

F = Clinical report
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WORKSHEET to accompany PROPOSED ARC Evidence-Based GUIDELINES

Worksheet Author: Firstname Lastname Franklin BRIDGEWATER	ARC Subcommittee: National Council
Guideline applicable: 10.1.1 Ancillary devices for Expired Air Resuscitation (EAR)	Date submitted to council: 6 October 2004

Step 1: Gather the evidence

Define your search strategy.

(e.g. ((cardiopulmonary-resuscitation*:me or heart-arrest*:me) not (atrial-fibrillation:me of electrophysiology:me)) and hypothermia:ab))

The following terms were recognized as MeSH headings:

artificial respiration, basic life support, cardiopulmonary resuscitation, disease transmission, first aid/mt (Methods), heart arrest, masks, protective devices

The following terms were recognized as text words or keywords:

barrier, barrier devices, expired air ventilation, face-shield, mouth to mouth ventilation, protective equipment

Using EndNote 7 to access PubMed (NLM), EMBASE (OVID) and Medline (OVID)

Cardiopulmonary resuscitation or CPR was used in "Title" for first option and the other MeSH headings and text words or keywords used in "Any field" for second option.

Using OVID

Searches were carried out using the above MeSH headings and text-words / keywords. "Author" was utilized for locating secondary reference articles.

List electronic databases searched (at least MEDLINE (<http://igm.nlm.nih.gov>) Embase, Cochrane database for systematic reviews and Central Register of Controlled Trials (<http://www.cochrane.org.au>), and hand searches of journals, review articles, and books.

The primary search was conducted by perusing the following recognized electronic data bases

AHA Endnote 7 Master Library (April 2004) (<http://ecc.heart.org/>),
Cochrane Database for Systematic Reviews (<http://www.cochrane.org/>)
Cochrane Central Register of Controlled Trials
MEDLINE : 1966- April 2004 (<http://www.ncbi.nlm.nih.gov/PubMed/>)
Embase: 1988-2004

A personal EndNote 7 Library, "ILCORUnited.enl" created for ILCOR Guidelines 2005 and relating to the risks of CPR for the resuscitator was also searched.

Articles of deemed relevance were retained in an EndNote 7 Library named "Airways.enl". The references provided by the material retained in this Library were scanned and, if relevant articles were found that were not already within the library, they were added to the data base.

• Describe search results; describe best sources for evidence.

A search often produced a large number of irrelevant articles. A significant number of articles were retrieved from the EndNote 7 Library previously created for ILCOR. There were no exclusion criteria. Text books were not addressed. Referral to the bibliography of retrieved recent articles and accessing "Related Articles" in PubMed were productive ploys.

- State major criteria you used to limit your search; state inclusion or exclusion criteria (e.g., only human studies with control group? no animal studies? N subjects > minimal number? type of methodology? peer-reviewed manuscripts only? no abstract-only studies?)

Number of articles/sources meeting criteria for further review:

One hundred and one articles were identified as being of interest. These are documented in EndNote 7 Library "Airways.enl". Of these 25 were selected for further review, being considered relevant and representative of other articles and are detailed in the Citation List.

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Step 2: Determine the Level of Evidence for each study.

For each article/source from step 1, assign a level of evidence—based on study design and methodology.

Level of Evidence	Definitions	Articles found
Level I	Evidence obtained from a systematic review of all relevant randomised controlled trials	
Level II	Evidence obtained from at least one properly designed randomised controlled trial	
Level III-1	Evidence obtained from well designed properly pseudo-randomised controlled trials (alternate allocation or other method)	
Level III-2	Evidence obtained from comparative studies with concurrent controls and allocation not randomised (cohort studies), case control studies, or interrupted time series with a control group	
Level III-3	Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group	
Level IV	Evidence obtained from case series, either post-test or pre-test and post-test	[Brenner, 2000 #47] [Hew, 1997 #72] [Jelinek, 2001 #78] [Lufkin, 1993 #3]
Other	Evidence based review	[Mejicano, 1998 #10] [Villanueva, 1999 #338]
Other	Mechanical model studies	[Blenkharn, 1990 #23] [Bowly, 1992 #2] [Cydulka, 1991 #50] [Hess, 1989 #4] [Hess, 1992] [Lightsey, 1992 #217] [Rossi, 1993 #5] [Simmons, 1995 #12] [Terndrup, 1989 #108]
Other	Rational conjecture and common practices before evidence-based guidelines were required	[Anonymous, 1990 #325] [Baskett, 1993 #245] [Bierens, 1996 #148] [Cohen, 1985 #241] [Hodgin, 1992 #323] [Nickalls, 1986 #242]
Other	Case report	[Heilman, 1965 #18] [Hendricks, 1980 #13]
Other	Guidelines BEBM	[Anonymous, 1987 #243] [Anonymous, 1989 #337]

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Step 2B: Critically assess each article/source in terms of research design and methods.

Was the study well executed? Suggested criteria appear in the table below. Assess design and methods and provide an overall rating. Ratings apply within each Level; a Level I study can be good or poor as a clinical trial, just as a Level II study could be good or poor. Where applicable, please append a code (A to E, as shown below) to categorize the primary endpoint of each study.

Component of Study and Rating	Good	Fair	Poor
Methodology	The methodological quality of the study is high with the likelihood of any significant bias being minimal	The methodological quality of the study is reasonable with the potential for significant bias being likely.	The methodological quality of the study is weak possessing considerable and significant biases.
Articles (use citation marker and code for outcome applicable: e.g. Elam 1998 D)	[Jelinek, 2001 #78] J [Villanueva, 1999 #338] G(Evb)	[Anonymous, 1987 #243] H [Anonymous, 1989 #337] H [Anonymous, 1990 #325] O [Baskett, 1993 #245] G(Narr) [Bierens, 1996 #148] G(Narr) [Blenkharn, 1990 #23] L [Bowlby, 1992 #2] L [Brenner, 2000 #47] J [Cydulka, 1991 #50] L [Hess, 1992 #149] L [Hess, 1993 #181] L [Hew, 1997 #72] J [Lightsey, 1992 #217] L [Lufkin, 1993 #3] F [Mejicano, 1998 #10] G(Evb) [Rossi, 1993 #5] L [Simmons, 1995 #12] L [Terndrup, 1989 #108] L	[Cohen, 1985 #241] F [Heilman, 1965 #18] F [Hendricks, 1980 #13] K [Nickalls, 1986 #242] K [Hodgin, 1992 #323] I

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STEP 3. DETERMINE THE CLASS OF RECOMMENDATION.**Select from these summary definitions.**

CLASS	DEFINITION
Class A <i>Recommended</i>	Class A treatment recommendations are given to those guidelines which are considered to be beneficial and should be used
Class B: <i>Acceptable</i>	Class B treatment recommendations are given to those guidelines which may be beneficial and are acceptable to be used if considered appropriate in that setting

State a **Class of Recommendation** for the Guideline Proposal.State either **a) the intervention**, and then the conditions under which the intervention is either Class A or Class B; or **b) the condition**, and then whether the intervention is Class A or Class B**Guideline or intervention (Class of recommendation):**

The use of ancillary devices for expired air resuscitation is recommended but instruction should emphasise that

- Contracting an infectious disease by EAR is an extremely rare event.
- EAR is a life saving manoeuvre.
- Standard Precautions should be observed.
- Ancillary devices are not compulsory.
- Resuscitation should not be delayed if such a device is unavailable.

(Class A: Recommended)

REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK: Summarize your final evidence integration and the rationale for the class of recommendation. Consider the frequency of adverse events and the possibility of harm? Describe any value or utility judgments you may have made, separate from the evidence. For example, you believe evidence-supported interventions should be limited to in-hospital use because you think proper use is too difficult for pre-hospital providers. Please include relevant key figures or tables to support your assessment

The foundation for this worksheet was one prepared by Anthony Nesbit from the Queensland Branch of the ARC.

Ancillary devices in EAR are unarguably (?) useful in removing the distaste of intimate contact with the patient's vomitus etc.

The topic hinges never the less on the general perception that it is easy to get infected with something by performing CPR and the reality that infection as a result of CPR is a rarity. Bierens [Bierens, 1996 #148] provides a rational approach to justify the statement that the risks of transmission of HIV is low ie "about one per million resuscitations in the highest risk group'. In the general community, the risk is calculably significant lower than that, and this needs to be emphasised. While HIV is the prime concern, it has been noted that in reality the risk of hepatitis is of greater import. Education on both issues is needed in all areas of society.

There has been a certain naivite among some authors with an assumption that the use of such devices automatically prevents disease transmission. This has not been demonstrated.

The topic, like many basic techniques, has not been subjected to detailed rigorous scientific assessment. It may well never be adequately addressed, with much of the data being of low level status. While the data are of low level status as far as evidence is concerned and generally only fair in scientific quality, the recommendation is a Class A one with the caveat being of equal importance to the key proposal.

Please submit completed document with the following attachments:

- Printed (paper) bibliography; and electronic version using a reference manager (eg. Endnote) if available. It is recommended that the bibliography be printed in annotated format. This will include the article abstract and any notes you would like to make providing specific comments on the quality, methodology and/or conclusions of the study, and/or reasons for exclusion.
- Key figures or tables from evidence-based analysis
- Full hard copies of the critical cited papers

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■ **Citation List**

Citation Marker	Full Citation
[Anonymous, 1987 #243]	<p>Anonymous. Recommendations for prevention of HIV transmission in health-care settings. MMWR - Morbidity & Mortality Weekly Report 1987;36 Suppl 2:1S-18S.</p> <p>H</p> <p><i>This document is the base for Universal Precautions. It states “Although saliva has not been implicated in HIV transmission, to minimize the need for emergency mouth-to-mouth resuscitation, mouth pieces, resuscitation bags, or other ventilation devices should be available for use in area in which the need for resuscitation is predictable.”</i></p> <p>Level of Evidence: Other - GBEBM</p> <p>Quality of Evidence: Fair</p>
[Anonymous, 1989 #337]	<p>Anonymous. Risk of infection during CPR training and rescue: supplemental guidelines. The Emergency Cardiac Care Committee of the American Heart Association. JAMA 1989;262(19):2714-5.</p> <p>H</p> <p>Abstract: The American Heart Association and the American Red Cross used the findings from the 1985 National Conference on Standards and Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiac Care to establish their policy on the risk of infection during cardiopulmonary resuscitation (CPR) training and rescue. Findings that support the safety of CPR training and rescue and appropriate risk reduction strategies are presented as an update to the 1985 article. The Emergency Cardiac Care Committee of the American Heart Association incorporated recent advisories from the Centres for Disease Control as well as other information into guidelines that augment earlier recommendations.</p> <p><i>Provides guidelines for</i></p> <ul style="list-style-type: none"> • <i>Rescuers with known or suspected infections</i> • <i>Rescuers with a duty to provide CPR</i> • <i>The layperson</i> • <i>CPR training for infected individuals</i> • <i>Individuals unable to complete a CPR course</i> <p>Level of Evidence: Other - GBEBM</p> <p>Quality of Evidence: Fair</p>
[Anonymous, 1990 #325]	<p>Anonymous. Disease transmission and cardiopulmonary resuscitation. Emergency Cardiac Care Committee, Heart and Stroke Foundation of Canada. CMAJ Canadian Medical Association Journal 1990;143(10):1007-8.</p> <p>O</p> <p><i>Refers to evidence for lack of transmissibility of HIV/AIDS and Hep B by saliva but notes spread of viral respiratory infections by M-M CPR. It accepts that “the value of CPR outweighs the small, theoretical risk of disease transmission.” It advocates ready access to mechanical ventilation or barrier devices accepting that their efficacy has not been demonstrated conclusively (in 1990).</i></p> <p><i>Concludes that “ the value of CPR outweighs the small, theoretical risk of disease transmission”.</i></p> <p>Level of Evidence: Other - Rational conjecture and common practices before evidence-based guidelines were required</p> <p>Quality of Evidence: Fair</p>

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[Baskett, 1993 #245]	<p>Baskett PJF. Ethics in cardiopulmonary resuscitation. <i>Resuscitation</i> 1993;25(1):1-8.</p> <p>G(Narr)</p> <p>Abstract: There is a minority of patients in whom resuscitation is inappropriate. It is important to identify such patients beforehand and communicate the decision not to attempt resuscitation to the would-be first responders. In the absence of the patient's expressed wishes, any decision not to attempt resuscitation must be made by the senior doctor in charge. This doctor will take into account a number of factors and, when appropriate, consult with medical and nursing colleagues relatives, etc. before making such a decision. There are many factors influencing the decision to terminate resuscitation once it has been started. These are listed and discussed. Legal aspects are addressed and indications are made of the expected performance of lay and professional rescuers working under a variety of circumstances. The various definitions of death are described in the light of modern medical practice and the possibility of organ transplantation. There is an increasing fear of infection hazards to the rescuer during mouth to mouth ventilation. The risks are discussed and the use of protective devices is encouraged if they are immediately available. Finally, guidelines for hospital ethical CPR policy are outlined in the hope that they will be considered for adoption on a national and international scale.</p> <p><i>The discussion on risks of disease transmission refers to the known reported incidents and the lack of transmission of HBV and HIV/AIDS and the need for good cleaning techniques and practice in training sessions.</i></p> <p>Level of Evidence: Other - Rational conjecture and common practices before evidence-based guidelines were required</p> <p>Quality of Evidence: Fair</p>
[Bierens, 1996 #148]	<p>Bierens JJ, Berden HJ. Basic-CPR and AIDS: are volunteer life-savers prepared for a storm? <i>Resuscitation</i> 1996;32(3):185-91.</p> <p>G(Narr)</p> <p>Abstract: Professional health care workers have access to guidelines, equipment and techniques to reduce the exposure to infectious material in case of resuscitation. The current official content of national courses for volunteer life-savers do not address this issue, as far as we know. Concern about the risks of infection due to resuscitation is increasing in this group. This article describes a rational approach of the problem, that includes data on the infection risk of basic-CPR, and an approach that accepts that the concern can not be controlled by objective data. In such an emotional approach, direct contact has to be minimised by using devices. Requirements for resuscitation devices with a barrier function are listed. Although both approaches will reduce the fear of infection, we advice a rational approach.</p> <p><i>Provides a rational approach to justify the statement that the risks of transmission of HIV is low ie "about one per million resuscitations in the highest risk group".</i></p> <p>Level of Evidence: Other - Rational conjecture and common practices before evidence-based guidelines were required</p> <p>Quality of Evidence: Fair</p>
[Blenkharn, 1990 #23]	<p>Blenkharn, J. I., S. E. Buckingham, et al. (1990). "Prevention of transmission of infection during mouth-to-mouth resuscitation.[see comment]." <i>Resuscitation</i> 19(2): 151-7.</p> <p>L</p> <p>Abstract: The risk of infection transmitted during mouth-to-mouth or mouth-to-nose resuscitation procedures is difficult to define but is possibly quite low. However, the perceived risk is sufficient to cause serious concern for many individuals, including trained hospital personnel as well as the general public, and may preclude prompt and effective action. A novel airway device was evaluated for the retention of infective droplets and fluid permeability under simulated resuscitation conditions using a cardiopulmonary resuscitation training manikin. Retention of a 0.5-5.0 micron aerosol of <i>Staphylococcus aureus</i> cells was greater than 80% at flow rates of 6 l/min while under simulated resuscitation conditions the trapping of bacteria, originating predominantly from saliva, was over 90%. These data suggest that this device may afford significant protection against transmission of infection during exhaled air resuscitation manoeuvres.</p> <p><i>An early assessment of the Resusci Face Shield (Laerdal Medical Limited).</i></p> <p>Level of Evidence: Other - Mechanical model studies</p> <p>Quality of Evidence: Fair</p>

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[Bowlby, 1992 #2]	<p>Bowlby KM. Mouth-to-mask resuscitation in the hospital: perceived problems of staff and variations in technique. <i>Journal of Nursing Staff Development</i> 1992;8(5):224-30.</p> <p>?</p> <p>Abstract: Mouth-to-mask resuscitation is used by many hospitals to implement "Universal Infection Precautions" and is now mandatory for health care Basic Cardiac Life Support (BCLS) courses nationwide. In the past, mouth-to-mask resuscitation was not routinely performed in hospital settings, and was optional in health care BCLS courses. This study suggests needed changes in mouth-to-mask resuscitation training and use. These findings can be used by nurse educators who are frequently responsible for implementing and evaluating BCLS programs.</p> <p><i>The author found that masks requiring assembly problematic or a deterrent to use due to difficulty assembling and-or coming apart during use. Problems maintaining a seal were also described.(Qld ARC)</i></p> <p>Level of Evidence: Other - Mechanical model studies</p> <p>Quality of Evidence: Fair</p>
[Brenner, 2000 #47]	<p>Brenner BE, Van DC, Lazar EJ, Camargo Jr. CA. Determinants of physician reluctance to perform mouth-to-mouth resuscitation. <i>Journal of Clinical Epidemiology</i> 2000;53(10):1054-61.</p> <p>J</p> <p>Abstract: Objectives: Mouth-to-mouth resuscitation (MMR) is widely taught and promoted. The purpose of this study was to better characterize the observation that health professionals are reluctant to perform MMR and to identify determinants of this reluctance. Methods: 324 residents and faculty at a New York City teaching hospital were anonymously surveyed regarding their reluctance to perform MMR. One year later, medical staff were resurveyed. Results: Reluctance varied across scenarios: 70-80% of physicians were willing to perform MMR on a newborn or child, 40-50% for an unknown man, and 20-30% for a trauma victim or potentially gay man. Physicians reported very similar percentages for each scenario in the two surveys. Factors associated with MMR reluctance were female gender (OR = 2), resident physician (OR = 2), and higher perceived risk of contracting HIV from MMR (OR = 1.4 per unit on 5-point scale). In the year before the survey, 30% of all respondents witnessed an apneic patient who required MMR for whom ventilation was not provided for at least 2 minutes. Conclusions: Many physicians are reluctant to perform MMR. Marked delays in ventilation of apneic patients are occurring. (C) 2000 Elsevier Science Inc.</p> <p>Level of Evidence: IV</p> <p>Quality of Evidence: Fair</p>
[Cohen, 1985 #241]	<p>Cohen HJ, Minkin W. Transmission of infection during training for cardiopulmonary resuscitation. <i>Annals of Internal Medicine</i> 1985;102(1):136-7.</p> <p>K</p> <p><i>The correspondents highlight the NRC 1984 Guidelines, express concern about transmission of viral diseases during training and the potential inadequacies of disinfection procedures, and advocate the use of an overlay mask.</i></p> <p>Level of Evidence: Other - Rational conjecture and common practices before evidence-based guidelines were required</p> <p>Quality of Evidence: Poor</p>
[Cydulka, 1991 #50]	<p>Cydulka RK, Connor PJ, Myers TF, Pavza G, Parker M. Prevention of oral bacterial flora transmission by using mouth-to-mask ventilation during CPR. <i>J Emerg Med</i> 1991;9(5):317-21.</p> <p>L</p> <p>Abstract: The Emergency Cardiac Care Committee of the American Heart Association has recently recommended utilizing protective barrier precautions during CPR (1,2). We assessed 17 mask and face-shield resuscitation devices for adequacy of barrier protection. Eight of the devices were face-shields (CPR Microshield, Hygenic, MedCare Mask, Resusci, Samaritan, Sealeasy, Portex); 8 were mask devices (Laerdal, Dyna Med, MTM Emergency Lung Ventilator, MTM Emergency Resuscitator, Res-Q-Flo, Rightway Mouth-</p>

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	<p>to-Mask Resuscitation, Trufit), and one of the devices did not meet the criteria for either face-shield or mask (Lifesaver). All masks were disinfected, applied to the investigator's face as directed by the manufacturers' instructions, and then cultured for oral aerobic bacterial flora on the rescuer side. No mask devices cultured positive for oral aerobic bacterial flora, while 6 of 8 face-shield devices cultured positive for oral aerobic bacterial flora (P less than 0.007). The CPR Microshield and the Portex face-shield were the only devices that did not develop a positive culture. We conclude that all ventilation devices with a one-way valve, except the Sealeasy device, provide adequate barrier type protection from oral aerobic bacterial flora when simulating mouth-to-barrier type protection when performing mouth-to-mouth ventilation.</p> <p><i>A technical assessment of ancillary equipment with one adverse finding being challenged by [Blenkharn, 1992 #137]</i></p> <p>Level of Evidence: Other – Mechanical model studies</p> <p>Quality of Evidence: Fair</p>
[Heilman, 1965 #18]	<p>Heilman KM, Muschenheim C. Primary cutaneous tuberculosis resulting from mouth-to-mouth respiration. <i>New England Journal of Medicine</i> 1965;273(19):1035-6.</p> <p>F</p> <p><i>Early advocate for ancillary devices in CPR to avoid the need for mouth –to-mouth resuscitation.</i></p> <p>Level of Evidence: Other – Case report</p> <p>Quality of Evidence: Poor</p>
[Hendricks, 1980 #13]	<p>Hendricks AA, Shapiro EP. Primary herpes simplex infection following mouth-to-mouth resuscitation. <i>JAMA</i> 1980;243(3):257-8.</p> <p>F</p> <p><i>Case report of disease transmission with reference to [Heilman, 1965 #129]. Advocates awareness of problem with use of protective devices and consideration of post resuscitation testing for syphilis, hepatitis and tuberculosis.</i></p> <p>Level of Evidence: Other – Case report</p> <p>Quality of Evidence: Poor</p>
[Hess, 1989 #4]	<p>Hess D, Ness C, Oppel A, Rhoads K. Evaluation of mouth-to-mask ventilation devices. <i>Respiratory Care</i> 1989;34(3):191-5.</p> <p>L</p> <p>A number of mouth-to-mask ventilation devices have become commercially available in the past several years. In this study, we compared the volumes delivered by eight of these devices to the volumes delivered by mouth-to-mouth ventilation. METHOD: Fourteen respiratory care practitioners participated in the study. Ventilation was delivered to an adult resuscitation manikin. Each subject ventilated the manikin using mouth-to-mouth technique and each of the following mouth-to-mask devices: Boehringer EVA, Hospitak, Hudson, Intertech Safe Response, Laerdal Pocket Mask, Life Design Systems (LDS), Respirationics SealEasy, and Vital Signs. Evaluation periods of 1 minute were used, minute ventilation and respiratory rate were measured, and tidal volume was calculated. RESULTS: There was a significant difference between the volumes delivered by the masks (p less than 0.001). The volumes delivered by each mask were less than mouth-to-mouth volumes (p less than 0.05 in each case). The mean +/- SD mouth-to-mouth volume was 1.04 +/- 0.32 L. The mean +/- SD volumes for each of the devices was 0.54 +/- 0.34 L for the EVA, 0.77 +/- 0.21 L for the Hospitak, 0.51 +/- 0.26 L for the Hudson, 0.81 +/- 0.35 L for the Safe Response, 0.65 +/- 0.25 L for the Pocket Mask, 0.82 +/- 0.27 L for the LDS, 0.79 +/- 0.32 L for the SealEasy, and 0.76 +/- 0.21 L for the Vital Signs. CONCLUSIONS: We found considerable variability between the volumes delivered with commercially available mouth-to-mask ventilation devices. Although the volumes delivered during mouth-to-mask technique were less than those delivered with mouth-to-mouth technique, the volumes delivered by some of the mouth-to-mask devices were large enough to allow them to be substituted for mouth-to-mouth technique.</p> <p>Level of Evidence: Other – Mechanical model studies</p> <p>Quality of Evidence: Fair</p>

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[Hess, 1992 #149]	<p>Hess D, Simmons M. An evaluation of the resistance to flow through the patient valves of twelve adult manual resuscitators. <i>Respiratory Care</i> 1992;37(5):432-8.</p> <p>L</p> <p>What is the inspiratory and expiratory resistance to flow through the patient valves of adult manual resuscitators? MATERIALS & METHODS: We evaluated the resistance to flow through the patient valves of 12 adult resuscitators (Ambu, Code Blue, DMR, Hope 4, Hospitak, Hudson, Intertech, Laerdal, Mercury, Respirationics, SPUR, Vitalograph). Expiratory resistance was evaluated by directing a flow of oxygen through the valve in the direction that the patient expires. Inspiratory resistance was evaluated by directing oxygen through the valve in the direction of flow when the bag is squeezed. Flow was controlled by a Timeter 0-75 flowmeter, and measured using a calibrated Timeter RT-200. Flows of 10, 20, 30, 40, 50, 60, 70, 80, and 90 L/min were used. Resistive back pressure of the resuscitator valves was measured using a calibrated Timeter RT-200. Resistance was calculated by dividing back pressure by flow. Five measurements were made at each flow setting for each resuscitator. RESULTS: Significant differences in back pressures and resistances existed between the resuscitators for both expiratory and inspiratory flows (p less than 0.001 in each case). Significant interaction effects also existed between resuscitator brands and flows (p less than 0.001 in each case). At an expiratory flow of 50 L/min, all resuscitators except the Hospitak and Vitalograph produced a back pressure less than 5 cm H₂O (the International Standards Organization standard). At an inspiratory flow of 50 L/min, all resuscitators but the Hospitak, Mercury, and Vitalograph produced a back pressure less than 5 cm H₂O. CONCLUSIONS: Significant differences existed in the back pressures produced due to the flow resistance through the patient valves of these resuscitators, and these might be considered excessive in some cases. Because this was a bench study, further work is needed to determine the clinical importance of these findings.</p> <p>Level of Evidence: Other – Mechanical model studies</p> <p>Quality of Evidence: Fair</p>
[Hew, 1997 #72]	<p>Hew P, Brenner B, Kaufman J. Reluctance of paramedics and emergency medical technicians to perform mouth-to-mouth resuscitation. <i>J Emerg Med</i> 1997;15(3):279-84.</p> <p>J</p> <p>Abstract: Recently, a reluctance of lay and medical personnel to perform mouth-to-mouth resuscitation (MMR) in hospital and community settings has been documented, with 45% of respondents declining to perform MMR on a stranger. In the present study, we examined whether the perceived risk and fear of contracting infectious diseases diminishes the willingness of paramedics and emergency medical technicians (EMTs) to perform MMR. Seventy-seven EMTs and 27 paramedics responded to a questionnaire, administered by one of two physicians, containing mock cardiac arrest scenarios that were designed to assess willingness to perform MMR as a citizen responder. Faced with a situation in which an adult stranger required MMR, 57% of the participating EMTs and all of the paramedics stated that they would refuse to perform MMR. None of the paramedics and only 32.5% of the EMTs stated that they would perform MMR on a man in a gay neighbourhood. In addition, 23% of the EMTs and 37% of the paramedics indicated that they would refuse to perform MMR on a child. White respondents were more willing than non-white respondents to perform MMR. Twenty-nine percent of the pre-hospital-care providers had been in situations requiring MMR in the community, and 40% either had walked away or did only external compression. Of those participating paramedics and EMTs who had performed MMR in emergency situations, only 45% indicated that they would do so again. The respondents indicated that they would not be willing to administer MMR because of the fear of contracting infectious agents, especially the human immunodeficiency virus. Despite the proven effectiveness of MMR in saving lives, paramedics and EMTs are highly reluctant to perform MMR as citizen responders. Their perceived risks of contracting infectious agents during MMR are high, despite the low actual risks. We recommend that instruction in cardiopulmonary resuscitation for providers of pre-hospital care, the medical community, and the general public should emphasize the benefits of providing MMR, the actual low risks of contracting infectious diseases during administration of MMR, and the use of widely available and effective barrier masks to minimize any risks due to administration of MMR.</p> <p>Level of Evidence: IV</p> <p>Quality of Evidence: Fair</p>

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[Hodgin, 1992 #323]	<p>Hodgin L. New law in the Big Apple mandates CPR infection-control equipment. Occupational Health & Safety 1992;61(3):56.</p> <p>I</p> <p><i>On the premise that trained personnel are reluctant to perform CPR because of fear of disease transmission, a city law was passed in January 2002 requiring all specified public places to have infection-control resuscitation equipment available</i></p> <p>Level of Evidence: Other - Rational conjecture and common practices before evidence-based guidelines were required</p> <p>Quality of Evidence: Poor</p>
[Jelinek, 2001 #78]	<p>Jelinek GA, Gennat H, Celenza T, O'Brien D, Jacobs I, Lynch D. Community attitudes towards performing cardiopulmonary resuscitation in Western Australia. Resuscitation 2001;51(3):239-46.</p> <p>J</p> <p>Objective: to determine the attitudes of the Western Australian community towards performing cardiopulmonary resuscitation, and the factors affecting these attitudes. Methods: telephone survey of a randomly selected sample of people from suburban Perth and rural Western Australia; practical assessment of a sub-sample of volunteers from those surveyed, to correlate survey answers with practical skills. Results: of 803 people surveyed, the majority (90.7%) definitely would give mouth-to-mouth ventilation to a friend or relative, but less than half (47.2%) would to a stranger. The reluctance was mostly (56%) because of health and safety concerns, particularly related to HIV infection. Higher percentages of people would definitely provide cardiac massage for a friend or relative (91.4%) or stranger (78.1%). People were more likely to give mouth-to-mouth and cardiac massage if they had been trained in cardiopulmonary resuscitation (CPR), trained several times, trained recently, and used their CPR skills in real life. There were no significant differences between city and country people in whether they would provide CPR, but older people were less willing to provide mouth-to-mouth or cardiac massage. On practical assessment of 100 volunteers, there were significant errors and omissions in airway assessment, mouth-to-mouth resuscitation and cardiac massage. Volunteers with better practical scores were more prepared to provide CPR. Discussion: our results indicate a significant reluctance of the Western Australia public to perform mouth-to-mouth, except to a friend or relative. Earlier CPR training, practice and use seemed to diminish this reluctance. Practical CPR skills were not well executed. Those with better skills were less reluctant to use them. We recommend increasing CPR training in the community, greater frequency of refresher courses and public education on the risks of CPR to improve rates of bystander CPR.</p> <p>Level of Evidence: IV</p> <p>Quality of Evidence: Good</p>
[Lightsey, 1992 #217]	<p>Lightsey DM, Shah PK, Forrester JS, Michael TA. A human immunodeficiency virus-resistant airway for cardiopulmonary resuscitation.[see comment]. American Journal of Emergency Medicine 1992;10(1):73-7.</p> <p>L</p> <p>Due to fear of transmitted disease, mouth-to-mouth cardiopulmonary resuscitation (CPR) is now rare, even though early CPR is associated with a fivefold to 30-fold increase in survival. The authors have devised a one-piece silicone mask (Kiss of Life [KOL], Brunswick Biomedical Technologies, Inc, Wareham, MA) with a one-way valve and circular recess to form a no-contact lip seal, enabling mouth-to-mouth CPR to be given. The ventilatory volume during mannequin CPR using the KOL mask was 0.75 +/- 0.235 L. This volume was significantly (P less than .05) greater than that generated by alternate widely used airways (range, 0.195 +/- 0.147 to 0.617 +/- 0.208 L). To assess mask performance in vivo, the authors measured exhaled volumes in 10 apneic anesthetized patients under three conditions: with the KOL mask, a standard anaesthetic mask and bag, and an anaesthetic mask with an endotracheal tube. The results were: anaesthetic mask and tube, 1.5 L (range, 1.2 to 1.7 L); KOL mask, 1.1 L (range, 1.0 to 1.3 L); anaesthetic mask alone, 0.7 L (range, 0.5 to 0.8 L). To test permeability, we exposed two KOL masks to a high titre of human immunodeficiency virus (HIV)-1 soup (10(6) culture infection doses/mL) for 10 and eight masks for 60 minutes, respectively, and cultured swabs of the interior of the valve for 1 month. There was no growth in any culture. These data suggest that the KOL mask has excellent ventilating characteristics, is practical (pocket-portable, disposable), experimentally impermeable to HIV-1, and inexpensive.(ABSTRACT TRUNCATED AT 250 WORDS)</p> <p>Level of Evidence: Other – Mechanical model studies</p> <p>Quality of Evidence: Fair</p>

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<p>[Lufkin, 1993 #3]</p>	<p>Lufkin KC, Ruiz E. Mouth-to-mouth ventilation of cardiac arrested humans using a barrier mask. Pre-hospital & Disaster Medicine 1993;8(4):333-5.</p> <p>F</p> <p>Abstract: INTRODUCTION: Concern for possible disease transmission during mouth-to-mouth resuscitation has decreased the incidence of bystander cardiopulmonary resuscitation (CPR). Barrier masks have become available that may be effective in CPR as well as protective against cross-contamination. HYPOTHESIS: A silicone rubber barrier mask incorporating a one-way-valved airway (Kiss of Life [KOL]) designed to prevent contamination of the rescuer, permits satisfactory mouth-to-mouth ventilation of victims of cardiopulmonary arrest. METHODS: Ten adult patients who did not survive non-traumatic cardiac arrest were ventilated with exhaled room air using a KOL barrier mask while external cardiac massage continued. Arterial blood gases were obtained every two minutes for a maximum of 10 minutes. The operator was blinded to the results of these blood tests. RESULTS: Eight men and two women with ages from 55 to 99 years were studied. Four patients were edentulous and two of these had marked mandibular atrophy. The two patients with mandibular atrophy were poorly ventilated with the barrier mask. One other patient was not ventilated successfully. This patient had undergone multiple attempts at endotracheal intubation and had trans-tracheal needle ventilation performed prior to use of the barrier mask. One patient had elevated PaCO₂ despite being well-ventilated clinically. Six patients were ventilated well clinically and had satisfactory PaCO₂ and PaO₂ values. CONCLUSION: The barrier mask studied appears to be an effective aid to ventilation in CPR. Patients without facial support, as in edentulous patients with mandibular atrophy, are not ventilated well with this device.</p> <p>Level of Evidence: IV Quality of Evidence: Fair</p>
<p>[Mejicano, 1998 #10]</p>	<p>Mejicano GC, Maki DG. Infections acquired during cardiopulmonary resuscitation: estimating the risk and defining strategies for prevention. Annals of Internal Medicine 1998;129(10):813-28.</p> <p>G(Evb)</p> <p>Abstract: PURPOSE: To estimate the risk for acquiring an infectious disease during cardiopulmonary resuscitation (CPR) or CPR training and to identify strategies to minimize that risk. DATA SOURCES: English-language articles published since 1965 were identified through a search of the MEDLINE database and selected bibliographies. STUDY SELECTION: Studies that contained information about transmission of infectious organisms, particularly HIV and other blood-borne viruses that might be transmitted through mouth-to-mouth ventilation, contact exposures, and needle-sticks during CPR. DATA EXTRACTION: Descriptive and analytic data from each study. DATA SYNTHESIS: Fear of acquiring infection, especially HIV infection, can delay prompt initiation of mouth-to-mouth ventilation. Although pathogens can be isolated from the saliva of infected persons, salivary transmission of blood-borne viruses is unusual and transmission of infection has been rare: Only 15 documented cases have been reported. Most of these cases involved a bacterial pathogen, such as Neisseria meningitidis. Transmission of hepatitis B virus, hepatitis C virus, or cytomegalovirus during CPR has not been reported; all three reported cases of HIV infection acquired during resuscitation of an infected patient resulted from high-risk cutaneous exposures. There have been no reports of infection acquired during CPR training. Simple infection-control measures, including use of barrier devices, can reduce the risk for acquisition of an infectious disease during CPR and CPR training. Postexposure protocols can further protect potential rescuers and trainees. CONCLUSIONS: The benefit of initiating lifesaving resuscitation in a patient in cardiopulmonary arrest greatly outweighs the risk for secondary infection in the rescuer or the patient. Nevertheless, use of simple infection-control measures during CPR and CPR training can reduce a very low level of risk even further. (My emboldening - FHB)</p> <p>Level of Evidence: Other – Evidence based review Quality of Evidence: Fair</p>
<p>[Nickalls, 1986 #242]</p>	<p>Nickalls RW, Thomson CW. Mouth to mask respiration. British Medical Journal Clinical Research Ed. 1986;292(6532):1350.</p> <p>K</p> <p>Strongly supports use of ancillary airway devices.</p> <p>Level of Evidence: Other - Rational conjecture and common practices before evidence-based guidelines were required Quality of Evidence: Poor</p>

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<p>[Rossi, 1993 #5]</p>	<p>Rossi, R., K. H. Lindner, et al. (1993). "Devices for expired air resuscitation." <u>Prehospital & Disaster Medicine</u> 8(2): 123-6.</p> <p>L</p> <p>Abstract: Objectives: Expired air resuscitation is an essential part of first-aid and cannot be replaced by other measures. Because of the risk of transmitting infectious diseases, the use of devices is recommended. Three types are available--masks, tubes, and foils. Participants: Six masks (Air-Vita Bi-Protect, Laerdal Pocketmask, Drager Hivita Mask E, Rescue-Med Device, Resuscitator, SealEasy Resuscitation Kit), five tube instruments (Dr. Brook Airway, Dual-Aid, Goettinger Tubus, Lifeway, Sussex Valve Airway), and two foils (Ambu Life-Key, Laerdal ResusciFace Shield) were studied. Measurements: Inspiratory and expiratory resistance, valve leakage, ability to protect against infection transmission, and practicability (e.g., possibility of training on standard mannequins, seal) were measured and tested in the laboratory. Results: Only a few of the mask and tube devices had low inspiratory and expiratory resistances. Some of the one-way valves failed. There were definite risks of provoking complications (vomiting, lacerations) when using tube instruments. Conclusions: Devices consisting of a foil have definite advantages, and seem to be more appropriate for the use by first-aiders [first responders].</p> <p><i>Supportive of ancillary devices in airway management during CPR but mentions hazards of tubes.</i></p> <p>Level of Evidence: Other - Mechanical model studies</p> <p>Quality of Evidence: Fair</p>
<p>[Simmons, 1995 #12]</p>	<p>Simmons, M., D. Deao, et al. (1995). "Bench evaluation: three face-shield CPR barrier devices." <u>Respiratory Care</u> 40(6): 618-23.</p> <p>L</p> <p>Abstract: Due to the fear of disease transmission, the practice of mouth-to-mouth (M-M) rescue breathing is rarely performed; to address this concern, many types of CPR barrier devices have been developed. These include bag-valve-mask devices, mouth-to-mask devices, and face shields (FS). The purpose of this study was to measure the volumes delivered during mouth-to-face shield (M-FS) breathing, to measure the back pressure and calculate the resistance to flow through their 1-way valves, and to test for backward leak of gas through the valves. METHODS: Three FS brands were evaluated: Kiss of Life (KOL), MicroSHIELD (Micro) and Res-Cue Key (RCK). Volume delivered during M-M and M-FS breathing was evaluated by 10 rescuers who used the devices while performing rescue breathing on a CPR mannequin. Back pressure was measured and resistance calculated by directing airflow through the 1-way valves. Backward leak was evaluated by measuring the O₂ concentration at the rescuer side of the valve while 100% O₂ was directed toward the patient side of the valve. Differences among the brands were evaluated using analysis of variance. RESULTS: The mean (SD) values for volumes in L were: M-M 1.00 (0.25), Micro 0.77 (0.20), RCK 0.64 (0.10), and KOL 0.24 (0.11). Mean values for back pressure in cm H₂O at 50 L/min were Micro 16.7 (1.29), KOL 7.22 (0.13), and RCK 2.15 (0.16). Significant backward leak only occurred with RCK. CONCLUSION: Not one of the FSs tested met all of the requirements suggested by the American Heart Association and by the International Standards Organization.</p> <p><i>Questions the efficacy of particular face-shields in CPR.</i></p> <p>Level of Evidence: Other - Mechanical model studies</p> <p>Quality of Evidence: Fair</p>
<p>[Terndrup, 1989 #108]</p>	<p>Terndrup TE, Kanter RK, Cherry RA. A comparison of infant ventilation methods performed by pre-hospital personnel. <u>Ann Emerg Med</u> 1989;18(6):607-11.</p> <p>L</p> <p>By comparing mouth-to-mouth ventilation to other methods, we tested whether there are significant differences among infant mannequin ventilation methods performed by emergency medical technicians-paramedics (EMT-Ps). Fifty-nine participants were evaluated in the performance of six ventilation methods; methods studied were mouth-to-mouth; two mouth-to-mask devices; and infant, paediatric, and adult bag-valve-mask devices. By measuring each breath, the percentage of acceptable ventilations in predetermined ranges, 5 to 25 mL/kg or 10 to 20 mL/kg, was calculated. Methods were compared using repeat measures ANOVA testing. Correlation between ventilation performance and the experience of personnel was expressed as the Pearson correlation coefficient. There were no significant differences in performance between methods, except for inadequate ventilation with the Laerdal Pocket Mask (P less than .05) from poor mask fit. The correlation between years of pre-hospital experience and the number of resuscitations versus ventilation performance was poor. Single rescuer, EMT-Ps can successfully ventilate an infant mannequin with various</p>

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	<p>size resuscitation bags. The Laerdal Pocket Mask is an ineffective device for infant mannequin ventilation and should not be recommended for infant resuscitation.</p> <p>Level of Evidence: Other - Mechanical model studies</p> <p>Quality of Evidence: Fair</p>
[Villanueva, 1999 #338]	<p>Villanueva E, Shaw S, Anderson J. Mouth to mouth ventilation: transmission of infection and the use of barruer devices: Centre for Clinical Effectiveness. Southern Health Care Network, Monash Institute of Public Health & Health Services Research; 1999 October 31, 1999.</p> <p>G(Evb)</p> <p><i>A rigidly enforced and confined systematic review seeking evidence of disease transmission following mouth to mouth resuscitation. It concludes that there is no current (October 1999) evidence to properly quantify the degree of risk of disease transmission associated with this manoeuvre. It highlights flaws in the systematic review by Mejicano [Mejicano, 1998 #10].</i></p> <p>Level of Evidence: Other – Evidence based review</p> <p>Quality of Evidence: Good</p>

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