Appendix A. Methods Appendix

Search Strategies for Published Literature

Table A-1. PubMed Search Strategy

#	Term
1	"emergency medical services"[tiab] OR EMS[tiab] OR ("emergency medical services"[mh] NOT ("emergency service, hospital"[mh] OR "advanced trauma life support care"[mh] OR "poison control centers"[mh]))
2	"emergency medical responder" [tiab]
3	"Advanced EMT"[tiab] OR "advanced emergency medical technician"[tiab] OR AEMT[tiab]
4	Paramedic*[tiab]
5	"emergency medical services"[tiab] OR EMS[tiab]
6	"emergency medical technician"[tiab] OR "emergency medical technicians"[tiab]
7	"emergency responders"[tiab] OR "Emergency Responders"[mh]
8	"first responder"[tiab] OR "first responders"[tiab]
9	"law enforcement"[tiab] OR police[tiab] OR police[mh]
10	Firefighters[tiab]
11	"fire department"[tiab]
12	"police dispatcher"[tiab] OR dispatcher[tiab]
13	"emergency medical dispatcher"[tiab] OR "emergency medical dispatcher"[mh] OR "medical dispatcher"[tiab]
14	((911[tiab] OR "9/11" [tiab] OR "9-11" [tiab] OR "9-1-1" [tiab] OR "9 1 1" [tiab]) AND dispatcher[tiab])
15	"field dispatcher"[tiab] OR "field responder"[tiab]
16	Ambulance[tiab] OR ambulances[mh] OR "emergency mobile unit"[tiab]
17	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16
18	Infection*[tiab] OR Infections[mh] OR Infectious[tiab] OR "infectious disease"[tiab] OR "Virus Diseases"[tiab] OR "Virus Diseases"[mh] OR contaminat*[tiab]
19	"Communicable Diseases"[mh] OR "Infectious Disease Transmission, Patient-to-Professional"[mh]
20	"Covid-19"[tiab] OR "Covid19"[tiab] OR "Covid 19"[tiab] OR "COVID-19"[mh] OR "SARS-CoV-2"[tiab] OR "SARS-CoV2"[tiab] OR "SARS CoV 2"[tiab] OR "SARS-CoV-2"[mh] OR "2019-nCoV"[tiab] OR "COVID-19 Vaccines"[mh] OR "2019 Novel Coronavirus"[tiab]
21	Influenza[tiab] OR "Influenza, Human"[mh] OR "flu"[tiab]
22	Tuberculosis[tiab] OR Tuberculosis[mh]
23	HIV[tiab] OR HIV[mh] OR "human immunodeficiency virus"[tiab] OR "acquired immunodeficiency syndrome"[tiab] OR AIDS[tiab] OR "Acquired Immunodeficiency Syndrome"[mh]
24	"Hepatitis B"[tiab] OR "hepatitis-b"[tiab] OR "Hepatitis B"[mh]
25	"Hepatitis C"[tiab] OR "hepatitis"[tiab] OR "Hepatitis C"[mh]
26	"Respiratory infection"[tiab] OR "Respiratory Tract Infections"[mh]
27	#18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26
28	#17 AND #27
29	English[la]
30	Animals[mh] NOT humans[mh]
31	Study protocol[ti] OR trial protocol[ti] OR review protocol[ti] OR editorial[pt] OR letter[pt] OR case reports[pt]
32	#28 AND #29 NOT #30 NOT #31
33	Date limits 2006-present

Table A-2. Embase Search Strategy

#	Term
1	'emergency medical services':ti,ab OR EMS:ti,ab OR 'emergency medical dispatch'/de
2	'emergency medical responder':ti,ab OR 'emergency medical responders':ti,ab
3	'Advanced EMT':ti,ab OR 'advanced emergency medical technician':ti,ab OR AEMT:ti,ab
4	Paramedic*:ti,ab
5	'emergency medical technician':ti,ab OR 'emergency medical technicians':ti,ab
6	'emergency responder':ti,ab OR 'emergency responders':ti,ab OR 'rescue personnel'/exp
7	'first responder':ti,ab OR 'first responders':ti,ab

8	'law enforcement':ti,ab OR police:ti,ab OR police/exp
9	Firefighter:ti,ab OR firefighters:ti,ab OR 'fire fighter':ti,ab OR 'fire fighters':ti,ab
10	'fire department':ti,ab OR 'fire departments':ti,ab
11	'police dispatcher':ti,ab OR dispatcher:ti,ab
12	'emergency medical dispatcher':ti,ab OR 'emergency medical dispatcher'/exp OR 'medical dispatcher':ti,ab
13	((911:ti,ab OR '9/11':ti,ab OR '9-11':ti,ab OR '9-1-1':ti,ab OR '9 1 1':ti,ab) AND dispatcher:ti,ab)
14	'field dispatcher':ti,ab OR 'field dispatchers':ti,ab OR 'field responder':ti,ab OR 'field responders':ti,ab
15	Ambulance:ti,ab OR ambulances:ti,ab OR ambulances/exp OR 'emergency mobile unit':ti,ab
16	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15
17	Infection*:ti,ab OR 'Infection'/de OR 'airborne infection'/de OR 'bloodstream infection'/de OR 'communicable disease'/de OR 'skin infection'/exp OR Infectious:ti,ab OR 'infectious disease':ti,ab OR 'infectious diseases':ti,ab OR 'viral disease':ti,ab OR 'viral diseases':ti,ab OR 'virus diseases':ti,ab OR 'virus infection'/de OR contaminat*:ti,ab
18	'communicable disease'/exp OR 'communicable disease':ti,ab OR 'communicable diseases':ti,ab OR 'patient-to-professional transmission'/exp
19	'Covid-19':ti,ab OR 'Covid19':ti,ab OR 'Covid 19':ti,ab OR 'coronavirus disease 2019'/exp OR 'SARS-CoV-2':ti,ab OR 'SARS-CoV2':ti,ab OR 'SARS CoV 2':ti,ab OR 'Severe acute respiratory syndrome coronavirus 2'/exp OR '2019-nCoV':ti,ab OR 'SARS-CoV-2 vaccine'/exp OR '2019 Novel Coronavirus':ti,ab OR 'SARSCov2':ti,ab OR 'severe acute respiratory syndrome coronavirus':ti,ab OR COVID:ti,ab
20	Influenza:ti,ab OR 'Influenza'/exp OR 'flu':ti,ab
21	Tuberculosis:ti,ab OR 'lung tuberculosis'/de
22	HIV:ti,ab OR 'Human immunodeficiency virus infection'/exp OR 'human immunodeficiency virus':ti,ab OR 'human immuno-deficiency virus':ti,ab OR 'human immune-deficiency virus':ti,ab OR 'acquired immunodeficiency syndrome':ti,ab OR 'acquired immune-deficiency syndrome':ti,ab OR AIDS:ti,ab OR 'acquired immune deficiency syndrome'/exp
23	'Hepatitis B':ti,ab OR 'hepatitis-b':ti,ab OR 'hepatitis B'/exp
24	'Hepatitis C':ti,ab OR 'hepatitis':ti,ab OR 'hepatitis C'/exp
25	'Respiratory infection':ti,ab OR 'respiratory tract infection'/de
26	#17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25
	Workforce AND Infection terms
27	#16 AND #26
28	English:la
29	Animals/exp NOT humans/exp
30	Study protocol:ti OR trial protocol:ti OR review protocol:ti OR editorial:it OR letter:it OR 'case reports':it OR 'conference abstract':pt
31	#27 AND #28 NOT #29 NOT #30
32	Date limits 2006-present

Table A-3. CINAHL Search Strategy

#	Term
1	TI ("emergency medical services" OR EMS) OR AB ("emergency medical services" OR EMS) OR MM ("emergency medical services" NOT ("trauma centers" OR "poison control centers"))
2	TI ("emergency medical responder" OR "Advanced EMT" OR "advanced emergency medical technician" OR AEMT OR Paramedic* OR "emergency medical technician" OR "emergency medical technicians") OR AB ("emergency medical responder" OR "Advanced EMT" OR "advanced emergency medical technician" OR AEMT OR Paramedic* OR "emergency medical technician" OR "emergency medical technicians")
3	TI ("emergency responders" OR "first responder" OR "first responders") OR AB ("emergency responders" OR "first responder" OR "first responders")
4	TI ("law enforcement" OR police) OR AB ("law enforcement" OR police) OR (MM police)
5	TI (firefighters OR "fire departments") OR AB (firefighters OR "fire departments")
6	TI ("police dispatcher" OR dispatcher OR "emergency medical dispatcher" OR "medical dispatcher" OR "field dispatcher" OR "field responder") OR AB ("police dispatcher" OR dispatcher OR "emergency medical dispatcher" OR "medical dispatcher" OR "field dispatcher" OR "field responder")
7	(TI ((911 OR "9/11" OR "9-11" OR "9-1-1" OR "9 1 1") AND dispatcher)) OR (AB ((911 OR "9/11" OR "9-11" OR "9-1-1" OR "9 1 1") AND dispatcher))
8	TI (ambulance OR "emergency mobile unit") OR (MM ambulances) OR AB (ambulance OR "emergency mobile unit")
9	1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9

10	TI (Infection* OR Infectious OR "infectious disease" OR "Virus Diseases" OR contaminat*) OR AB (Infection* OR Infectious OR "infectious disease" OR "Virus Diseases" OR contaminat*) OR MM (Infection OR "virus diseases")
11	MM ("Communicable Diseases" OR "Disease Transmission, Patient-to-Professional")
12	TI ("Covid-19" OR "Covid19" OR "Covid 19" OR "SARS-CoV-2" OR "SARS-CoV2" OR "SARS CoV 2" OR "2019-nCoV" OR "2019 Novel Coronavirus") OR (MM "COVID-19") OR AB ("Covid-19" OR "Covid19" OR "Covid 19" OR "SARS-CoV-2" OR "SARS-CoV2" OR "SARS CoV 2" OR "2019-nCoV" OR "2019 Novel Coronavirus") OR (MM "COVID-19") OR (MM "SARS-CoV-2") OR (MM "COVID-19 Vaccines")
13	TI (Influenza OR flu) OR AB (Influenza OR flu) OR (MM "Influenza, Human")
14	TI (Tuberculosis) OR AB (Tuberculosis) OR (MM Tuberculosis)
15	TI (HIV OR "human immunodeficiency virus" OR "acquired immunodeficiency syndrome" OR AIDS) OR AB (HIV OR "human immunodeficiency virus" OR "acquired immunodeficiency syndrome" OR AIDS) OR (MM "Human Immunodeficiency Virus") OR (MM "Acquired Immunodeficiency Syndrome")
16	TI ("Hepatitis B" OR "hepatitis-b") OR AB ("Hepatitis B" OR "hepatitis-b") OR (MM "Hepatitis B")
17	TI ("Hepatitis C" OR "hepatitis-c") OR AB ("Hepatitis C" OR "hepatitis-c") OR (MM "Hepatitis C")
18	TI ("Respiratory infection") OR AB ("Respiratory infection") OR (MM "Respiratory Tract Infections")
19	10 OR 11 OR 12 OR 13 OR 14 OR 15 OR 16 OR 17 OR 18
20	9 AND 19
21	(LA English)
22	MM (Animals NOT human)
23	TI ("study protocol" OR "trial protocol" OR "review protocol") OR (PT editorial) OR (PT letter) OR (PT "case reports)
24	20 AND 21 NOT 22 NOT 23
25	Date limit 2006 - present
26	24 AND 25

Table A-4. SCOPUS Search Strategy

#	Term
1	TITLE-ABS-KEY ("emergency medical services" OR ems "emergency medical responder" OR "emergency medical responders" OR "emergency medical responder" OR "emergency medical responders" OR "advanced emt" OR "advanced emergency medical technician" OR aemt OR "advanced emts" OR "advanced emergency medical technicians" OR aemts OR paramedic* OR "emergency responder" OR "emergency responders" OR "emergency medical technician" OR "emergency medical technicians" OR "first responder" OR "first responders" OR "law enforcement" OR "police" OR firefighter OR firefighters OR "fire fighter" OR "fire fighters" OR "fire department" OR "fire departments" OR "police dispatcher" OR dispatcher* OR "emergency medical dispatcher" OR "medical dispatcher" OR ((911 OR "9/11" OR "9-11" OR "9-1-1" OR "9 1 1") AND dispatcher*) OR "field dispatcher" OR "field dispatchers" OR "field responder" OR "field responders" OR ambulance OR ambulances OR "emergency mobile unit") AND TITLE-ABS-KEY (infection* OR Infectious OR "infectious disease" OR "Virus Diseases" OR contaminat* OR "communicable disease" OR "communicable diseases" OR "Covid-19" OR "Covid19" OR "Covid 19" OR "SARS-CoV-2" OR "SARS-CoV2" OR "SARS CoV 2" OR "2019-nCoV" OR "2019 Novel Coronavirus" OR SARSCoV2 OR "severe acute respiratory syndrome coronavirus" OR influenza OR flu OR tuberculosis OR HIV OR "human immunodeficiency virus" OR "human immuno-deficiency virus" OR "human immune-deficiency virus" OR "acquired immunodeficiency syndrome" OR "acquired immune-deficiency syndrome" OR AIDS or "hepatitis B" OR "hepatitis-b" OR "hepatitis C" OR "hepatitis-C" OR "respiratory infection")

Appendix B. List of Excluded Studies

A mixed population with <50% EMS or 911 responders and does not report data separately

1. Akinbami LJ, Petersen LR, Sami S, et al. Coronavirus Disease 2019 Symptoms and Severe Acute Respiratory Syndrome Coronavirus 2 Antibody Positivity in a Large Survey of First Responders and Healthcare Personnel, May-July 2020. Clin Infect Dis. 2021 Aug 2;73(3):e822-e5. doi: 10.1093/cid/ciab080. PMID: 33515250.
2. Brant-Zawadzki M, Fridman D, Robinson PA, et al. Prevalence and Longevity of SARS-CoV-2 Antibodies Among Health Care Workers. Open Forum Infect Dis. 2021 Feb;8(2):ofab015. doi: 10.1093/ofid/ofab015. PMID: 33604403.
3. Fowlkes A, Gaglani M, Groover K, et al. Effectiveness of COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Frontline Workers Before and During B.1.617.2 (Delta) Variant Predominance - Eight U.S. Locations, December 2020-August 2021. MMWR Morb Mortal Wkly Rep. 2021 Aug 27;70(34):1167-9. doi: 10.15585/mmwr.mm7034e4. PMID: 34437521.
4. Iwuji K, Islam E, Berdine G, et al. Prevalence of Coronavirus Antibody Among First Responders in Lubbock, Texas. J Prim Care Community Health. 2020 Jan-Dec;11:2150132720971390. doi: 10.1177/2150132720971390. PMID: 33161808.
5. Niu J, Rodriguez JA, Sareli C, et al. COVID-19 infection among first responders in Broward County, Florida, March-April 2020. J Public Health (Oxf). 2020 Dec 24doi: 10.1093/pubmed/fdaa231. PMID: 33367792.
6. Sabourin KR, Schultz J, Romero J, et al. Risk Factors of SARS-CoV-2 Antibodies in Arapahoe County First Responders-The COVID-19 Arapahoe SErosurveillance Study (CASES) Project. J Occup Environ Med. 2021 Mar 1;63(3):191-8. doi: 10.1097/jom.0000000000002099. PMID: 33298759.
7. Stausmire JM, Rohaley DJ, Tita JA, et al. Initial distribution of COVID-19 vaccines to front-line hospital workers and community first responders-A prospective descriptive study. J Healthc Risk Manag. 2021 Aug 27doi: 10.1002/jhrm.21485. PMID: 34453366.
8. Thompson MG, Burgess JL, Naleway AL, et al. Prevention and Attenuation of Covid-19 with the BNT162b2 and mRNA-1273 Vaccines. N Engl J Med. 2021 Jul 22;385(4):320-9. doi: 10.1056/NEJMoa2107058. PMID: 34192428.

Describes intervention of interest but does NOT assess infection control

9. Alexander AB, Masters MM, Warren K. Caring for Infectious Disease in the Prehospital Setting: A Qualitative Analysis of EMS Providers Experiences and Suggestions for Improvement. Prehosp Emerg Care. 2020 Jan-Feb;24(1):77-84. doi: 10.1080/10903127.2019.1601313. PMID: 30917729.
10. Alhazmi RA, Parker RD, Wen S. Standard Precautions Among Emergency Medical Services in Urban and Rural Areas. Workplace Health and Safety. 2020;68(2):73-80. doi: 10.1177/2165079919864118.

11. Bucher J, Donovan C, Ohman-Strickland P, et al. Hand Washing Practices Among Emergency Medical Services Providers. West J Emerg Med. 2015 Sep;16(5):727-35. doi: 10.5811/westjem.2015.7.25917. PMID: 26587098.

12. Caban-Martinez AJ, Silvera CA, Santiago KM, et al. COVID-19 Vaccine Acceptability Among US Firefighters and Emergency Medical Services Workers: A Cross-Sectional Study. J Occup Environ Med. 2021 May 1;63(5):369-73. doi: 10.1097/jom.0000000000002152. PMID: 33560073.

13. Cash RE, Leggio WJ, Powell JR, et al. Emergency medical services education research priorities during COVID-19: A modified Delphi study. J Am Coll Emerg Physicians Open. 2021 Aug;2(4):e12543. doi: 10.1002/emp2.12543. PMID: 34458888.

14. Cash RE, Rivard MK, Camargo CA, Jr., et al. Emergency Medical Services Personnel Awareness and Training about Personal Protective Equipment during the COVID-19 Pandemic. Prehosp Emerg Care. 2021 Jan 12:1-8. doi: 10.1080/10903127.2020.1853858. PMID: 33211613.

15. Chen GX, Jenkins EL. Potential work-related exposures to bloodborne pathogens by industry and occupation in the United States Part II: A telephone interview study. Am J Ind Med. 2007 Apr;50(4):285-92. doi: 10.1002/ajim.20441. PMID: 17340611.

16. Development of a negative pressure isolation system for containment, filtration, and disinfection of airborne diseases for use in hospitals, ambulances, and alternate care settings. 2021.

17. Gershon RR, Vandelinde N, Magda LA, et al. Evaluation of a pandemic preparedness training intervention of emergency medical services personnel. Prehosp Disaster Med. 2009 Nov-Dec;24(6):508-11. doi: 10.1017/s1049023x00007421. PMID: 20301068.

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19. Lindsley WG, Blachere FM, McClelland TL, et al. Efficacy of an ambulance ventilation system in reducing EMS worker exposure to airborne particles from a patient cough aerosol simulator. J Occup Environ Hyg. 2019 Dec;16(12):804-16. doi: 10.1080/15459624.2019.1674858. PMID: 31638865.

20. McClelland G, Charlton K, Mains J, et al. A two-armed, randomised, controlled exploratory study of adding the AmbuGard cleaning system to normal deep-cleaning procedures in a regional ambulance service. Br Paramed J. 2020 Sep 1;5(2):10-7. doi: 10.29045/14784726.2020.09.5.2.10. PMID: 33456386.

21. Rebmann T, Charney RL, Loux TM, et al. Emergency Medical Services Personnel's Pandemic Influenza Training Received and Willingness to Work during a Future Pandemic. Prehosp Emerg Care. 2020 Sep-Oct;24(5):601-9. doi: 10.1080/10903127.2019.1701158. PMID: 31800338.

22. Rebmann T, Loux TM, Zink TK, et al. US disaster planners' attitudes regarding preevent vaccine for first responders and point-of-dispensing workers. Health Secur. 2015 Jan-Feb;13(1):29-36. doi: 10.1089/hs.2014.0066. PMID: 25812426.

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25. Subbarao I, Bond WF, Johnson C, et al. Using innovative simulation modalities for civilian-based, chemical, biological, radiological, nuclear, and explosive training in the acute management of terrorist victims: A pilot study. Prehosp Disaster Med. 2006 Jul-Aug;21(4):272-5. doi: 10.1017/s1049023x00003824. PMID: 17076429.

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28. Thompson MG, Burgess JL, Naleway AL, et al. Interim Estimates of Vaccine Effectiveness of BNT162b2 and mRNA-1273 COVID-19 Vaccines in Preventing SARS-CoV-2 Infection Among Health Care Personnel, First Responders, and Other Essential and Frontline Workers - Eight U.S. Locations, December 2020-March 2021. MMWR Morb Mortal Wkly Rep. 2021 Apr 2;70(13):495-500. doi: 10.15585/mmwr.mm7013e3. PMID: 33793460.

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31. Wilson AM, Jones RM, Lugo Lerma V, et al. Respirators, face masks, and their risk reductions via multiple transmission routes for first responders within an ambulance. J Occup Environ Hyg. 2021 Jul;18(7):345-60. doi: 10.1080/15459624.2021.1926468. PMID: 34129448.

Does not evaluate emergency medical service workforce who have been exposed to or are at risk of exposure to an occupationally-acquired infectious disease

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38. Gibson CV. Emergency medical services oxygen equipment: a fomite for transmission of MRSA? Emerg Med J. 2019 Feb;36(2):89-91. doi: 10.1136/emermed-2018-207758. PMID: 30504457.

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42. Petersen LR, Sami S, Vuong N, et al. Lack of antibodies to SARS-CoV-2 in a large cohort of previously infected persons. Clin Infect Dis. 2020 Nov 4doi: 10.1093/cid/ciaa1685. PMID: 33147319.

43. Rajasingham R, Bangdiwala AS, Nicol MR, et al. Hydroxychloroquine as Pre-exposure Prophylaxis for Coronavirus Disease 2019 (COVID-19) in Healthcare Workers: A Randomized Trial. Clin Infect Dis. 2021 Jun 1;72(11):e835-e43. doi: 10.1093/cid/ciaa1571. PMID: 33068425.

44. Ro YS, Shin SD, Noh H, et al. Prevalence of positive carriage of tuberculosis, methicillin-resistant Staphylococcus aureus, and vancomycin-resistant Enterococci in patients transported by ambulance: a single center observational study. J Prev Med Public Health. 2012 May;45(3):174-80. doi: 10.3961/jpmph.2012.45.3.174. PMID: 22712044.

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Does not report on an outcome of interest

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Appendix C. Evidence Tables

Evidence Table C-1. Study characteristics of studies investigating the characteristics, incidence, prevalence, and severity of occupationally-acquired exposures to infectious diseases for the EMS/911 workforce (Guiding Question 1)

Author, year	Study design	Setting	Location	High-performing EMS system	Number of providers engaged	Type of transport	Volunteer or funded department	Population	Infectious disease
Akinbami, 2020[1]	Cross-sectional	Urban	Michigan: Detroit	No/not reported	1558	NR	NR	Emergency medical service workers including firefighters	SARS-COV2
Al Amiry, 2013[2]	Cross-sectional	Urban, suburban	Maryland: Baltimore area	No/not reported	110	Ground	Funded	Emergency medical service workers including firefighters	MRSA
Caban-Martinez, 2020[3]	Cross-sectional	Not reported	Florida: South Florida	No/not reported	203	Not reported	Not reported	Firefighters only	SARS-COV2
El Sayed, 2012[4]	Retrospective cohort	Urban	Massachusetts: Boston	No/not reported	397	NR	NR	Emergency medical service workers not including firefighters	Meningitis, TB, viral respiratory infection, skin membrane splash, eye splash, rash, mammalian bite, scratch, needlestick
Elie-Turenne, 2010[5]	Cross-sectional	Urban	New Jersey: Newark	No/not reported	52	NR	NR	Emergency medical service workers not including firefighters	MRSA

Author, year	Study design	Setting	Location	High-performing EMS system	Number of providers engaged	Type of transport	Volunteer or funded department	Population	Infectious disease
Firew, 2020[6]	Cross-sectional	Urban, suburban, rural	Nationwide	No/not reported	266	NR	NR	Emergency medical service workers not including firefighters	SARS-COV2
Harris, 2010[7]	Cross-sectional	Urban, suburban, rural	Virginia: Greater Richmond area	No/not reported	311	Ground	Mixed department (both volunteers and funded)	Emergency medical service workers including firefighters	Any type of blood-borne exposure
McGuire, 2021[8]	Cross-sectional	NR	Minnesota: Rochester	No/not reported	255	Ground	NR	Pre-hospital provider (EMS or fire but unclear)	SARS-COV2
Murphy, 2020[9]	Retrospective cohort	Urban, suburban, rural	Washington: King County	No/not reported	700	NR	NR	Emergency medical service workers including firefighters	SARS-COV2
Newberry, 2021[10]	Cross-sectional	Urban	California: Santa Clara County	No/not reported	983	NR	NR	Emergency medical service workers including firefighters	SARS-COV2
Orellana, 2016[11]	Cross-sectional	Urban, suburban, rural	Ohio: Statewide	No/not reported	280	NR	NR	Emergency medical service workers not including firefighters	MRSA
Prezant, 2020[12]	Retrospective cohort	Urban	New York: New York City	No/not reported	15638	NR	NR	Emergency medical service workers including firefighters	SARS-COV2

Author, year	Study design	Setting	Location	High-performing EMS system	Number of providers engaged	Type of transport	Volunteer or funded department	Population	Infectious disease
Sami, 2021[13]	Cross-sectional	Urban	New York: New York City	No/not reported	22647	NR	NR	Emergency medical service workers including firefighters	SARS-COV2
Shukla, 2020[14]	Cross-sectional	Urban, suburban	Arizona: Phoenix, Tempe, Glendale, Peoria, Surprise and Chandler	No/not reported	3326	Ground	NR	Emergency medical service workers including firefighters	SARS-COV2
Tarabichi, 2021[15]	Cross-sectional	Urban	Ohio: Cleveland	No/not reported	296	Ground	NR	Emergency medical service workers including firefighters	SARS-COV2
Vieira, 2021[16]	Cross-sectional	Urban	California: Orange County	No/not reported	923	NR	NR	Firefighters only	SARS-COV2
Webber, 2018[17]	Prospective cohort	Urban	New York: New York City	No/not reported	11374	NR	NR	Emergency medical service workers including firefighters	Hepatitis C
Weiden, 2021[18]	Cross-sectional	Urban	New York: New York City	No/not reported	14290	NR	NR	Emergency medical service workers including firefighters	SARS-COV2

EMS=emergency medical service; MRSA= Methicillin-resistant Staphylococcus aureus; NR=not reported; TB=tuberculosis

Evidence Table C-2. Patient characteristics of studies investigating the characteristics, incidence, prevalence, and severity of occupationally-acquired exposures to infectious diseases for the EMS/911 workforce (Guiding Question 1)

Author, year	Age	Gender, males n (%)	Race, n (%)	Experience	Type of training, n (%)	Vaccination status
Akinbami, 2020[1]	NR	NR	NR	NR	NR	NR
Al Amiry, 2013[2]	Mean: 35.2	92 (83.6)	NR	Mean: 10.5	EMT-Basic: 45 EMT-Intermediate6 EMT-Paramedic: 59	NR
Caban-Martinez, 2020[3]	Range: 21 - 30: 33; 31 - 40: 51; 41 - 50: 67; 51+: 52	188 (93.5)	White: 154 (78.2) African-American: 9 (4.6) Other: 34 (17.3)	Mean: 15.3 +/- 9.1	NR	NR
El Sayed, 2012[4]	NR	NR	NR	NR	NR	NR
Elie-Turenne, 2010[5]	NR	NR	NR	NR	NR	NR
Firew, 2020[6]	NR	NR	NR	NR	NR	NR
Harris, 2010[7]	Mean: 37 Range: 17 to 72	(56)	White: (85) African-American: (8.9) Asian: (1) Hispanic: (2.6) Other: (2)	Mean: 6 Range: 0.5 to 25	EMR: 5 EMT-Basic: 226 EMT-Paramedic: 2	NR
McGuire, 2021[8]	NR	NR	NR	NR	Firefighter: 92 (1)	NR
Murphy, 2020[9]	NR	NR	NR	NR	NR	NR
Newberry, 2021[10]	Range: 18-34: 206 (21%); 35-49: 556 (56.6%); 50+: 221 (22.5%)	942 (95.8)	White: 594 (60.4) African-American: 26 (2.6) Asian: 78 (7.9) Hispanic: 192 (19.5) Other: 93 (9.5)	NR	NR	NR
Orellana, 2016[11]	Mean: 36.9	246 (87.9)	White: 278 () Other: 2 ()	Range:< 16 years: 178; 16+ years: 102	NR	NR
Prezant, 2020[12]	Mean: 35.8 +/- 10.2 (EMS); 38.9 +/- 8.3 (Fire)	5135 (out of population on medical leave); 1305 EMS	NR	NR	NR	NR

Author, year	Age	Gender, males n (%)	Race, n (%)	Experience	Type of training, n (%)	Vaccination status
		and 3830 Fire (72.8% EMS; 98.9% Fire)				
Sami, 2021[13]	NR	NR	NR	NR	NR	NR
Shukla, 2020[14]	Mean: 41.4 Range: 18–24 yrs 100 (3.1%) 25–34 yrs 730 (22.2%) 35–44 yrs 1,186 (36.1%) 45–54 yrs 984 (30.0%) 55–64 yrs 266 (8.1%) 65+ yrs 16 (0.5%)	2637 (82.9)	NR	NR	NR	NR
Tarabichi, 2021[15]	Mean: 43.8 (negative) 50.1 (positive) Range: 22-65 (negative) 35.4-60.6 (positive)	253 (85)	White, Non-Hispanic: 200 (71.4%) White, Other: 27 (9.6%) Black, Non-Hispanic: 21 (7.5%) White, Hispanic: 12 (4.3%) Other, Hispanic: 10 (3.6%) Other: 10 (1.6%)	NR	EMR: 111 (37.5) Firefighter: 185 (62.5)	NR
Vieira, 2021[16]	Range: 21-30: 112 (12.1%); 31-40: 324 (35.1%); 41-50: 286 (31.0%); 51+: 201 (21.8%)	897 (97.2)	White: 827 (89.6) African-American: 11 (1.2) Asian: 60 (6.5) Hispanic: 174 (18.9) Other: 25 (2.7)	NR	NR	NR
Webber, 2018[17]	Range: 40 years FF; 37 years EMS (on 9/11)	(100)	White: 10077 (89) African-American: 546 (5) Asian: 60 (1) Hispanic: 682 (6) Other: 9 (0)	NR	EMR: 1327 (12) Firefighter: 10047 (88)	NR
Weiden, 2021[18]	Mean: 40.4	(92)	White: (97.8) African-American: (11.2) Hispanic: (16.6) Other: (4.4)	NR	NR	NR

EMR=emergency medical responders; EMS=emergency medical services; EMT=emergency medical technician; Fire=firefighters; NR=not reported

Evidence Table C-3. Risk of bias assessment (modified EPHPP) of studies investigating the characteristics, incidence, prevalence, and severity of occupationally-acquired exposures to infectious diseases for the EMS/911 workforce (Guiding Question 1)

Author, year	Completeness Q1. Are the targeted individuals likely to be representative of the target population?	Completeness Q2. What percentage of targeted individuals agreed to participate?	Accuracy Q1. Did the study report any data on the validity of the tests of interest?
Akinbami, 2020[1]	Very likely	Can't tell	Yes
Al Aminy, 2013[2]	Very likely	Can't tell	Yes
Caban-Martinez, 2020[3]	Very likely	80-100% agreement	Yes
El Sayed, 2012[4]	Very likely	80-100% agreement	Yes
Elie-Turenne, 2010[5]	Somewhat likely	less than 60% agreement	Yes
Firew, 2020[6]	Not likely	Can't tell	Self-Report
Harris, 2010[7]	Somewhat likely	less than 60% agreement	Self-Report
McGuire, 2021[8]	Very likely	80-100% agreement	Yes
Murphy, 2020[9]	Very likely	80-100% agreement	Yes
Newberry, 2021[10]	Very likely	60-79% agreement	Can't tell
Orellana, 2016[11]	Very likely	Can't tell	Yes
Prezent, 2020[12]	Very likely	80-100% agreement	Can't tell
Sami, 2021[13]	Can't tell	less than 60% agreement	Yes
Shukla, 2020[14]	Very likely	80-100% agreement	Yes
Tarabichi, 2021[15]	Very likely	Can't tell	Yes
Vieira, 2021[16]	Very likely	80-100% agreement	Yes
Webber, 2018[17]	Very likely	80-100% agreement	Can't tell
Weiden, 2021[18]	Very likely	80-100% agreement	Yes

Evidence Table C-4. Results of studies investigating the incidence, prevalence, and severity of exposures by demographic characteristics for the EMS/911 workforce (Guiding Question 1a)

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Caban-Martinez, 2020[3]	Age, 21 - 30	Prevalence	Seroprevalence based on IgG test	SARS-COV2	33	n with event: 2
Caban-Martinez, 2020[3]	Age, 31 - 40	Prevalence	Seroprevalence based on IgG test	SARS-COV2	51	n with event: 6
Caban-Martinez, 2020[3]	Age, 41 - 50	Prevalence	Seroprevalence based on IgG test	SARS-COV2	67	n with event: 7
Caban-Martinez, 2020[3]	Age, 51+	Prevalence	Seroprevalence based on IgG test	SARS-COV2	52	n with event: 3
Caban-Martinez, 2020[3]	Gender, Male	Prevalence	Seroprevalence based on IgG test	SARS-COV2	188	n with event: 16
Caban-Martinez, 2020[3]	Gender, Female	Prevalence	Seroprevalence based on IgG test	SARS-COV2	13	n with event: 2
Caban-Martinez, 2020[3]	Race, White	Prevalence	Seroprevalence based on IgG test	SARS-COV2	154	n with event: 15
Caban-Martinez, 2020[3]	Race, Black	Prevalence	Seroprevalence based on IgG test	SARS-COV2	9	n with event: 0
Caban-Martinez, 2020[3]	Race, Other	Prevalence	Seroprevalence based on IgG test	SARS-COV2	34	n with event: 3
Caban-Martinez, 2020[3]	Race, Hispanic	Prevalence	Seroprevalence based on IgG test	SARS-COV2	149	n with event: 15
Caban-Martinez, 2020[3]	Race, Non-Hispanic	Prevalence	Seroprevalence based on IgG test	SARS-COV2	48	n with event: 3
Newberry, 2021[10]	Age, 18-34	Prevalence	IgG seroprevalence test	SARS-COV2	206	n with event: 2 (1%)
Newberry, 2021[10]	Age, 18-34	Incidence	PCR test	SARS-COV2	206	n with event: 2 (1%)
Newberry, 2021[10]	Age, 35-49	Prevalence	IgG seroprevalence test	SARS-COV2	556	n with event: 17 (3%) Ref: Age, 18-34 RR: 3.15 (95% CI: 0.73 to 13.51)
Newberry, 2021[10]	Age, 35-49	Incidence	PCR test	SARS-COV2	556	n with event: 3 (1%) Ref: Age, 18-34 RR: 0.56 (95% CI: 0.09 to 3.3)
Newberry, 2021[10]	Age, 50+	Prevalence	IgG seroprevalence test	SARS-COV2	221	n with event: 6 (3%) Ref: Age, 18-34 RR: 2.8 (95% CI: 0.57 to 13.7)
Newberry, 2021[10]	Age, 50+	Incidence	PCR test	SARS-COV2	221	n with event: 4 (2%) Ref: Age, 18-34

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
						RR: 1.86 (95% CI: 0.35 to 10.07)
Newberry, 2021[10]	Race, White	Prevalence	IgG seroprevalence test	SARS-COV2	594	n with event: 8 (1%)
Newberry, 2021[10]	Race, White	Incidence	PCR test	SARS-COV2	594	n with event: 6 (1%)
Newberry, 2021[10]	Race, Hispanic	Prevalence	IgG seroprevalence test	SARS-COV2	192	n with event: 9 (5%) Ref: Race, White RR: 3.48 (95% CI: 1.36 to 8.9)
Newberry, 2021[10]	Race, Hispanic	Incidence	PCR test	SARS-COV2	192	n with event: 3 (2%) Ref: Race, White RR: 1.55 (95% CI: 0.39 to 6.13)
Newberry, 2021[10]	Race, Black	Prevalence	IgG seroprevalence test	SARS-COV2	26	n with event: 1 (4%) Ref: Race, White RR: 2.86 (95% CI: 0.37 to 21.99)
Newberry, 2021[10]	Race, Black	Incidence	PCR test	SARS-COV2	26	n with event: 0 (0%)
Newberry, 2021[10]	Race, Asian	Prevalence	IgG seroprevalence test	SARS-COV2	78	n with event: 3 (4%) RR: 2.86 (95% CI: 0.77 to 10.54)
Newberry, 2021[10]	Race, Asian	Incidence	PCR test	SARS-COV2	78	n with event: 0 (0%)
Newberry, 2021[10]	Race, Other	Prevalence	IgG seroprevalence test	SARS-COV2	93	n with event: 4 (4%) RR: 3.19 (95% CI: 0.98 to 10.39)
Newberry, 2021[10]	Race, Other	Incidence	PCR test	SARS-COV2	93	n with event: 0 (0%)
Orellana, 2016[11]	Age	Prevalence	Nasal colonization of MRSA	MRSA	NR	OR: 1.03, p = 0.2306
Tarabichi, 2021[15]	Gender, Male	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	253	n with event: 12
Tarabichi, 2021[15]	Gender, Female	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	42	n with event: 4
Tarabichi, 2021[15]	Age Mean	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	NR	Mean (negative): 43.8 years; Mean (positive): 50.1 years
Tarabichi, 2021[15]	Race, White, Non-Hispanic	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	200	n with event: 8
Tarabichi, 2021[15]	Race, White, Other	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	27	n with event: 0

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Tarabichi, 2021[15]	Race, Black, Non-Hispanic	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	21	n with event: 5
Tarabichi, 2021[15]	Race, White, Hispanic	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	12	n with event: 0
Tarabichi, 2021[15]	Race, Other, Hispanic	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	10	n with event: 3
Tarabichi, 2021[15]	Race, Other	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	10	n with event: 0
Vieira, 2021[16]	Age, 21 - 30	Prevalence	IgG seroprevalence test	SARS-COV2	112	n with event: 5, p=0.678
Vieira, 2021[16]	Age, 31 - 40	Prevalence	IgG seroprevalence test	SARS-COV2	324	n with event: 20
Vieira, 2021[16]	Age, 41 - 50	Prevalence	IgG seroprevalence test	SARS-COV2	286	n with event: 12
Vieira, 2021[16]	Age, 51+	Prevalence	IgG seroprevalence test	SARS-COV2	201	n with event: 12
Vieira, 2021[16]	Gender, Male	Prevalence	IgG seroprevalence test	SARS-COV2	897	n with event: 49, p=0.454
Vieira, 2021[16]	Gender, Female	Prevalence	IgG seroprevalence test	SARS-COV2	26	n with event: 0
Vieira, 2021[16]	Race, White	Prevalence	IgG seroprevalence test	SARS-COV2	827	n with event: 46
Vieira, 2021[16]	Race, Asian	Prevalence	IgG seroprevalence test	SARS-COV2	60	n with event: 1
Vieira, 2021[16]	Race, Black	Prevalence	IgG seroprevalence test	SARS-COV2	11	n with event: 0
Vieira, 2021[16]	Race, Other	Prevalence	IgG seroprevalence test	SARS-COV2	25	n with event: 2
Vieira, 2021[16]	Race, Hispanic	Prevalence	IgG seroprevalence test	SARS-COV2	174	n with event: 8
Webber, 2018[17]	Age, 18-29	Prevalence	Positive test from 2000 - 2012	Hepatitis C	947	n with event: 0
Webber, 2018[17]	Age, 30-39	Prevalence	Positive test from 2000 - 2012	Hepatitis C	4561	n with event: 12
Webber, 2018[17]	Age, 40-49	Prevalence	Positive test from 2000 - 2012	Hepatitis C	4578	n with event: 84
Webber, 2018[17]	Age, 50-59	Prevalence	Positive test from 2000 - 2012	Hepatitis C	1193	n with event: 55
Webber, 2018[17]	Age, 60+	Prevalence	Positive test from 2000 - 2012	Hepatitis C	95	n with event: 0
Webber, 2018[17]	Race, White	Prevalence	Positive test from 2000 - 2012	Hepatitis C	10077	n with event: 115
Webber, 2018[17]	Race, Hispanic	Prevalence	Positive test from 2000 - 2012	Hepatitis C	682	n with event: 15
Webber, 2018[17]	Race, Black	Prevalence	Positive test from 2000 - 2012	Hepatitis C	546	n with event: 21
Webber, 2018[17]	Race, Asian	Prevalence	Positive test from 2000 - 2012	Hepatitis C	60	n with event: 0
Webber, 2018[17]	Race, Other	Prevalence	Positive test from 2000 - 2012	Hepatitis C	9	n with event: 0

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Weiden, 2021[18]	Gender	Healthcare Utilization	Hospitalization or death from COVID	SARS-COV2	NR	OR: Male sex 1.55 (95% CI: 0.60 to 4.02), p=0.365
Weiden, 2021[18]	Gender	Incidence	COVID diagnosis	SARS-COV2	NR	OR: 1.12 (95% CI: 0.88 to 1.44), p=0.355
Weiden, 2021[18]	Age	Healthcare Utilization	Hospitalization or death from COVID	SARS-COV2	NR	OR: Age per 10 years 1.59 (95% CI: 1.20 to 2.10), p=0.001
Weiden, 2021[18]	Age	Incidence	COVID diagnosis	SARS-COV2	NR	OR: 0.79 (95% CI: 0.74 to 0.84), p<0.001
Weiden, 2021[18]	Race	Healthcare Utilization	Hospitalization or death from COVID	SARS-COV2	NR	OR: Non-white race 2.46 (95% CI: 1.34 to 4.51), p=0.004
Weiden, 2021[18]	Race	Incidence	COVID diagnosis	SARS-COV2	NR	OR: 1.21 (95% CI: 1.06 to 1.38), p=0.004

CI=confidence interval; ELISA= Enzyme-linked immunosorbent assay; IgG= Immunoglobulin G; MRSA=Methicillin-resistant Staphylococcus aureus; n=number of participants; N=sample size; OR=odds ratio; PCR=polymerase chain reaction; Ref=reference; RR=risk ratio

Evidence Table C-5. Results of studies investigating the incidence, prevalence, and severity of exposures vary by workforce characteristics for the EMS/911 workforce (Guiding Question 1b)

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Harris, 2010[7]	Advanced Life Support	Incidence	Needlestick	Any type of blood-borne exposure	80	n with event: 10 Ref: Basic Life Support (FR/BLS) OR: 10.8 (95% CI: 2.89 to 40.3)
Harris, 2010[7]	Basic Life Support (FR/BLS)	Incidence	Needlestick	Any type of blood-borne exposure	230	n with event: 3
Harris, 2010[7]	Advanced Life Support	Incidence	Lancet stick	Any type of blood-borne exposure	80	n with event: 0 Ref: Basic Life Support (FR/BLS) OR: 0.23 (95% CI: 0.01 to 4.68)
Harris, 2010[7]	Basic Life Support (FR/BLS)	Incidence	Lancet stick	Any type of blood-borne exposure	231	n with event: 5
Harris, 2010[7]	Advanced Life Support	Incidence	Blood Exposure	Any type of blood-borne exposure	80	n with event: 66 Ref: Basic Life Support (FR/BLS) OR: 3.1 (95% CI: 1.63 to 5.78)
Harris, 2010[7]	Basic Life Support (FR/BLS)	Incidence	Blood Exposure	Any type of blood-borne exposure	231	n with event: 140
Harris, 2010[7]	Advanced Life Support	Incidence	Fluids Exposure	Any type of contact exposure	78	n with event: 67 Ref: Basic Life Support (FR/BLS) OR: 5.8 (95% CI: 2.93 to 11.6)
Harris, 2010[7]	Basic Life Support (FR/BLS)	Incidence	Fluids Exposure	Any type of contact exposure	231	n with event: 118
Harris, 2010[7]	Volunteer	Incidence	Needlestick	Any type of blood-borne exposure	129	n with event: 9 Ref: Professional OR: 0.74 (95% CI: 0.23 to 2.30)
Harris, 2010[7]	Professional	Incidence	Needlestick	Any type of blood-borne exposure	54	n with event: 5
Orellana, 2016[11]	Work Experience	Prevalence	Nasal colonization of MRSA	MRSA	NR	16+ years OR: 0.83, p=0.8076
Orellana, 2016[11]	Geographic Area	Prevalence	Nasal colonization of MRSA	MRSA	NR	Urban vs rural OR: 0.94, p=0.9445
Orellana, 2016[11]	Work Level	Prevalence	nasal colonization of MRSA	MRSA	NR	ALS vs. BLS OR: 0.72, p=0.6754
Tarabichi, 2021[15]	EMS	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	111	n with event: 6 OR: 1 (95% CI: 0.35 to 2.83)* Ref: firefighters
Tarabichi, 2021[15]	Fire	Prevalence	Seroprevalence using IgG and IgM ELISA	SARS-COV2	185	n with event: 10 Ref
Webber, 2018[17]	Fire	Prevalence	Positive test from 2000 - 2012	Hepatitis C	10047	n with event: 123 Ref

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Webber, 2018[17]	EMS	Prevalence	Positive test from 2000 - 2012	Hepatitis C	1327	n with event: 28 OR: 1.74 (95% CI: 1.15 to 2.63)* Ref: firefighters
Weiden, 2021[18]	EMS vs. Fire	Healthcare Utilization	Hospitalization or death from COVID	SARS-COV2	NR	EMS versus firefighter OR: 4.23 (95% CI: 2.20 to 8.15), p<0.001
Weiden, 2021[18]	EMS vs. Fire	Prevalence	COVID diagnosis	SARS-COV2	NR	OR: 1.28 (95% CI: 1.10 to 1.49), p=0.001

ALS=advanced life support; BLS=basic life support; CI=confidence interval; ELISA= Enzyme-linked immunosorbent assay; EMS=emergency medical services; Fire=firefighter; FR=first responder; IgG= Immunoglobulin G; MRSA=Methicillin-resistant Staphylococcus aureus; n=number of participants; N=sample size; OR=odds ratio
*Odds ratio calculated by the Evidence-based Practice Center from available data in article

Evidence Table C-6. Study characteristics of studies investigating the characteristics and reported effectiveness in studies of EMS/911 workforce practices to prevent infectious diseases (Guiding Question 2/3)

Author, year	Study design	Setting	Location	High-performing EMS system	Number of providers engaged	Type of transport	Volunteer or funded department	Population	Infectious disease
Brown, 2021[19]	Observational study with concurrent comparison group	Urban, suburban, and rural	Washington: King County	No/not reported	2920	Not reported	Not reported	Emergency medical service workers including firefighters	SARS-COV2
Glaser, 2011[20]	Observational study with concurrent comparison group	Urban	New York: New York City	No/not reported	10612	Not reported	Not reported	Emergency medical service workers including firefighters	Influenza
Halbrook, 2021[21]	Observational study with concurrent comparison group	Urban	California: Los Angeles	No/not reported	465	Not reported	Not reported	Emergency medical service workers including firefighters	SARS-COV2
Harris, 2010[7]	Observational study with concurrent comparison group	Urban, suburban, and rural	Virginia: Greater Richmond area	No/not reported	311	Ground	Mixed department (both volunteers and funded)	Emergency medical service workers including firefighters	Any type of blood-borne exposure
Harris, 2010[7]	Observational study with concurrent comparison group	Urban, suburban, and rural	Virginia: Greater Richmond area	No/not reported	311	Ground	Mixed department (both volunteers and funded)	Emergency medical service workers including firefighters	Any type of blood-borne exposure
Hubble, 2011[22]	Observational study with concurrent comparison group	Urban, suburban, and rural	North Carolina: 14 different agencies within the state	No/not reported	601	Not reported	NR	Emergency medical service workers not including firefighters	Influenza

Author, year	Study design	Setting	Location	High-performing EMS system	Number of providers engaged	Type of transport	Volunteer or funded department	Population	Infectious disease
Miramonti, 2013[23]	Observational study with concurrent comparison group	Urban	Indiana	No/not reported	186	Not reported	NR	Emergency medical service workers not including firefighters	MRSA
Newberry, 2021[10]	Observational study with concurrent comparison group	Urban	California: Santa Clara County	No/not reported	983	NR	NR	Emergency medical service workers including firefighters	SARS-COV2
Orellana, 2016[11]	Observational study with concurrent comparison group	Urban, suburban, and rural	Ohio	No/not reported	280	NR	NR	Emergency medical service workers not including firefighters	MRSA
Rebmann, 2012[24]	Observational study with concurrent comparison group	Urban	Missouri: St. Louis	No/not reported	265	NR	NR	Emergency medical service workers including firefighters	Influenza

EMS=emergency medical service; MRSA= Methicillin-resistant Staphylococcus aureus; NR=not reported

Evidence Table C-7. Intervention characteristics of studies investigating the characteristics and reported effectiveness in studies of EMS/911 workforce practices to prevent infectious diseases (Guiding Question 2/3)

Author, year	Arm name	Type of intervention	Levels of the hierarchy of controls were addressed by the intervention	Intervention	Single or multi-dimension intervention	National, state, or local protocol	Intervention setting
Brown, 2021[19]	AGP	PPE protocol	Engineering, PPE	EMS PPE protocols include wearing a mask, eye protection, gloves, and a gown. Surgical masks were considered sufficient for treating patients not requiring AGP, but an N95 respirator was required when patients underwent AGPs. HEPA (high efficiency particulate air) filters were added to ventilation bags. Otherwise, clinical protocols did not change in response to the pandemic	Single	Yes	Field
Glaser, 2011[20]	BIOPOD	Vaccines, on-site	Elimination	Vaccines offered during BIOPOD event, on-site clinic, education pre-BIOPOD- compliance with getting a flu vaccine was measured among both people who attended event and those who did not	Single	No	Station
Halbrook, 2021[21]	Vaccine Uptake	Level of training	Administrative	level of training: healthcare workers compared to EMS	Single	No	NR
Harris, 2010[7]	Recap needles, dispose of needles in marked container, and dispose of other contaminated materials in marked container	Disposal	Elimination	Self-reported behaviors (Recap needles, dispose of needles in marked container, and dispose of other contaminated materials in marked container)	Single	No	NR
Harris, 2010[7]	Use of face mask, use of protective device for performing resuscitation,	PPE protocol	PPE	Self-reported behaviors (Use of face mask, use of protective device for performing resuscitation, wear gloves for all calls)	Single	No	NR

Author, year	Arm name	Type of intervention	Levels of the hierarchy of controls were addressed by the intervention	Intervention	Single or multi-dimension intervention	National, state, or local protocol	Intervention setting
	wear gloves for all calls						
Hubble, 2011[22]	Vaccine Clinic	Training and education, vaccines	Elimination	Survey: looked at vaccine rates among rural, urban, and suburban (vaccine as intervention); then asked participants about training, education, and whether employer offered vaccine	Multi	No	NR
Miramonti, 2013[23]	Students	Training and education	No applicable	EMTS with at least six months of experience compared EMT students with less than two months of experience (including training); the "intervention" would be experience in the field	Single	No	NR
Newberry, 2021[10]	Full PPE	PPE protocol	PPE	Survey: asked if full PPE during exposure	Single	No	NR
Orellana, 2016[11]	Hygiene	Hand hygiene	Administrative	Survey: asked about hand hygiene and compared to MRSA colonization rates	Single	No	Station
Rebmann, 2012[24]	Mandate	Personnel policies	Elimination	Employers had a mandatory vaccination policy	Single	No	Station

AGP=aerosol generating procedures; BIOPOD= biologic points of distribution; EMS=emergency medical services; HEPA=high efficiency particulate air; NR=not reported; PPE=personal protective equipment

Evidence Table C-8. Participant characteristics of studies investigating the characteristics and reported effectiveness in studies of EMS/911 workforce practices to prevent infectious diseases (Guiding Question 2/3)

Author, year	Age	Gender, males n (%)	Race, n (%)	Experience	Type of training, n (%)	Vaccination status
Brown, 2021[19]	NR	NR	NR	NR	NR	NR
Glaser, 2011[20]	Range: <30: 1928; 30-39: 4071; 39+ 4613	10042 (94.6)	White: 8538 (80.46) African-American: 770 (7.26) Asian: 142 (1.34) Hispanic: 1153 (10.87) Other: 9 (8)	NR	EMR: 2254 (21.24) Firefighter: 8358 (78.76)	Influenza: 5831 (54.95)
Halbrook, 2021[21]	Range: 18-29: 26 (5.59%); 30-39: 139 (29.89%); 40-49: 124 (26.67%); 50-59: 160 (34.41%); 60+: 16 (3.44%)	428 (92)	White: 316 (68) African-American: 30 (6.5) Asian: 23 (5) Other: 96 (20.7)	NR	NR	NR
Harris, 2010[7]	Mean: 37 Range: 17 to 72	(56)	White: (85) African-American: (8.9) Asian: (1) Hispanic: (2.6) Other: (2)	Mean: 6 Range: 0.5 to 25	EMR: 5 EMT-Basic: 226 EMT-Paramedic: 2	NR
Harris, 2010[7]	Mean: 37 Range: 17 to 72	(56)	White: (85) African-American: (8.9) Asian: (1) Hispanic: (2.6) Other: (2)	Mean: 6 Range: 0.5 to 25	EMR: 5 EMT-Basic: 226 EMT-Paramedic: 2	NR
Hubble, 2011[22]	Mean: 35.9	(64.8)	White: (94.3)	NR	EMT-Basic: (11.7) EMT-Intermediate: (5) EMT-Paramedic: (83.2)	Influenza: (52.1)
Miramonti, 2013[23]	Mean: EMS: 34.3; Control: 27	178	White: 261 African-American: 18	NR	EMT-Basic: 45 EMT-Paramedic: 89	NR
Newberry, 2021[10]	Range: 18-34: 206 (21%); 35-49: 556 (56.6%); 50+: 221 (22.5%)	942 (95.8)	White: 594 (60.4) African-American: 26 (2.6) Asian: 78 (7.9) Hispanic: 192 (19.5) Other: 93 (9.5)	NR	NR	NR
Orellana, 2016[11]	Mean: 36.9	246 (87.9)	White: 278 Other: 2	Range: < 16 years: 178; 16+ years: 102	NR	NR
Rebmann, 2012[24]	Range: 83.7% were between 31 - 60	212 (84.8)	White: 232 (87.5)	Range: 73.1% had 11+ years experience	NR	Influenza: 195 (73.6)

EMR=emergency medical responders; EMS=emergency medical services; EMT=emergency medical technician; n=number of participants; NR=not reported

Evidence Table C-9. Risk of bias assessment (modified EPHPP) of studies investigating the characteristics and reported effectiveness in studies of EMS/911 workforce practices to prevent infectious diseases (Guiding Question 2/3)

Author, year	Selection Bias Q1. Are the individuals selected to participate in the study likely to be representative of the target population?	Selection Bias Q2. What percentage of selected individuals agreed to participate?	Selection Bias Rating	Confounders Q1. Were there important differences between groups prior to the intervention?	Confounders Q2. If yes, indicate the percentage of relevant confounders that were controlled?	Confounders Rating
Brown, 2021[19]	Very likely	80-100% agreement	Strong	No	Not Applicable	Strong
Glaser, 2011[20]	Very likely	80-100% agreement	Strong	No	Not Applicable	Strong
Halbrook, 2021[21]	Somewhat likely	80-100% agreement	Moderate	Can't tell	Not Applicable	Weak
Harris, 2010[7]	Somewhat likely	Less than 60% agreement	Weak	Can't tell	Not Applicable	Weak
Hubble, 2011[22]	Somewhat likely	Can't tell	Weak	Can't tell	Not Applicable	Weak
Miramonti, 2013[23]	Very likely	60-79% agreement	Moderate	Yes	Not Applicable	Weak
Newberry, 2021[10]	Very likely	60-79% agreement	Moderate	Can't tell	Not Applicable	Weak
Orellana, 2016[11]	Very likely	Can't tell	Weak	Can't tell	Not Applicable	Weak
Rebmann, 2012[24]	Somewhat likely	Can't tell	Weak	Can't tell	Not Applicable	Weak

EPHPP=Effective Public Healthcare Panacea Project quality assessment tool; Q=question

*Selection bias grading is assessed as either[25]:

Strong = Selected individuals are very likely to be representative of the target population and there is greater than 80% participation

Moderate = The selected individuals are at least somewhat likely to be representative of the target population and there is 60 - 79% participation

Weak = The selected individuals are not likely to be representative of the target population, there is less than 60% participation or selection is not described

†Confounders domain is assessed as either[25]:

Strong = Will be assigned to those articles that controlled for at least 80% of relevant confounders

Moderate = Will be given to those studies that controlled for 60 – 79% of relevant confounders

Weak = will be assigned when less than 60% of relevant confounders were controlled or control of confounders was not described

Evidence Table C-10. Results of studies investigating how workforce practices recognize and prevent infectious diseases vary by demographic characteristics of the EMS/911 workforce (Guiding Question 2/3a)

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Glaser, 2011[20]	Age	Vaccine Uptake	Influenza Vaccine	Influenza	NR	Got vaccine: 39.6 years; Did not: 37.1 years p<0.03
Glaser, 2011[20]	Gender, Male	Vaccine Uptake	Influenza Vaccine	Influenza	NR	Percent of events: 55.5%, p<0.0001
Glaser, 2011[20]	Gender, Female	Vaccine Uptake	Influenza Vaccine	Influenza	NR	Percent of events: 45.8%, p<0.0001
Glaser, 2011[20]	Race, Black	Vaccine Uptake	Influenza Vaccine	Influenza	NR	OR: 0.46

N=sample size; NR=not reported; OR=odds ratio

Evidence Table C-11. Results of studies investigating how workforce practices recognize and prevent infectious diseases vary by workforce characteristics of the EMS/911 workforce (Guiding Question 2/3b)

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Halbrook, 2021[21]	Not Applicable	Vaccine Uptake	COVID-19 Vaccine uptake	SARS-COV2	465	Percent with events: 87.5%
Halbrook, 2021[21]	Not Applicable	Vaccine Uptake	COVID-19 Vaccine uptake	SARS-COV2	858	Percent with events: 96%
Hubble, 2011[22]	Vaccinated	Vaccine Uptake	Influenza Vaccine	Influenza	107	Percent with events: 35.5%
Hubble, 2011[22]	Vaccinated	Vaccine Uptake	Influenza Vaccine	Influenza	70	Percent with events: 54.3%
Hubble, 2011[22]	Vaccinated	Vaccine Uptake	Influenza Vaccine	Influenza	424	Percent with events: 50%

N=sample size

Evidence Table C-12. Results of studies investigating how workforce practices recognize and prevent infectious diseases vary by practice characteristics of the EMS/911 workforce (Guiding Question 2/3c)

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Glaser, 2011[20]	Not Applicable	Vaccine Uptake	Influenza Vaccine	Influenza	9559	n with events: 5469
Glaser, 2011[20]	Not Applicable	Vaccine Uptake	Influenza Vaccine	Influenza	1053	n with events: 362
Harris, 2010[7]	Not Applicable	Practice	Recap needles, never	NR	NR	63 v. 48 OR: ref
Harris, 2010[7]	Not Applicable	Practice	Recap needles, seldom	NR	NR	9 v. 12 OR: 1.75 (95% CI: 0.68 to 4.49) Ref: Recap needles, never
Harris, 2010[7]	Not Applicable	Practice	Recap needles, most of the time	NR	NR	3 v. 22 OR: 9.63 (95% CI: 2.72 to 34) Ref: Recap needles, never
Harris, 2010[7]	Not Applicable	Practice	Recap needles, always	NR	NR	3 v. 23 OR: 10.1 (95% CI: 2.85 to 34.5) Ref: Recap needles, never
Harris, 2010[7]	Not Applicable	Practice	Dispose of needles in marked container, always	NR	NR	68 v. 92 OR: 0.96 (95% CI: 0.4 to 2.32) Ref: Dispose of needles in marked container, most of the time
Harris, 2010[7]	Not Applicable	Practice	Dispose of needles in marked container, most of the time	NR	NR	10 v. 13 OR: ref
Harris, 2010[7]	Not Applicable	Practice	Dispose of other contaminated material in marked container, always	NR	NR	51 v. 93 OR: 0.24 (95% CI: 0.11 to 0.52) Ref: Dispose of other contaminated material in marked container, most of the time, sometimes, and seldom
Harris, 2010[7]	Not Applicable	Practice	Dispose of other contaminated material in marked container, most of the time, sometimes, and seldom	NR	NR	27 v. 12 OR: ref
Harris, 2010[7]	Not Applicable	Practice	Wear gloves for all calls, always	NR	NR	69 v. 188 OR: 1.75 (95% CI: 0.81 to 3.79) Ref: Wear gloves for all calls, most of the time
Harris, 2010[7]	Not Applicable	Practice	Wear gloves for all calls, most of the time	NR	NR	9 v. 43 OR: ref
Harris, 2010[7]	Not Applicable	Practice	Use of face mask (TB), always	NR	NR	71 v. 151 OR: 4.86 (95% CI: 1.44 to 16.4) Ref: Use of face mask (TB), most of the time, seldom, and never
Harris, 2010[7]	Not Applicable	Practice	Use of face mask (TB), most of the time, seldom, and never	NR	NR	3 v. 31 OR: ref
Harris, 2010[7]	Not Applicable	Practice	Use of protective device for performing resuscitation, always	NR	NR	80 v. 209 OR: 17.3 (95% CI: 1.04 to 28.8) Ref: Use of protective device for performing resuscitation, most of the time and seldom

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Harris, 2010[7]	Not Applicable	Practice	Use of protective device for performing resuscitation, most of the time and seldom	NR	NR	0 v. 22 OR: ref
Hubble, 2011[22]	Vaccinated	Vaccine Uptake	Influenza Vaccine	Influenza	303	n with events: 161
Hubble, 2011[22]	Not Applicable	Vaccine Uptake	Influenza Vaccine	Influenza	566	n with events: 281
Rebmann, 2012[24]	Experimen t	Vaccine Uptake	Vaccine uptake in H1N1 vaccine	H1N1	14	n with events: 14
Rebmann, 2012[24]	Control	Vaccine Uptake	Vaccine uptake in H1N1 vaccine	H1N1	251	Percent with events: 66.8%
Rebmann, 2012[24]	Not Applicable	Vaccine Uptake	Vaccine uptake in influenza vaccine	Influenza	7	n with events: 7
Rebmann, 2012[24]	Not Applicable	Vaccine Uptake	Vaccine uptake in influenza vaccine	Influenza	258	Percent with events: 75.6%

CI=confidence interval; n=number of participants; N=sample size; NR=not reported; OR=odds ratio; Ref=reference; TB=tuberculosis

Evidence Table C-13. Results of studies reporting effectiveness on how workforce practices recognize and prevent infectious diseases of EMS/911 workforces (Guiding Question 2/3d)

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Brown, 2021[19]	Not Applicable	Incidence	PCR test	SARS-COV2	NR	1.17/10,000 person days IRR: 1.64 (95% CI: 0.22 to 12.26) Ref: Cohort 3 (COVID-19 encounter, NO AGP procedure, NOT during infectious window)
Brown, 2021[19]	Not Applicable	Incidence	PCR test	SARS-COV2	NR	0/10,000 person days IRR: 0 (95% CI: 0.0 to 1.5) Ref: Cohort 3 (COVID-19 encounter, NO AGP procedure, NOT during infectious window)
Brown, 2021[19]	Not Applicable	Incidence	PCR test	SARS-COV2	NR	0.71/10,000 person days Ref
Brown, 2021[19]	Not Applicable	Incidence	PCR test	SARS-COV2	NR	0.46/10,000 person days IRR: 0.64 (95% CI: 0.30 to 1.36) Ref: Cohort 3 (COVID-19 encounter, NO AGP procedure, NOT during infectious window)
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	110	n with events: 9 (%) OR: 1.49 (95% CI, 0.44 to 5.04) Ref: Recap needles, seldom, most of the time, and always
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	71	n with events: 4
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	158	n with events: 12 (%) OR: 1.8 (95% CI, 0.22 to 14.6) Ref: Recap needles, seldom, most of the time, and always
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	23	n with events: 1

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	142	n with events: 6 (%) OR: 0.2 (95% CI, 0.06 to 0.64) Ref: Recap needles, seldom, most of the time, and always
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	39	n with events: 7
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	143	n with events: 12 (%) OR: 2.95 (95% CI, 0.17 to 52.2) Ref: Recap needles, seldom, most of the time, and always
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	15	n with events: 0
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	174	n with events: 14 (%) OR: 1.72 (95% CI, 0.09 to 31.0) Ref: Recap needles, seldom, most of the time, and always
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	9	n with events: 0
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	153	n with events: 12 (%) OR: 1.11 (95% CI, 0.23 to 5.24) Ref: Recap needles, seldom, most of the time, and always
Harris, 2010[7]	Not Applicable	Incidence	Needlestick	Any type of blood-borne exposure	28	n with events: 25
Miramonti, 2013[23]	Not Applicable	Prevalence	Nasal colonization of MRSA	MRSA	152	% with events: 5.3%
Miramonti, 2013[23]	Not Applicable	Prevalence	Nasal colonization of MRSA	MRSA	134	% with events: 4.5%
Miramonti, 2013[23]	Not Applicable	Prevalence	Nasal colonization of MRSA	MRSA	89	% with events: 5.6%
Miramonti, 2013[23]	Not Applicable	Prevalence	Nasal colonization of MRSA	MRSA	45	% with events: 2.2%

Author, year	Subgroup	Outcome category	Outcome	Infectious disease	N	Results
Newberry, 2021[10]	Not Applicable	Prevalence	IgG seroprevalence test	SARS-COV2	227	n with events: 3 (1.3%) Ref
Newberry, 2021[10]	Not Applicable	Prevalence	IgG seroprevalence test	SARS-COV2	90	n with events: 5 (5.6%) RR: 4.2 (95% CI: 1.03 to 17.22) Ref: Full PPE during exposure
Newberry, 2021[10]	Not Applicable	Prevalence	IgG seroprevalence test	SARS-COV2	18	n with events: 2 (11.1%) RR: 8.41 (95% CI: 1.5 to 47.12) Ref: Full PPE during exposure
Newberry, 2021[10]	Not Applicable	Incidence	PCR test	SARS-COV2	227	n with events: 3 (1.3%) Ref
Newberry, 2021[10]	Not Applicable	Incidence	PCR test	SARS-COV2	90	n with events: 2 (2.2%) RR: 1.68 (95% CI: 0.29 to 9.9) Ref: Full PPE during exposure
Newberry, 2021[10]	Not Applicable	Incidence	PCR test	SARS-COV2	18	n with events: 0 (0%)
Orellana, 2016[11]	Handwashing	Prevalence	Nasal colonization of MRSA	MRSA	NR	OR: Daily hand hygiene frequency: 3.41 (less frequent) p = 0.036
Orellana, 2016[11]	Handwashing	Prevalence	Nasal colonization of MRSA	MRSA	NR	OR: Frequency of hand hygiene after glove use: 5.18 (less frequent) p = 0.0065

AGP= aerosol generating procedures; CI=confidence interval; IgG= Immunoglobulin G; IRR=incidence rate ratio; MRSA=Methicillin-resistant Staphylococcus aureus; n=number of participants; N=sample size; NR=not reported; OR=odds ratio; PCR=polymerase chain reaction; PPE=personal protective equipment; RR=risk ratio

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Appendix D. Gray Literature Search Results

Table D-1. Summary of the Gray Literature Search

Organization	Site	Date of Search	# of Results	# Included
Assistant Secretary for Preparedness and Response	https://www.phe.gov/about/aspr/Pages/default.aspx	11/18/2021	244	3
Centers for Disease Control and Prevention	www.cdc.org	11/18/2021	41	3
National Institutes of Health	https://www.nih.gov	11/22/2021	920	0
Infectious Diseases Society of America	https://www.idsociety.org/	11/22/2021	229	0
Society for Healthcare Epidemiology of America	https://shea-online.org/search/	12/9/2021	46	0
Association for Professionals in Infection Control and Epidemiology	https://apic.org/	12/10/2021	93	2