasonal	2/180 (1.1)
			Nov 2002-April 2003	Comm (NA)	65+	Seasonal	10/295 (3.4)

			1999-2003	Meda (OP)	65+	Seasonal	16/611 (2.6)
High-risk subgroups population							
COPD							
McManus 2008 UK	Hospital	COPD	Study period 2 years (not specified)	Meda (OP)	18+* (Mean (SD): 70.2 (9.4))	Annual	0/68 (0.0)
Neutropenic patients							
Jansen 2013 Netherlands	Hospital	Patients with chemotherapy-induced significant neutropenia (sample taken upon admission)	Nov 2008-Apr 2010	Meda (OP)	18+*	Annual	0/71 (0.0)
		Sample taken during deep neutropenia			18+*	Annual	0/46 (0.0)
		Sample taken at the start of neutropenic fever			18+*	Annual	1/42 (2.4)
Lung transplant recipients							
Peghin 2017 Spain	Hospital	Lung transplant recipients	Sep 2009-Sep 2011	Meda (IP and OP)	18+	Annual	2/68 (2.9)
Kumar 2005 Canada	Hospital	Lung transplant recipients	2001-2003	Meda (OP)	18+* (Mean (SD): 48.8 (14.9))	Annual	0/50 (0.0)
Dare 2007 USA	Hospital	Lung transplant recipients	May 2004-Apr 2005	Meda (OP)	22+	Annual	1/36 (2.7)
Kumar 2010 USA	Hospital	Lung transplant recipients	Feb 2003-Dec 2005	Meda (IP and OP)	18+* (Mean (SD): 51.6 (12.1))	Annual	4/419 (1.0)
Other high-risk groups							
Walsh 2008 USA	Hospital, GP/ Primary care	COPD, Cardiovascular disease: Congestive heart failure, Other: lung disease	Nov 1999-Apr 2000	Meda (OP)	18+	Seasonal	2/206 (1.0)
			Nov 2000-Apr 2001		18+	Seasonal	5/271 (1.8)
			Nov 2001-Apr 2002		18+	Seasonal	6/195 (3.1)
			Nov 2002-Apr 2003		18+	Seasonal	6/210 (2.9)
			1999-2003		18+	Seasonal	19/537 (3.5)

AEC: Acute exacerbation; Comm: Community-based; COPD: Chronic obstructive pulmonary disease; GP: General practitioner; ILI: Influenza-Like Illness; IP: Inpatient; LRTI: Lower Respiratory Tract Infection; Meda: Medically attended; NA: Not applicable; OP: Outpatient; RTI: Respiratory Tract Infection; RVI: Respiratory Viral Infection. Note: for age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered.

Table S9. Proportion of hospitalisations among hMPV-positive older adults.

Author Year	Country	Setting	Population	Respiratory disease	Age	Events/Total
Gioula 2010	Greece	Medically attended	OP	ILI	60+	0/1 (0%)
Walsh 2008	United States	Medically attended	OP	RTI	65+	0/13 (0%)
Kurai 2022	Japan	Community	OP	ARI/ARD	65+	1/12 (8.3%)

ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; ILI: Influenza-Like Illness; OP: Outpatient; RTI: Respiratory Tract Infection.

Table S10. Intensive care unit admission proportion among hMPV-positive older adults.

Author Year	Country	Setting	Population	Respiratory disease	Age	Events/Total
Kurai 2022	Japan	Community	OP	ARI/ARD	65+	0/1 (0%)
Widmer 2012	United States	Medically attended	IP	ARI/ARD	50+	3/23 (13%)
Walsh 2008	United States	Medically attended	IP	RTI	65+	12/91 (13%)

ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; IP: Inpatient; OP: Outpatient; RTI: Respiratory Tract Infection

Table S11. hMPV associated hospitalisation rate among older adults.

Author Year Country	Setting	Sample size description	Type of respiratory infection	Populatio n type	Age categor y (years)	Study period	Hospitalisation rate
Sieling 2020, USA	Hospital	Hospitalised patients with a respiratory virus detected	ARI	Meda (IP)	50-64	October 2017- Sept 2018	4·1 / 10000 population
					65-79	October 2017- Sept 2018	10·0 / 10000 population
					80-100	October 2017- Sept 2018	38·4 / 10000 population
					50-64	October 2018- Sept 2019	4·5 / 10000 population
					65-79	October 2018- Sept 2019	10·7 / 10000 population
					80-100	October 2018- Sept 2019	30·3 / 10000 population
Zimmerman 2022, USA	Health Insurance Database	Hospitalised patients with acute respiratory infection	ARI/ARD	Meda (IP)	50-64	01 July 2015–30 June 2019	17·6 / 10000 persons
					65+	01 July 2015-30 June 2019	59·3 / 10000 persons
Widmer 2014, USA	Hospital	Participants with adequate samples for hMPV or RSV	RTISS	Meda (IP and OP)	50+	May 2009-Apr 2010	14·21 / 10000 persons
					50-64	May 2009–Apr 2010	9·76 / 10000 persons
					65+	May 2009–Apr 2010	21·41 / 10000 persons
Widmer 2012, USA	Hospital	Samples tested for RSV, hMPV, and influenza	ARI/ARD	Meda (IP)	50+	Nov 2006–Apr 2009 (Winter)	9·8 / 10000 residents (95% CI: 5·8-14·4)
					50-64	Nov 2006–Apr 2009 (Winter)	1·8 / 10000 residents (95% CI: 0·3-4·0)
					65+	Nov 2006–Apr 2009 (Winter)	22·1 / 10000 residents (95% CI: 12·1-33·7)

ARI/ARD: Acute Respiratory Infection/Disease; CI: Confidence interval; hMPV: Human metapneumovirus; IP: Inpatient; Meda: Medically attended; OP: Outpatient; RTISS: Respiratory Tract Infection Signs and Symptoms

Table S12. Hospital length of stay among hMPV-positive older adults.

Author, Year, Country	Setting	Sample Size Description	Response Type	Population Type	Age category (years)	Study period	Hospitalisation LoS
Kurai 2022, Japan	Community	Older adults	ARI/ARD	Comm* (OP, LTCF)	65+	April 2019 – July 2020	6 days
Widmer 2012, USA	Hospital	Samples from general population tested for RSV, hMPV, and Influenza	ARI/ARD	Meda (IP)	50+	Nov 2006 – Apr 2009 (Winter)	Median (IQR): 3 (1-4) days
Walsh 2008, USA	Hospital, GP/Primary care	Hospitalised older adults	RTI	Meda (IP)	50+	Nov 1999-Apr 2003 (Winter)	Mean (SD): 9 (7) days

ARI/ARD: Acute Respiratory Infection/Disease; Comm (OP, LTCF): Community (Outpatient, Long-Term Care Facility); Meda (IP): Medically Attended (Inpatient); RTI: Respiratory Tract Infection. For entries where only the number of days is presented, it is important to note that this information is based on a single observation (n=1). *99.6% of patients lived at home.

Table S13. Outpatient and emergency room (ER) visits among hMPV-positive older and high-risk adults.

Author Year Country	Setting	Sample size description	Type of respiratory infection	Population type	Study period	Age category (years)	Outpatient clinic n/N (%)	Emergency Department/Room n/N (%)
Older adults								
Walsh 2008 USA	Hospital/Primary care	General population (elderly >65 years)	RTI	Meda (IP & OP)	1999-2003	65+	5/13 (38)	0/13 (0)
High-risk								
Walsh 2008 USA	Hospital, GP/Primary care	RTI	Meda (IP and OP)	Lung disease, COPD, Chronic heart failure (CHF)	1999-2003	18+	11/17 (67.0)*	1/17 (6.0)*
Saraya 2017 Japan	Hospital	AEA	Meda (IP and OP)	Asthma	Aug 2012-May 2015	18+	3/9 (33.0)	NR
Hopkins 2008 Australia	Hospital	ILI, URTI, RVI	Meda (IP and OP)	Lung transplant recipients	July 2003-Dec 2006	29+	7/19 (36.8)	NR
Peghin 2017 Spain	Hospital	RVI	Meda (IP and OP)	Lung transplant recipients	Sep 2009-Sep 2011	18+	11/16 (68.7)	NR

AEA: Acute Asthma Exacerbation; CHF: Congestive heart failure; COPD: Chronic obstructive pulmonary disease; ILI: Influenza-like illness; IP: Inpatient; Meda: Medically attended; NR: Not reported; OP: Outpatient; RTI: Respiratory tract infection; RVI: Respiratory viral infection; SD: Standard deviation; URTI: Upper respiratory tract infection. *Numerator (n) was calculated as the study only reported percentages.

Table S14. HMPV complications among hMPV-positive older adults.

Author Year Country	Setting	Sample size description	Type of respiratory infection	Popula tion type	Age category (years)	Study period	n/N (%)
Pneumonia (n=2)							
Korsun 2021 Bulgaria	Hospital, GP/Primary care	Hospitalised patients	ARI/ARD	Meda (IP)	65+	Oct 2016- Sept 2019	1/8 (12.5)
Reiche 2014 Germany	GP/Primary care	Clinical specimens from patients with ILI	ILI	Meda (OP)	60+	Oct 2000- Apr 2010	3/24 (12.5)
Mechanical ventilation (n=2)							
Widmer 2012, USA	Hospital	ARI in older adults	ARI/ARD	Meda (IP)	50+	Nov 2006- Apr 2009	1/23 (4.3)
Walsh 2008, USA	Hospital, GP/Primary care	Hospitalised subjects	RTI	Meda (IP)	65+	Nov 1999- Apr 2003 (Winter)	11/91 (12.0)

ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; GP: General Practitioner; hMPV: Human metapneumovirus; ILI: Influenza-Like Illness; IP: Inpatient; Meda: Medically attended; OP: Outpatient; RTI: Respiratory Tract Infection.

Table S15. Case fatality rate among hMPV-positive older adults by region.

Author Year	Country	Setting	Population	Respiratory disease	Age	Fatality type	Events/Total
Kurai 2022	Japan	Community	Community, LTCF	ARI/ARD	65+	NR	0/12 (0%)
Degail 2012	United Kingdom	Medically attended	IP	ILI	68+	NR	0/5 (0%)
Widmer 2012	United States	Medically attended	IP	ARI/ARD	50+	In-hospital	2/23 (8.7%)
Widmer 2014	United States	Medically attended	Both	RTI/SS	50+	NR	0/23 (0%)
Walsh 2008	United States	Medically attended	IP	RTI	65+	In-hospital	6/91 (6.6%)

ARI/ARD: Acute Respiratory Infection/Acute Respiratory Disease; ILI: Influenza-Like Illness; IP: Inpatient; LTCF: Long-Term Care Facility; NR: Not Reported; RTI: Respiratory Tract Infection; RTISS: Respiratory Tract Infection Signs and Symptoms.

Table S16. Hospital length of stay among hMPV-positive high-risk adults.

Author Year Country	Setting	Type of respirator y infection	Type of high-risk	Age categor y (years)	Study period	Hospitalisati on LOS
Kapandji 2023, France	Specialise d Medical Care Centres	NR	Malignancies: onco- haematological	18+* (Median (IQR): 66 (56- 74))	Sep 2010-June 2018	Median (IQR): 17 (9- 27) days
Moret 2021, Switzerla nd	Hospital	RVI	Immunocompromised status: Autologous haematopoietic stem-cell transplantation (auto-SCT)	18+	Nov 2015- Apr 2017	19 days
El Chaer 2017, USA	Hospital	ARI/ARD	Immunocompromised status: Haematopoietic cell transplantation (HCT) in remission	16+	Apr 2012-May 2015	Median (IQR): 6 (NR) days
Egli 2012, Switzerla nd	Hospital	LRTI	Immunocompromised status: Allogeneic HSCT	27+	June 2009- June 2010	Median (IQR): 13 (NR) days
Müller 2009, Germany	Hospital	CAP	Immunocompromised status: chronic myeloid leukaemia and allogenic bone marrow transplantation	20+	2003-2004	10 days
Martinello 2006, USA	Hospital	AEC	COPD	18+* (Mean (SD): 63 (13))	Dec 2002-May 2003 (Winter, Spring)	Median (IQR): 4 (3- 16) days
Sumino 2005, US	Hospital	RTISS	COPD, Immunocompromised status: Leukaemia, lung and heart transplant recipients	31+	Feb 2003- Apr 2003	Mean (SD): 25 (NR) days
Hamelin 2005, Canada	Hospital	CAP, AEC	COPD, Asthma, Cardiovascular disease: cardiac heart failure	39+	2002-2004/ Jan-May/ Winter, Spring	Mean (SD): 10 (NR) days

Note: For age categories marked with an asterisk (), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered; For entries where only the number of days is presented, it is important to note that this information is based on a single observation (n=1). AEC: Acute Exacerbation of Chronic; ARI/ARD: Acute Respiratory Infection/Disease; CAP: Community-Acquired Pneumonia; COPD: Chronic Obstructive Pulmonary Disease; LoS: Length of stay, LRTI: Lower Respiratory Tract Infection; NR: Not reported; RVI: Respiratory Viral Infection; RTISS: Respiratory Tract Infection Signs and Symptoms, SD: Standard deviation.

Table S17. HPMV Complications and exacerbations hMPV-positive high-risk adults.

Author Year Country	Setting	Type of respirator y infection	Population type	Type of high- risk	Age category (years)	Study period	n/N (%)
Acute Rejection (n=6)							
Weinberg 2010, USA	Hospital	URTI, LRTI	Meda (IP and OP)	Lung transplant recipients	18+*	Sept 2005-Nov 2007	1/4 (25·0)
Kumar 2010, USA	Hospital	LRTI, RVI	Meda (IP and OP)	Lung transplant recipients	18+* [Mean (SD): 51·6 (12·1)]	Feb 2003-Dec 2005	1/4 (25·0)
Larcher 2005, Austria	Hospital	CAP	Meda (IP)	Lung and bone marrow transplant recipients	35-65	Sept 2003-March 2004	4/12 (33·3)
Kumar 2005, Canada	Hospital	RTI	Meda (OP)	Lung transplant recipients	18+* [Mean (SD): 45·5 (14·5)]	2001-2003	0/1 (0·0)
Permpalung 2021, USA	Hospital	URTI, LRTI	Meda (IP and OP)	Lung transplant recipients	18+* [Median (IQR): 58 (54-65)]	July 2010-June 2019	2/31 (6·4)
Englund 2006, USA	Specialised Medical Care Centres	LRTI, CAP	Meda (IP and OP)	Haematopoietic stem-cell transplant recipients	24-54	Jan 1995-Apr 1999	1/5 (20·0)
Chronic rejection (n=7)							
Kumar 2010, USA	Hospital	LRTI, RVI	Meda (IP and OP)	Lung transplant recipients (BOS)	18+* [Mean (SD): 51·6 (12·1)]	Feb 2003-Dec 2005	1/4 (25·0)
Hopkins 2008, Australia	Hospital	ILI, URTI, RVI	Meda (IP and OP)	Lung transplant recipients (BOS)	18+	July 2003-Oct 2006	0/19 (0·0)
Larcher 2005, Austria	Hospital	CAP	Meda (IP)	Lung and bone marrow transplant recipients (BOS)	35-65	Sep 2003-Mar 2004	2/12 (16·7)
Kumar 2005, Canada	Hospital	RTI	Meda (OP)	Lung transplant recipients (BOS)	18+* [Mean (SD): 45·5 (14·5)]	2001-2003	0/1 (0·0)
Gottlieb 2009, Germany	Hospital	URTI, LRTI, RVI	Meda (OP)	Lung transplant recipients (BOS)	18-68	Oct 2005-Apr 2007	2/6 (33·3)
Permpalung 2021, USA	Hospital	URTI, LRTI	Meda (IP and OP)	Lung transplant recipients (CLAD)	18+* [Median (IQR): 58 (54-65)]	July 2010-June 2019	11/31 (35·5)
Hopkins 2008, Australia	Hospital	ILI, URTI, RVI	Meda (IP and OP)	Lung transplant recipients (CLAD)	18+	July 2003-Oct 2006	12/19 (63·2)
ARDS (n=2)							
Kapandji 2023, France	Specialised Medical Care Centres	NR	Meda (IP)	Haematological malignancies	18+* [Median (IQR): 66 (56-74)]	1 Sept 2010–30 June 2018	5/26 (19·2)

Author Year Country	Setting	Type of respirator y infection	Population type	Type of high- risk	Age category (years)	Study period	n/N (%)
Vidaur 2019, Spain	Hospital	CAP	Meda (IP and OP)	COPD, Asthma, immunocomprom ised status: non- Hodgkin lymphoma, Multiple myeloma, Heart transplant, Chemotherapy, Pancreas and kidney transplant and SLE	30+	July 2007– June 2017	4/14 (28· 5)
Vasopressor support (n=1)							
Kapandji 2023, France	Specialise d Medical Care Centres	NR	Meda (IP)	Haematological malignancies	18+* [Median (IQR): 66 (56- 74)]	1 Sept 2010– 30 June 2018	11/2 6 (42· 3)
Respiratory failure (n=1)							
Müller 2009, German y	Hospital	CAP	Meda (IP)	Chronic myeloid leukaemia and allogenic bone marrow transplantation	20-86	Jan 2003– Dec 2004	1/1 (100)
Oxygen supplement (n=2)							
El Chaer 2017, USA	Hospital	ARI/ARD	Meda (IP)	Haematopoietic cell transplant (HCT) recipients in remission	16-76	Apr 2012– May 2015	12/5 7 (21· 0)
Permpal ung 2021, USA	Hospital	URTI, LRTI	Meda (IP and OP)	Lung transplant recipients	18+* [Median (IQR): 58 (54- 65)]	July 2010– June 2019	6/31 (19· 3)
Progression URTI to LRTI (n=1)							
El Chaer 2017, USA	Hospital	ARI/ARD	Meda (IP)	Haematopoietic cell transplant (HCT) recipients in remission	16-76	Apr 2012– May 2015	5/57 (8·7)
Exacerbations due to HMPV in the high-risk population							
Permpal ung 2021, USA	Hospital	URTI, LRTI	Meda (IP)	Lung transplant recipients: Hospitalised for respiratory exacerbation within 90 d post HMPV	18+* [Median (IQR): 58 (54- 65)]	July 2010- June 2019	7/31 (22· 5)

ARDS: Acute respiratory distress syndrome; ARI/ARD: Acute respiratory infection/disease; BOS: Bronchiolitis obliterans syndrome; CAP: Community-acquired pneumonia; CLAD: Chronic lung allograft dysfunction; IP: Inpatient; IQR: Interquartile range; LRTI: Lower respiratory tract infection; Meda: Medically attended; NR: Not reported; OP: Outpatient; Respiratory tract infection; SD: Standard deviation; URTI: Upper respiratory tract infection. *Note: For age categories marked with an asterisk (*), the lower limit was assumed, as it was not explicitly stated within the article. Mean/medians far above the lower limit of our scope were considered.

Table S18. Clinical presentation (URTI, LRTI and bronchitis) among hMPV cases in older and high-risk adults.

Author Year Country	Setting	Sample size description	Type of respiratory infection	Populati on type	Age category (years)	Annual vs season al	n/N (%)
URTI in older adults							
Kurai 2022 Japan	Commun ity	Older adults, either in the community, assisted living, or LTCF	ARI/ARD	Comm (OP, LTCF)	65+	Annual	6/12 (50)
LRTI in older adults							
Korsun 2021 Bulgaria	Hospital, GP/Prim ary care	Hospitalised patients	2016- 2019	ARI/ARD	Meda (IP)	65+	Seas onal
Reiche 2014 Germany	GP/Prim ary care	Clinical specimens of outpatient participants	2000- 2010	ILI	Meda (OP)	60+	Annu al
Kurai 2022 Japan	Commun ity	Older adults, either in the community, assisted living, or LTCF	Apr 2019-July 2020	ARI/ARD	Comm+ (OP, LTCF)	65+	Seas onal
Bronchitis in Older adults							
Reiche 2014 Germany	GP/Prim ary care	Clinical specimens from general population	ILI	Meda (OP)	60+	Oct 2000- Apr 2010	3/24 (12.5)
Bronchitis in the high-risk population							
Peghin 2017 Spain	Hospital	Lung transplant recipients	RVI	Meda (IP and OP)	Lung transplant	Mean (SD): 49.9 (12.6)	Sep 2009 -Sep 2011
Boivin 2007, Canada	Nursing Homes or care institutio ns	Residents in facility	ILI	Meda (LTCF)	Institutionali sed older adults	Mean (SD): 79 (NR)	1 Jan 2006 –15 Feb 2006

ARI/ARD: Acute respiratory infection/disease; ILI: Influenza-Like Illness; IP: Inpatient; URTI: Upper respiratory tract infection, LRTI: Lower respiratory tract infection; LTCF: Long-Term Care Facility; OP: Outpatient; RVI: Respiratory Viral Infection; SD: standard deviation.

Table S19. HMPV symptoms description in older and high-risk adults.

Symptoms Description	#Studies	Citations	#Patients	Median HMPV cases with symptom/sign (%)	Mean (overall proportion) HMPV cases with symptom/sign (%)	Min HMPV cases with symptom/sign (%)	Max HMPV cases with symptom/sign (%)
Self-reported symptoms							
General population – older adults >50 and above							
Cough	4	Kurai 2022; Reiche 2014; Walsh 2008; Widmer 2012	163	93.4	95.1	91.7	100.0
Dyspnoea	3	Ciotti 2020; Walsh 2008; Widmer 2012	135	87.0	86.7	50.0	89.4
Fever	3	Reiche 2014; Walsh 2008; Widmer 2012	151	52.2	56.3	50.0	87.5
Sore throat	3	Kurai 2022; Walsh 2008; Widmer 2012	139	31.7	35.3	30.4	75.0
Wheezing	3	Kurai 2022; Walsh 2008; Widmer 2012	139	73.1	69.8	16.7	82.6
Congested nose	2	Walsh 2008; Widmer 2012	127	70.9	60.6	54.8	87.0
Fatigue	2	Kurai 2022; Widmer 2012	35	49.6	60.0	16.7	82.6
Headache	2	Kurai 2022; Widmer 2012	35	32.1	34.3	25.0	39.1
Myalgia	2	Kurai 2022; Widmer 2012	35	23.6	25.7	16.7	30.4
Altered mental status	1	Widmer 2012	10	50.0	50.0	50.0	50.0
Constitutional	1	Walsh 2008	104	40.4	40.4	40.4	40.4
Decreased appetite	1	Widmer 2012	23	43.5	43.5	43.5	43.5
Earache	1	Widmer 2012	23	13.0	13.0	13.0	13.0
Feverishness	1	Kurai 2022	12	33.3	33.3	33.3	33.3
Hoarse	1	Walsh 2008	104	29.8	29.8	29.8	29.8
Nasal congestion	1	Kurai 2022	12	41.7	41.7	41.7	41.7
Nausea/vomiting/ diarrhoea	1	Widmer 2012	23	43.5	43.5	43.5	43.5
New/ worsening sputum	1	Walsh 2008	104	72.1	72.1	72.1	72.1
Shortness of breath	1	Kurai 2022	12	16.7	16.7	16.7	16.7
Sputum Production	1	Kurai 2022	12	83.3	83.3	83.3	83.3
High-risk adults: Immunocompromised							
Cough	13	Carr 2005; Egli 2012; Englund 2006; Hamelin 2005; Johnstone 2008; Kapandji 2023; Larcher 2005; Müller 2009; Niggli 2016; O'Gorman 2006; Sumino 2005; Walsh 2008; de Zwart 2020	157	82.6	78.3	8.3	100.0
Dyspnoea	10	Egli 2012; Hamelin 2005; Johnstone 2008; Kapandji 2023; Müller 2009; Niggli 2016; O'Gorman 2006; Sumino 2005; Walsh 2008; de Zwart 2020	136	75.7	58.1	26.1	100.0
Sore throat	6	Englund 2006; Hamelin 2005; Niggli 2016; Sumino 2005; Walsh 2008; de Zwart 2020	93	40.6	32.3	13.0	100.0
New/ worsening sputum	5	Hamelin 2005; Johnstone 2008; Kapandji 2023; Walsh 2008; de Zwart 2020	103	60.9	54.4	34.6	64.7

Symptoms Description	#Studies	Citations	#Patients	Median HMPV cases with symptom/sign (%)	Mean (overall proportion) HMPV cases with symptom/sign (%)	Min HMPV cases with symptom/sign (%)	Max HMPV cases with symptom/sign (%)
Wheezing	5	Carr 2005; Hamelin 2005; Kapandji 2023; Klein 2010; Walsh 2008	59	50.0	32.2	15.4	50.0
Congested nose	4	Englund 2006; Hamelin 2005; Martino 2005; Walsh 2008	44	64.6	65.9	60.0	70.6
Myalgia	4	Hamelin 2005; Johnstone 2008; Niggli 2016; O'Gorman 2006	34	23.3	23.5	12.5	33.3
Headache	3	Martino 2005; Niggli 2016; O'Gorman 2006	36	20.0	25.0	13.3	37.5
Productive cough	3	Johnstone 2008; Niggli 2016; O'Gorman 2006	28	46.7	50.0	20.0	75.0
Fatigue	2	Johnstone 2008; Niggli 2016	23	73.3	65.2	46.7	100.0
Rhinorrhoea	2	Carr 2005; Niggli 2016	19	66.7	47.4	33.3	100.0
Arthralgia	1	Niggli 2016	15	13.3	13.3	13.3	13.3
Chest pain	1	Niggli 2016	15	6.7	6.7	6.7	6.7
Constitutional	1	Walsh 2008	17	70.6	70.6	70.6	70.6
Coryza	1	de Zwart 2020	46	41.3	41.3	41.3	41.3
Digestive symptoms	1	Kapandji 2023	26	26.9	26.9	26.9	26.9
Ear, Nose and Throat syndrome	1	Kapandji 2023	26	30.8	30.8	30.8	30.8
Fever	1	Walsh 2008	17	35.3	35.3	35.3	35.3
Flu-like syndrome	1	Kapandji 2023	26	19.2	19.2	19.2	19.2
Hoarse	1	Walsh 2008	17	29.4	29.4	29.4	29.4
Lethargy	1	O'Gorman 2006	5	20.0	20.0	20.0	20.0
Nausea	1	O'Gorman 2006	5	20.0	20.0	20.0	20.0
Night sweats	1	O'Gorman 2006	5	20.0	20.0	20.0	20.0
Otalgia	1	Englund 2006	5	0.0	0.0	0.0	0.0
Palpitations	1	O'Gorman 2006	5	20.0	20.0	20.0	20.0
Rhinorrhoea, sore throat, or cough	1	Permpalung 2021	31	48.4	48.4	48.4	48.4
Runny nose	1	Egli 2012	8	50.0	50.0	50.0	50.0
Shivers	1	Kapandji 2023	26	34.6	34.6	34.6	34.6
Skin rashes	1	Englund 2006	5	0.0	0.0	0.0	0.0
Thoracic pain	1	Kapandji 2023	26	3.8	3.8	3.8	3.8
Vomiting	1	Johnstone 2008	8	12.5	12.5	12.5	12.5
Institutionalized patients							
Cough	1	Boivin 2007	6	66.7	66.7	66.7	66.7
New/worsening shortness of breath	1	Boivin 2007	6	33.3	33.3	33.3	33.3
Runny nose	1	Boivin 2007	6	16.7	16.7	16.7	16.7
Sore throat	1	Boivin 2007	6	33.3	33.3	33.3	33.3

The table shows mean, min, and max number of percentages of patients reporting symptoms and the amount of studies (#Studies column) and specific studies identified (Citation) informing on HMPV symptoms percentages. Symptoms affecting >50% of patients are in red. #Patients column shows the total number of patients reporting on a specific symptom from all included studies from #Studies column

Table S20. HMPV signs description in older and high-risk adults.

Signs Description	# Studies	Citations	# Patients	Median HMPV cases with symptom/sign (%)	Mean (overall proportion) HMPV cases with symptom/sign (%)	Min HMPV cases with symptom/sign (%)	Max HMPV cases with symptom/sign (%)
Signs on examination							
General population – older adults >50 and above							
Fever	2	Kurai 2022; Reiche 2014	36	27.1	27.8	25.0	29.2
Wheezing	2	Walsh 2008; Widmer 2012	127	78.3	75.6	74.0	82.6
Crackles / rales	1	Walsh 2008	104	50.0	50.0	50.0	50.0
Rhinorrhoea	1	Walsh 2008	104	18.3	18.3	18.3	18.3
Asthma							
Fever	1	Williams 2005a	7	57.1	57.1	57.1	57.1
COPD							
Fever	1	Martinello 2006	6	66.7	66.7	66.7	66.7
immunocompromised							
Fever	1	Carr 2005; Egli 2012; Englund 2006; Hamelin 2005; Johnstone 2008; Kapandji 2023; Martino 2005; Müller 2009; Niggli 2016; Sumino 2005; de Zwart 2020	139	75.0	45.3	0.0	100.0
Wheezing	6	Englund 2006; Klein 2010; Niggli 2016; O'Gorman 2006; Sumino 2005; Walsh 2008	52	22.5	19.2	0.0	60.0
Desaturation	3	Hamelin 2005; Johnstone 2008; O'Gorman 2006	24	75.0	58.3	20.0	100.0
Tachypnoea	3	Carr 2005; Johnstone 2008; O'Gorman 2006	17	25.0	29.4	12.5	60.0
Crackles / rales	2	O'Gorman 2006; Walsh 2008	22	31.8	27.3	23.5	40.0
Cough	1	Martino 2005	16	25.0	25.0	25.0	25.0
Hypotension	1	O'Gorman 2006	5	20.0	20.0	20.0	20.0
Hypothermia	1	O'Gorman 2006	5	20.0	20.0	20.0	20.0
Hypoxia	1	O'Gorman 2006	5	20.0	20.0	20.0	20.0
Left consolidation and pleural effusion on chest radiograph	1	O'Gorman 2006	5	20.0	20.0	20.0	20.0
Rhinorrhoea	1	Walsh 2008	17	64.7	64.7	64.7	64.7
Systolic blood pressure of <90 mm Hg	1	Johnstone 2008	8	0.0	0.0	0.0	0.0
Institutionalized patients							
Fever	1	Boivin 2007	6	100.0	100.0	100.0	100.0

The table shows mean, min, and max number of percentages of patients reporting signs and the amount of studies (#Studies column) and specific studies identified (Citation) informing on HMPV signs percentages. Signs affecting >50% of patients are in red. #Patients column shows the total number of patients reporting on a specific sign from all included studies from #Studies column

COPD: Chronic Obstructive Pulmonary Disease; hMPV: human metapneumovirus.