WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care

Worksheet author(s)

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Clinical question.

In rescuers (P), does performing resuscitation (ventilations, compressions, defibrillation, etc) on adult and pediatric patients with cardiac arrest (out-of-hospital and in-hospital) (I) as opposed to not performing resuscitation (C), increase the likelihood of harm (O) (eg. Infection, exhaustion, stress, physical harm..)?

Is this question addressing an intervention/therapy, prognosis or diagnosis?No
State if this is a proposed new topic or revision of existing worksheet: Revision

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? No

Search strategy (including electronic databases searched).

The primary search was carried out by using the following electronic databases: Pubmed, AHA EndNote X Master Library 24Mar08, and All of The Cochrane Library including Cochrane database for systemic reviews and Cochrane Central Register of Controlled Trials.

The following terms were recognized as MeSH headings: Heart arrest, Cardiopulmonary resuscitation, Electric countershock (including electric defibrillation), Disease transmission, patient-to-professional, Stress, psychological.
The following terms were used as text words: Adverse effects, Harm, Exhaustion, Safety, Hazard, Injuries.

Pubmed:
"Heart arrest" [MeSH Terms] or "cardiopulmonary resuscitation" [MeSH Terms] (28,585 hits) and "disease transmission, patient-to-professional" [MeSH Terms] (14 hits, 7 selected) or "stress, psychological" [MeSH Terms] (102 hits, 9 selected) or "adverse effects" (491 hits, 9 selected) or "harm" (39 hits, 1 selected) or "exhaustion" (17 hits, 2 selected) or "safety" and "rescuer" (13 hits, 5 selected) as text words in abstract or title.
"Electric countershock" [MeSH Terms] or "electric countershock" [All Fields] or "electric defibrillation [All Fields] (10,666 hits) and "hazard" [All Fields] (69 hits, 2 selected) or "safety" [All Fields] (574 hits, 6 selected) or "injuries" [All Fields] (186 hits, 3 selected)

AHA EndNote X Master Library 24Mar08:
"Cardiopulmonary resuscitation" [Any Field] (2,910 hits) and "disease transmission, patient-to-professional" [Keywords] (16 hits, 6 selected) or "stress, psychological" [Keywords] (11 hits, 3 selected) or "adverse effects" [Any Field] (309 hits, 17 selected) or "harm" [Text word in abstract] (84 hits, 1 selected) or "exhaustion" [Text word in abstract] (3 hits, 2 selected) or "safety" [Text word in abstract] (60 hits, 4 selected) or "injuries" [Text word in abstract] (45 hits, 0 selected).
"Electric countershock" [Any Field] or "electric defibrillation" [Any Field] (806 hits), and "hazard" [Any Field] (15 hits, 6 selected) or "safety" [Any Field] (79 hits, 7 selected) or "injuries" [Any Field] (28 hits, 6 selected).

All of the Cochrane Library
There are 3 results for MeSH descriptor "Heart Arrest", 1 result for MeSH descriptor "Cardiopulmonary Resuscitation", 3 results for MeSH descriptor "Disease Transmission, Patient-to-Professional", and 2 results for MeSH descriptor "Electric Countershock" out of 5676 records.
There are 2 results out of 564,387 records for MeSH descriptor "Cardiopulmonary Resuscitation" and "Psychological Stress".
None of results were selected.

EMBASE:
"Heart arrest" [EMTREE Terms] or "resuscitation" [EMTREE Terms] (43,752 hits) and "disease transmission" [EMTREE Terms] (147 hits, 22 selected) or "mental stress" [EMTREE Terms] (82 hits, 3 selected) or "adverse effects" [Text Terms] (352 hits, 0 selected) or "harm" [Text Terms] (138 hits, 1 selected) or "exhaustion" [EMTREE Terms] (39 hits, 2 selected) or "safety" [EMTREE Terms] and "rescue personnel" [EMTREE Terms] (35 hits, 2 selected) as EMTREE terms or text words in abstract or title.
"Cardioversion" [EMTREE Terms] or "Defibrillation" [EMTREE Terms] (15,699 hits) and "electric hazard" [EMTREE Terms] (1 hits, 0 selected) or "safety" [EMTREE Terms] and "rescue personnel" [EMTREE Terms] (11 hits, 1 selected) or "injury" [EMTREE Terms] and "rescue personnel" [EMTREE Terms] (17 hits, 0 selected) or "occupational accident" [EMTREE Terms] (0 hits) or "electric injury" [EMTREE Terms] (271 hits, 1 selected)

Search for the above terms using OVID and SCOPUS.
Manual search was also carried out.

- **State inclusion and exclusion criteria**

Included were human studies.
Excluded were animal studies or those that did not describe risk or adverse effects in CPR performers.
Abstract only studies and studies, not peer reviewed or not answer question, were excluded.

- **Number of articles/sources meeting criteria for further review:**

Fifty-one articles met criteria for further review. Of these, thirty-one articles were LOE 4, and twenty were LOE 5. There was no LOE 1, 2 or 3 study.

Summary of evidence

Evidence Supporting Clinical Question

Good				Ashton, 2002 E, 151 Virkkunen, 2006 E, 39 Morgan, 2002 E, 413 Thierbach, 2005 E, 185 Walker, 2001 E, 179	Deshilder, 2007 E, 113 Hosmans, 2008 E, 216 Laws, 2001, E, 76
Fair				Ballard, 1986 E, 198 Chalumeau, 2005 E, 29 Christian, 2004 E, 287 Deetz, 1979 E, 912 Feldman, 1972 E, 1107 Figura, 1996 E, 1342 Finkelhor, 1980 E, 650 Heilman, 1965, E, 1035 Hendricks, 1980 E, 257 Jones, 2004 E, 63 Jones, 2005 E, 332 Khan, 1979 E, 2701 Marcus, 1988 E, 1118 Memon, 1982 E, 322 Shimokawa, 2001 E, 290 Steinhoff, 2001 E, 159 Sullivan, 2000 E, 64 Todd, 1980 E, 331 Valenzuela, 1991 E, 90	Mannis, 1984 E, 64 Ochoa, 1998 E, 149 Ong, 2007 E, 103
Poor					Ahmad, 1990 E, 787
	1	**2**	**3**	**4**	**5**
Level of evidence					

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Animal studies

Evidence Neutral to Clinical question

Good					Becker, 1997 E, 189 Mejicano, 1998 E, 813
Fair					Anonymous, 1989 E, 2714 Anonymous, 1998 E, 1870 Achong, 1980 E, 759 Arend, 2000 E, 73 Rinker, 2001 E, 89
Poor					
	1	**2**	**3**	**4**	**5**
Level of evidence					

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Animal studies

Evidence Opposing Clinical Question

Good				Lloyd, 2008 E, 2510 Peberdy, 2006 E, 59 Riegel, 2006 E, 98	Bierens, 1996 E, 185 Hoke, 2009 E, 395 Riera, 2007 E, 108 Sun, 1995 E, 205
Fair				Gibbs, 1990 E, 101 Glaser, 1985 E, 1653 Osterholm, 1979 E, 1263 Saviteer, 1985 E, 1606	Lyster, 2003 E, 307
Poor					Cutler, 1979 E, 1074
	1	**2**	**3**	**4**	**5**
Level of evidence					

A = Return of spontaneous circulation
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E = Other endpoint
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REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

The performance of CPR on individuals is generally safe for rescuers (Class Indeterminate). Few reports demonstrate the possibility of disease transmission in the course of performing mouth-to-mouth resuscitation. These reports include infectious diseases transmitted via direct mouth-to-mouth contact or inhalation of exhaled flow from the victim during mouth-to-mouth ventilation. To date, infectious diseases recorded as transmissible to the rescuer included Salmonella (Ahmad, 1990, 787), Streptococcal infection (Deetz, 1979, 912, Valenzuela, 1991, 90), Meningococcal disease (Feldman, 1972, 1107), Helicobacter pylori (Figura, 1996, 1342), Herpes simplex (Finkelhor, 1980, 650, Hendricks, 1980, 257, Mannis, 1984, 64), Staphylococcus aureus (Chalumeau, 2005, 29), cutaneous tuberculosis (Heilman, 1965, 1035), and Shigellosis (Todd, 1980, 331). No reports have indicated the transmission of human immunodeficiency virus (HIV) or hepatitis virus to the rescuer following mouth-to-mouth resuscitation. Similarly, no cases involving disease transmission to a fireman through rescue breathing have occurred in the past 22 years, although exact statistics are unavailable (Cutler, 1979, 1074). Exposure to potentially infective saliva from a patient with AIDS-related complex during mouth-to-mouth resuscitation did not result in seroconversion (Saviteer, 1985, 1606). In a rational approach, the overall risk of seroconversion due to CPR was calculated as approximately one per million resuscitations in the highest risk group and less than one per billion resuscitations in the group that is most often resuscitated (Bierens, 1996, 185). None of participants developed a new hepatitis B infection following group exposure to CPR training mannequins contaminated with saliva from a participant in the presymptomatic infections stage of antigen-positive hepatitis (Osterholm, 1979, 1263, Glaser, 1985, 1653), even though potential danger of cross infection during a CPR training session has raised (Khan, 1979, 2701). However, exposure to blood or other bloody fluids may cause a very small increase in the risk of disease transmission if the rescuer has any cuts or lesions in or around the mouth or hands. The Cooperative Needlestick Surveillance Group reported that two exposures to the blood of an AIDS patient as a result of accidental needle-sticks during resuscitation procedures resulted in seroconversion (Marcus, 1988, 1118). The actual risk of HIV transmission to a rescuer is higher during ACLS than BLS because the needle-stick risk is not present during BLS (Rinker, 2001, 89). Transmission of SARS-CoV to healthcare workers has occurred during attempted CPR of a SARS patient (Christian, 2004, 287).

Other than disease transmission, adverse effects associated with the performance or practice of CPR include the accidental ingestion of secretions during mouth-to-tube suctioning for neonatal resuscitation (Ballard, 1986, 198), fatal myocardial infarction following CPR training (Memon, 1982, 322), anterior interosseous nerve palsy in a resuscitator with undiagnosed muscle anomaly (Shiokawa, 2001, 290), physical injury of puncture wounds from sternotomy wires (Steinhoff, 2001, 159), and pneumothorax during CPR training (Sullivan, 2000, 64). Prolonged basic life support with mouth-to-mouth ventilation may result in hypocarbia in the ventilating rescuer (Walker, 2001, 179, Thierbach, 2005, 185) or gastric regurgitation in the victims (Virkkunen, 2006, 39). Caution needs to be taken resuscitating victims of specific poisoning from hydrogen cyanide, hydrogen sulphide gas, corrosive chemicals, or organophosphorus compounds (Anonymous, 1998, 1870). Rescuer fatigue may occur during prolonged chest compressions, which may influence the quality of the chest compressions (Ochoa, 1998, 149, Ashton, 2002, 151, Deschilder, 2007, 113, Riera, 2007, 108). Rescuers may experience back discomfort during delivering CPR and some ambulance personnel and nurses consider CPR to be the cause of back injuries (Jones, 2004, 63, Jones, 2005, 332). Psychological stress may occur related to the performance of CPR or in situations involving a presumed cardiac arrest. The level of psychological stress was low in lay responders (Riegel, 2006, 98), but remained high for professional healthcare providers (Laws, 2001, 76, Morgan, 2002, 413) or during witnessed resuscitation (Ong, 2007, 103).

Concern has been expressed regarding potential shock hazards for operators or bystanders during the use of automated external defibrillators (AEDs) in resuscitation. Injuries to individuals administering defibrillatory shock during CPR occurred if the shock was delivered while the rescuer was still in contact with the patient's body (Gibbs, 1990, 101). No accidental shocks resulted in permanent injury. During delivery of defibrillatory shock, rescuers are exposed to low levels of leakage current and voltage when performing chest compressions with using gloves (Lloyd, 2008, 2510) or even in a wet environments (Lyster, 2003, 307). During the PAD trial, there were no reports of lay rescuer's injuries during shock delivery (Peberdy, 2006, 59).

Evidence supporting rescuer safety during CPR is limited. The few isolated reports of adverse effects resulting from the widespread and frequent use of CPR suggests that performing CPR is relatively safe.

Delivery of defibrillatory shock with an AED during basic life support is also safe. The incidence and morbidity of defibrillator-related injuries in the rescuers is low.

Acknowledgements:

Citation List

Achong MR. Infectious hazards of mouth-to-mouth resuscitation. Am Heart J 1980; 100:759-61.

LOE 5 study, Neutral, Fair
Authors comment on potential risk of transmitting hepatitis and meningococcal infection and management of such mouth-to-mouth contacts.

Ahmad F, Senadhira DCA, Charters J, et al. Transmission of salmonella via mouth-to-mouth resuscitation. Lancet 1990; 335:787-788.

LOE 5, Supporting, Poor
Case report of a physician who performed mouth-to-mouth resuscitation to save a 68-year-old woman who had gastroenteritis from infection of Salmonella infantis 6,7:r, then the doctor had gastroenteritis and S infantis 6,7:r in his stool. The report demonstrated potential risk of disease transmission during mouth-to-mouth resuscitation.

Anonymous. Risk of infection during CPR training and rescue: supplemental guidelines, The Emegency Cardiac Care Committee of the American Heart Association. JAMA 1989: 262;2714-5.

LOE 5, Neutral, Fair

Anonymous. The 1998 European Resuscitation Council guidelines for adult single rescuer basic life support. Basic Life Support Working Group of the European Resuscitation Council. BMJ 1998; 316:1870-1876.

LOE 5, Neutral, Fair
The Guidelines for adult single rescuer basic life support. The Guidelines describe risks to the rescuer including poisoning and infection.

Arend CF. Transmission of infectious diseases through mouth-to-mouth ventilation: evidence-based or emotion-based medicine? Arq Bras Cardiol 2000: 74;73-97.

LOE 5, Neutral, Fair
Review article on infectious diseases transmitted through mouth-to-mouth ventilation

Ashton A, McCluskey A, Gwinnutt CL, Keenan AM. Effect of rescuer fatigue on performance of continuous external chest compressions over 3 min. Resuscitation 2002:55;151-5.

LOE 4, Supporting, Good.

Ballard JL, Musial MJ, Myers MG. Hazards of delivery room resuscitation using oral methods of endotracheal suctioning. Pediatr Infect Dis 1986; 5:198-200.

LOE 4, Supporting, Fair

Becker LB, Berg RA, Pepe PE, et al. A reappraisal of mouth-to-mouth ventilation during bystander-initiated cardiopulmonary resuscitation. A statement for healthcare professionals from the Ventilation Working Group of the Basic Life Support and Pediatric Life Support Subcommittees, American Heart Association. Resuscitation 1997; 35:189-201.

LOE 5, Neutral, Good
Special report. A statement for healthcare professionals from the ventilation working group of the basic life support and pediatric life suport subcommittee, American Heart Association. The purpose of this special report was to review the historical rationale for providing mouth-to-mouth ventilation during CPR and to critically analyze the necessity and timing of ventilation during CPR and adverse effect that result from inclusion of mouth-to-mouth ventilation. The report includes review of the risks of disease transmission during mouth-to-mouth ventilation.

Bierens JJ, Berden HJ. Basic-CPR and AIDS: are volunteer life-savers prepared for a storm? Resuscitation 1996; 32:185-191.

LOE 5, Opposing, Good
This review describes two approaches for information to life-savers about the risks of HIV infection. The authors estimated that the

calculated overall risk of seroconversion due to CPR is about one per million resuscitations in the highest risk group and less than one per billion resuscitation in the group that is most often resuscitated.

Chalumeau M, Bidet P, Lina G, Mokhtari M, Andre MC, Gendrel D. Transmission of Panton-Valentine leukocidin-producing Staphylococcus aureus to a physician during resuscitation of a child. Clin Infect Dis 2005;41:e29-30.

LOE 4, Supporting, Fair
The authors reported a case of transmission of Staphylococcus aureus to a physician during the resuscitation an infant.

Christian MD, Loutfy M, McDonald LC, et al. Possible SARS coronavirus transmission during cardiopulmonary resuscitation. Emerg Infect Dis 2004; 10:287-293.

LOE 4, Supporting, Fair
This case report describes the apparent transmission of SARS-CoV from a patient to healthcare workers during an attempted resuscitation.

Cutler SS. Safety of mouth-to-mouth resuscitation. Lancet 1979; 2:1074.

LOE 5, Opposing, Poor
Dr. Cutler wrote that over twenty-two years no case of transmission of disease to a fireman through rescue breathing has occurred in the New York City Fire Department.

Deetz TR. Operator risk in mouth-to-mouth resuscitation. Lancet 1979; 2:912.

LOE 4, Supporting, Fair
The letter describes a nurse who had attempted mouth-to-mouth resuscitation on a 7-year-old child who had had a cardiopulmonary resuscitation and proved to be infected streptococci after twenty-four hour of exposure.

Deschilder K, De Vos R, Stockman W. The effect on quality of chest compressions and exhaustion of a compression--ventilation ratio of 30:2 versus 15:2 during cardiopulmonary resuscitation--a randomised trial. Resuscitation 2007: 74:;113-8.

LOE 5, Supporting, Good

Feldman HA. Some recollections of the meningococcal diseases. The first Harry F. Dowling lecture. JAMA 1972; 220:1107-12.

LOE 4, Supporting, Fair
The report describes that at least four cases (of meningococcal disease) have followed mouth-to-mouth resuscitation.

Figura N. Mouth-to-mouth resuscitation and Helicobacter pylori infection. Lancet 1996; 347:1342.

LOE 4, Supporting, Fair
A 49-year-old doctor was seropositive and breath-test positive for Helicobacter pylori infection after giving a man mouth-to-mouth resucitation. This report confirms possible transmission of H pylori infection by vomit, and indicates that mouth-to-mouth resuscitation has to be considered a risk factor for acquiring H pylori infection

Finkelhor RS, Lampman JH. Herpes simplex infection following cardiopulmonary resuscitation. JAMA 1980; 243: 650.

LOE 4, Supporting, Fair
Letter, Case report describes a 26-year-old medical resident who infected herpes simplex after performance of emergency mouth-to-mouth ventilation on a 55-year-old female patient.

Gibbs W, Eisenberg M, Damon SK. Dangers of defibrillation: injuries to emergency personnel during patient resuscitation. Am J Emerg Med 1990: 8;101-4.

LOE 4, Opposing, Fair

Glaser JB, Nadler JP. Hepatitis B virus in a cardiopulmonary resuscitation training course. Risk of transmission from a surface antigen-positive participant. Arch Intern Med 1985: 145;1653-5.

LOE 4, Opposing, Fair

Heilman KM, Muschenheim C. Primary cutaneous tuberculosis resulting from mouth-to-mouth respiration. N Engl J Med 1965; 273:1035-6.

A 25-year-old intern performed mouth-to-mouth respiration to resuscitate a victim whose postmortem examination disclosed active tuberculosis of the right lung. After 8 weeks after contact, the intern noted a submaxillary lymphadenopathy. The biopsy showed granulomatous inflammation and the culture for acid-fast bacilli was subsequently positive. He was treated and cured with anti-tuberculosis drug.
LOE 4, Supporting, Fair

Hendricks AA, Shapiro EP. Primary herpes simplex infection following mouth-to-mouth resuscitation. JAMA 1980; 243:257-8.

Authors report a case of a primary herpes simplex infection acquired by a physician from mouth-to-mouth resuscitation of a patient with herpes simplex pneumonia
LOE 4, Supporting, Fair

Hoke RS, Heinroth K, Trappe HJ, Werdan K. Is external defibrillation an electric threat for bystanders? Resuscitation 2009; 80:395-401.

LOE 5, Opposing, Good
Review paper

Hosmans TP, Maquoi I, Vogels C, Courtois AC, Micheels J, Lamy M, et al. Safety of fully automatic external defibrillation by untrained lay rescuers in the presence of a bystander. Resuscitation 2008: 77;216-9.

LOE 5, Supporting, Good
Comment: Safety was not compromised when untrained lay rescuers used an AED. However, data showed significant compromise of safety of lay rescuers and bystanders in their simulation model.

Jones AY. Can cardiopulmonary resuscitation injure the back? Resuscitation 2004:61;63-7.

LOE 4, Supporting, fair

Jones AY, Lee RY. Cardiopulmonary resuscitation and back injury in ambulance officers. Int Arch Occup Environ Health 2005:78;332-6.

LOE 4, Supporting, Fair

Khan AH, Roland FP, Carleton RA. Cardiopulmonary resuscitation-potential danger of cross-infection. JAMA 1979: 241;2701-2.

LOE 4, Supporting, Fair
Comment: The authors conducted cultures taken from the oral surface of manikins and from the students' throats. Culture results revealed that normal respiratory flora was isolated after mouth-to-mouth breathing on the oral surface of manikins. They concluded that it is possible to transmit bacteria to manikins during mouth-to-mouth breathing.

Laws T. Examining critical care nurses' critical incident stress after in hospital cardiopulmonary resuscitation (CPR). Aust Crit Care 2001: 14;76-81.

LOE 5, Supporting, Good

Lloyd MS, Heeke B, Walter PF, Langberg JJ. Hands-on defibrillation: an analysis of electrical current flow through rescuers in direct contact with patients during biphasic external defibrillation. Circulation 2008: 117;2510-4.

LOE 4, Opposing, Good

Lyster T, Jorgenson D, Morgan C. The safe use of automated external defibrillators in a wet environment. Prehosp Emerg Care 2003: 7;307-11.

LOE 5, Opposing, Fair

Mannis MJ, Wendel RT. Transmission of herpes simplex during CPR training. Ann Ophthalmol 1984; 16:64-6.

LOE 5, Supporting, Fair

Marcus R. Surveillance of health care workers exposed to blood from patients infected with the human immunodeficiency virus. N Engl J Med 1988; 319:1118-23.

LOE 4, Supporting, Fair
Seroprevalence of HIV antibody in healthcare workers exposed to blood from patients infected with HIV was 0.47% when exposure is due to needle stick or cut with sharp object and 0% when mucous membrane is contaminated.

Mejicano GC, Maki DG. Infections acquired during cardiopulmonary resuscitation: estimating the risk and defining strategies for prevention. Ann Intern Med 1998; 129:813-828.

LOE 5, Neutral, Good

Memon AM, Salzer JE, Hillman EC Jr, et al. Fatal myocardial infarct following CPR training: the question of risk. Ann Emerg Med 1982; 11:322-323.

Case report describes a 46-year-old obese male physician who fatal myocardial infarction developed shortly after manikin practice for mouth-to-mouth ventilation and external cardiac compression. Authors emphasize any person with known ischemic heart disease should be excluded from participating in CPR training, and that persons characterized by risk factors associated with ischemic heart disease should be asked to check with their physicians before signing up for a CPR course.
LOE 4, Supporting, Fair

Morgan R, Westmoreland C. Survey of junior hospital doctors' attitudes to cardiopulmonary resuscitation. Postgrad Med J 2002;78:413-5.

LOE 4, Supporting, Good

Ochoa FJ, Ramalle-Gomara E, Lisa V, Saralegui I. The effect of rescuer fatigue on the quality of chest compressions. Resuscitation 1998: 37;149-52.

LOE 5, Supporting, Fair

Ong ME, Chung WL, Mei JS. Comparing attitudes of the public and medical staff towards witnessed resuscitation in an Asian population. Resuscitation 2007: 73;103-8.

LOE 5, Supporting, Fair

Osterholm MT, Bravo ER, Crosson JT, et al. Lack of transmission of viral hepatitis type B after oral exposure to HBsAg-positive saliva. Br Med J 1979; 2:1263-1264.

Authors report a study in which viral hepatitis type B was not transmitted to people exposed to HBsAg-positive saliva during CPR training. They studied twenty-two hospital trainees who had participated in a CPR training programme eight days before one of them developed clinical hepatitis B. All were negative for both HBs Ag and anti-HBs and none reported illness.
LOE 4, Opposing, Good

Peberdy MA, Ottingham LV, Groh WJ, Hedges J, Terndrup TE, Pirrallo RG, et al. Adverse events associated with lay emergency response programs: the public access defibrillation trial experience. Resuscitation 2006: 70;59-65.

LOE 4, Opposing, Good

Riegel B, Mosesso VN, Birnbaum A, Bosken L, Evans LM, Feeny D, et al. Stress reactions and perceived difficulties of lay responders to a medical emergency. Resuscitation 2006: 70;98-106.

LOE 4, Opposing, Good

Riera SQ, Gonzalez BS, Alvarez JT, Fernandez Mdel M, Saura JM, et al. The physiological effect on rescuers of doing 2min of uninterrupted chest compressions. Resuscitation 2007: 74;108-12.

LOE 5, Opposing, Good

Rinker AG Jr. Disease transmission by mouth-to-mouth resuscitation. Emerg Med Serv 2001; 30:89-90.

The author describes risks of disease transmission by mouth-to-mouth resuscitation. Perceived risk: refusal to perform mouth-to-mouth resuscitation on cardiac arrest patients, a s result of misinformation and an exaggerated risk perception, reduces the patients' chances of survival. Actual risk: Only a few documented cases have been reported, most of which involved bacterial pathogens. There have been no reports of transmission of hepatitis B virus, hepatitis C virus or cytomegalovirus during CPR. A report of HIV infection during resuscitation involved high-risk cutaneous exposure (eg. needle-stick injuries)
LOE 5, Neutral, Fair

Saviteer SM, White GC, Cohen MS, et al. HTLV-III exposure during cardiopulmonary resuscitation. N Engl J Med 1985; 313:1606-1607.

The letter describe two nurses who participated in mouth-to-mouth resuscitation of a patient with the AIDS-related complex, who was positive for human T-cell lymphotropic virus Type III/lymphadenopathy-associated virus, and their seronegativity nine months after exposure.
LOE 4, Opposing, Fair

Shimokawa A, Tateyama S, Shimizu Y, et al. Anterior interosseous nerve palsy after cardiopulmonary resuscitation in a resuscitator with undiagnosed muscle anomaly. Anesth Analg 2001; 93:290-291.

LOE 4, Supporting, Fair

Steinhoff JP, Pattavina C, Renzi R. Puncture wound during CPR from sternotomy wires: case report and discussion of periresuscitation infection risks. Heart Lung 2001; 30:159-160.

LOE 4, Supporting, Fair

Sullivan F, Avstreih D. Pneumothorax during CPR training: case report and review of the CPR literature. Prehosp Disaster Med 2000; 15:64-9.

LOE 4, Supporting, Fair

Sun D, Bennett RB, Archibald DW. Risk of acquiring AIDS from salivary exchange through cardiopulmonary resuscitation courses and mouth-to-mouth resuscitation. Semin Dermatol 1995; 14:205-11.

LOE 5, Neutral, Good

Thierbach AR, Piepho T, Kunde M, Wolcke BB, Golecki N, Kleine-Weischede B, et al. Two-rescuer CPR results in hyperventilation in the ventilating rescuer. Resuscitation 2005: 65;185-90.

LOE 4, Supporting, Good

Todd MA, Bell JS. Shigellosis from cardiopulmonary resuscitation. JAMA 1980; 243:331.

The letter describes a physician who performed mouth-to-mouth CPR for reviving a 3-year-old child and had fever, severe headache, and diarrhea. The stool cultures from the child at autopsy and the physician all yielded Shigella sonnei.
LOE 4, Opposing, Fair

Valenzuela TD, Hooton TM, Kaplan EL, et al. Transmission of 'toxic strep' syndrome from an infected child to a firefighter during CPR. Ann Emerg Med 1991; 20:90-92.

LOE 4, Supporting, Fair

Virkkunen I, Kujala S, Ryynanen S, et al. Bystander mouth-to-mouth ventilation and regurgitation during cardiopulmonary resuscitation. J Intern Med 2006; 260:39-42.

LOE 4, Supporting, Good

Walker GM, Liddle R. Prolonged two-man basic life support may result in hypocarbia in the ventilating rescuer. Resuscitation 2001; 50:179-83.

LOE 4. Supporting, Good