### Clinical question.

BLS-051B - In adults and pediatric patients who are NOT in cardiac arrest (P), how often does provision of chest compressions from lay rescuers (I), lead to harm (eg rib fracture) (O)?

**Is this question addressing an intervention/therapy, prognosis or diagnosis?** Intervention/therapy

**State if this is a proposed new topic or revision of existing worksheet:** New

### 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)


2) bystander CPR[keyword] AND complications[keyword]


Last search: 01-22-2010

Databases search: PubMed, Google Scholar

### State inclusion and exclusion criteria

Only peer-reviewed articles were selected.

Articles were excluded for lack of relevance to the topic.

For the grid, only articles specifically addressing bystander CPR and complications were included. A summary justification for the rating of each is included below the article citation in italics. Additional articles providing supportive information were also included in the reference list but not in the grid.

### Number of articles/sources meeting criteria for further review: 42
## Summary of evidence

### Evidence Supporting Clinical Question

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**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

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A = Return of spontaneous circulation  
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**Italics** = Animal studies

### Evidence Opposing Clinical Question

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<td>Bedell, 1986, 1725 (E)</td>
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<td>Engelstein, 1984, 68 (E)</td>
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<td>Fosse, 1996, 502 (E)</td>
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<td>Offerman, 2001, 137 (E)</td>
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**Italics** = Animal studies
Early initiation of chest compressions by bystanders is associated with improved survival from cardiac arrest (Becker et al, 1991, 355; Cobb & Hallstrom, 1982, 330; Herlitz et al, 1995, 11; Hollenberg et al, 2008, 389; SOS-Kanto, 2008, 920). However, bystander CPR rates remain low. One of the factors presumed to be an important contributor to the unwillingness of bystanders to initiate compressions is the inability to determine with certainty the absence of perfusion. Substantial data exist to document inaccuracy with pulse check as the primary determinant of perfusion for both healthcare providers and laypersons (Bahr et al, 1997, 573; Dick et al, 2000, 183; Eberle et al, 1996, 107; Moule, 2000, 195; Ochoa et al, 1998, 173). Sensitivity in detecting a carotid pulse that is present approaches 90% within 10 seconds, although most of these data are derived using healthcare providers as subjects. The sensitivity at determining the absence of a pulse within 10 seconds is much lower, which may justify an alternative approach to the initial assessment of perfusion status. Agonal or absent respirations in an unresponsive patient with an open airway may be an appropriate surrogate for the absence of perfusion. However, it is unclear whether laypersons can appropriately differentiate agonal respirations from other causes of abnormal respirations in unresponsive patients (Bang et al, 2003, 25; Vaillancourt et al, 2007, 877; Perkins et al, 2005, 109). Thus, the term “abnormal breathing” was used for layperson training to avoid Type II errors (ie, falsely identifying agonal respirations as breathing and withholding compressions in a non-perfusing patient). Concerns have since been expressed about the initiation of compressions in patients who are unresponsive due to causes other than cardiopulmonary arrest with “abnormal breathing” that is not agonal. This could result in chest compressions applied to perfusing patients, with the potential for complications as a result.

Most reports of injury following performance of CPR, either by bystanders or professional rescuers, exist as case reports, making the overall risk of complications difficult to assess. Several autopsy-based studies of arrest victims with unsuccessful resuscitation document a high incidence of injuries related to performance of CPR (Bedell & Fulton, 1986; Bush et al, 1996, 40; Kloss et al, 1983, 199; Krischer et al, 1987, 287). However, these studies were all performed on arrest victims and could not differentiate between injuries related to bystander versus professional-rescuer CPR.

Three studies explored the question of bystander CPR-related injuries directly. White et al (LOE 4, 2010, 91) evaluated 247 non-arrest patients who received bystander CPR under direction from dispatch operators. A total of 12% of these patients reported discomfort related to the compressions, and 2% sustained injuries “likely” or “possibly” caused by bystander CPR. Most of these were chest wall fractures, and no patients suffered visceral organ injury. The authors concluded that serious injuries related to bystander CPR performed on non-arrest patients were extremely rare. Of note, 45% of patients for whom dispatcher CPR instructions were initiated were not in arrest. Hallstrom et al (LOE 4, 2000, 1546) performed a similar analysis on a smaller group (n=14) of non-arrest patients receiving bystander CPR and observed no serious complications in this group. Oschatz et al (LOE 5, 2001, 4) compared chest radiographs of arrest victims receiving bystander and EMS CPR versus those receiving EMS CPR alone. They observed no difference between the groups with regard to the incidence of severe gastric insufflation, suspicion of aspiration, soft tissue emphysema, or serial rib fractures. The authors concluded that bystander CPR does not increase the rate of complications in out-of-hospital cardiac arrest. A third study (Bedell et al, 1986, 1725) compared the rate of CPR-related complications among inpatient arrest victims resuscitated in the ICU versus the wards. This suggests that CPR-related complications may be related to rescuer experience. A single case report of cardiac tamponade (Reardon, 1987, 137) documents a CPR-related injury in a non-arrest patient.

At the present time, the potential benefit of increasing the frequency of bystander CPR appears to outweigh the risk of complications related to inappropriate initiation of chest compressions by laypersons. However, it is imperative that we document that this “simplified” approach to initial assessment of potential cardiopulmonary arrest victims is associated with an increased likelihood of bystander CPR to justify the small but measurable increase in the risk of chest compression-related traumatic complications. In addition, it is also important to define the rate of “false positives” (ie, bystander CPR initiated in non-arrest patients) to make a final determination regarding the current recommendation. Until then, the opinion of this reviewer is to maintain the current recommendations.

Acknowledgements: None
**Citation List**

**STUDIES INCLUDED IN DIRECTLY EVALUATING THE STUDY QUESTION:**


LOE 5, Fair, Neutral – This is a secondary analysis of a larger, observational study. The focus of this report is on the incidence of bystander CPR and resultant outcomes. However, the potential for complications related to bystander CPR is discussed.


LOE 5, Good, Neutral – This report focuses on inpatient arrest. However, it was included as a grid article because the incidence of complications was higher among ward patients versus ICU patients. This provides some opposing evidence that suggests inexperienced rescuers produce more complications.


LOE 5, Good, Supportive – This study documents a low incidence of CPR-related complications among pediatric arrest victims, including some receiving bystander CPR. They did not focus on the relative incidence of complications in those patients receiving bystander CPR.


LOE 5, Poor, Opposing – This is a case report related to the performance of mouth-to-mouth resuscitation.


LOE 5, Poor, Opposing – This is a case report of cardiac rupture in a patient receiving CPR, including that performed by bystanders.


LOE 4, Good, Supportive – This study focused on the potential for dispatch-assisted CPR to improve outcomes in an EMS system. The likelihood of CPR being applied to non-arrest patients was addressed, with no serious complications observed in this subgroup.


LOE 5, Good, Neutral – This is an autopsy-based case series documenting the incidence of injuries and occult pathology.
in a population of arrest victims, including some receiving bystander CPR.


LOE 5, Good, Neutral – This is an autopsy-based case series documenting the incidence of injuries and occult pathology in a population of arrest victims, including some receiving bystander CPR.


LOE 5, Good, Neutral – This is an autopsy-based case series documenting the incidence of injuries and occult pathology in a population of arrest victims, including some receiving bystander CPR.


LOE 5, Poor, Opposing – This is a case report of gastric perforation related to the performance of bystander CPR.


LOE 5, Good, Supportive – This is a cohort study comparing the incidence of injuries identified on chest radiograph among arrest victims with and without bystander CPR. No difference in the incidence of injuries was observed. Patients not in cardiopulmonary arrest were not included.


LOE 4, Poor, Opposing – This is a case report of cardiac tamponade following performance of bystander CPR on a child not in cardiac arrest.


LOE 4, Good, Supportive – This is a descriptive report of injuries to non-arrest patients receiving dispatcher-assisted bystander CPR. A low incidence of serious injuries was reported.

STUDIES INCLUDED IN DIRECTLY EVALUATING THE STUDY QUESTION:


cardiac arrest among patients found in ventricular fibrillation.” Resuscitation 29(1):11-21.


