

QUESTION

Should Automatic external defibrillators application vs. no application be used for pediatric cardiac arrest by lay rescuers?	
POPULATION:	pediatric cardiac arrest by lay rescuers
INTERVENTION:	Automatic external defibrillators application
COMPARISON:	no application
MAIN OUTCOMES:	CPC 1 or 2 at hospital discharge; CPC 1 or 2 hospital discharge < 1 year of age; CPC 1 or 2 at hospital discharge 1-12 years; CPC 1 or 2 at hospital discharge 13-18 years; Hospital discharge 0-18 years; Hospital discharge < 1 year; Hospital discharge 1-12 years; Hospital discharge 13-18 years; CPC 1-2 at one month 6-17 years; Association of Bystander CPR with Hospital discharge with AED use; Association of bystander CPR with AED with CPC 1-2 at hospital discharge;
SETTING:	out of hospital pediatric cardiac arrest
PERSPECTIVE:	
BACKGROUND:	
CONFLICT OF INTERESTS:	

ASSESSMENT

Problem		
Is the problem a priority?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know 	<p>Cardiac arrest survival rates are low in infants, children, and adolescents. Although shockable rhythms are less common in children compared to adults, survival (with good neurological outcome) could be improved with the application of an AED.</p>	
Desirable Effects		
How substantial are the desirable anticipated effects?		
JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <input type="radio"/> Trivial <input type="radio"/> Small <input type="radio"/> Moderate <input type="radio"/> Large <input checked="" type="radio"/> Varies <input type="radio"/> Don't know 	<p>Survival with favorable neurologic outcome is the optimal outcome of cardiac arrest. If AEDs improve outcomes, then the effect is considerable. A child will be able to resume all activities and continue to grow into adulthood. This effect increases with increasing age as the frequency of shockable rhythms increases with age. If a shockable rhythm is not present, then application of an AED may delay</p>	

	initiation of CPR or increase pause duration. Alternatively, since AEDs can provide CPR instructions, AED application can assist lay rescuers and improve CPR quality.	
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Undesirable Effects

How substantial are the undesirable anticipated effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <input type="radio"/> Large <input type="radio"/> Moderate <input type="radio"/> Small <input type="radio"/> Trivial <input checked="" type="radio"/> Varies <input type="radio"/> Don't know 	<p>Application of an AED may delay initiation of chest compressions or contribute to longer pauses in chest compressions and ventilations. This may potentially decrease survival in children with non-shockable rhythms.</p>	

Certainty of evidence

What is the overall certainty of the evidence of effects?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <input checked="" type="radio"/> Very low <input type="radio"/> Low <input type="radio"/> Moderate <input type="radio"/> High <input type="radio"/> No included studies 	<p>All published data are from two large registries. No controlled trials are available. Although both registries are quality-controlled, there is limited ability to assure completeness or accuracy of the data. The number of subjects on whom an AED was applied was very small in all age groups compared to the total number of subjects who had a cardiac arrest. There may be significant selection bias in those children who had the AED applied. The rescuers who applied the AED may be those with a greater skillset and provide higher quality CPR, than those with less experience</p>	

Values

Is there important uncertainty about or variability in how much people value the main outcomes?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <input type="radio"/> Important uncertainty or variability <input type="radio"/> Possibly important uncertainty or variability <input type="radio"/> Probably no important uncertainty or variability <input checked="" type="radio"/> No important uncertainty or variability 	<p>Society values survival especially with favorable neurologic outcome.</p>	

Balance of effects

Does the balance between desirable and undesirable effects favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> ○ Favors the comparison ○ Probably favors the comparison ○ Does not favor either the intervention or the comparison ● Probably favors the intervention ○ Favors the intervention ○ Varies ○ Don't know 	<p>The evidence probably favors the intervention in all age groups except those < 1 year. Although the RR for both age groups > 1 indicates a marked increase in survival, the number of patients included in the intervention group is very small compared to control. Additionally, for children in the 1-12 age group, ventilations remain an important aspect of successful resuscitation. Application of an AED may delay the initiation of CPR or increase the length of pauses. Data on long-term outcomes (>= 30 days after hospital discharge) is minimal. For infants < 1 year, the data are even more limited (12 patients, 1 survivor), so no recommendation could be made.</p> <p>For patients suffering a cardiac arrest of cardiac origin, the likelihood of an initial shockable rhythm is high and delivery of a shock is required for termination. The risk of a shockable rhythm increases with age even in this population.</p>	

Resources required

How large are the resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> ○ Large costs ○ Moderate costs ○ Negligible costs and savings ○ Moderate savings ○ Large savings ● Varies ○ Don't know 	<p>The placement of AEDs in locations with few children will increase the overall cost of Public Access Defibrillation programs. Use of pediatric pads will also increase costs. The data may support increased placement of AEDs in locations where young children congregate such as day care centers and all schools, not just high schools. However, risk of pediatric cardiac arrest is low in these locations so cost-effectiveness may be poor. Alternatively, improved survival leads to lower long-term medical costs and decreases premature loss of life.</p>	

Certainty of evidence of required resources

What is the certainty of the evidence of resource requirements (costs)?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS

<ul style="list-style-type: none"> <input type="radio"/> Very low <input type="radio"/> Low <input type="radio"/> Moderate <input type="radio"/> High <input checked="" type="radio"/> No included studies 	<p>There are no studies on the required resources or the cost. Pediatric pads are not required by current guidelines. Data on effectiveness and safety of pediatric vs adult pads in OHCA are not available.</p>	
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Cost effectiveness
Does the cost-effectiveness of the intervention favor the intervention or the comparison?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <input type="radio"/> Favors the comparison <input type="radio"/> Probably favors the comparison <input type="radio"/> Does not favor either the intervention or the comparison <input type="radio"/> Probably favors the intervention <input type="radio"/> Favors the intervention <input type="radio"/> Varies <input checked="" type="radio"/> No included studies 	<p>There are no published data on cost effectiveness in children. Cost effectiveness has been shown for adult programs. Successful neurologic outcomes promotes cost effectiveness. Placement of AEDs in locations with few children or where the risk of a cardiac arrest is low would lower cost-effectiveness.</p>	

Equity
What would be the impact on health equity?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<ul style="list-style-type: none"> <input type="radio"/> Reduced <input checked="" type="radio"/> Probably reduced <input type="radio"/> Probably no impact <input type="radio"/> Probably increased <input type="radio"/> Increased <input type="radio"/> Varies <input type="radio"/> Don't know 	<p>Equity may be reduced for locations of lower socioeconomic status sites which are not equipped with AEDs.</p>	

Acceptability
Is the intervention acceptable to key stakeholders?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
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<input type="radio"/> No <input type="radio"/> Probably no <input checked="" type="radio"/> Probably yes <input type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	AEDs have wide acceptability and there is increasing use in children. Favorable neurologic outcomes are highly desirable. Trained rescuers may hesitate to use an AED when likelihood of a shockable rhythm is considered to be low.	
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Feasibility

Is the intervention feasible to implement?

JUDGEMENT	RESEARCH EVIDENCE	ADDITIONAL CONSIDERATIONS
<input type="radio"/> No <input type="radio"/> Probably no <input type="radio"/> Probably yes <input checked="" type="radio"/> Yes <input type="radio"/> Varies <input type="radio"/> Don't know	AEDs are readily available in many locations. Use of an AED when available is highly feasible.	

SUMMARY OF JUDGEMENTS

	JUDGEMENT						
PROBLEM	No	Probably no	Probably yes	Yes		Varies	Don't know
DESIRABLE EFFECTS	Trivial	Small	Moderate	Large		Varies	Don't know
UNDESIRABLE EFFECTS	Large	Moderate	Small	Trivial		Varies	Don't know
CERTAINTY OF EVIDENCE	Very low	Low	Moderate	High			No included studies
VALUES	Important uncertainty or variability	Possibly important uncertainty or variability	Probably no important uncertainty or variability	No important uncertainty or variability			
BALANCE OF EFFECTS	Favors the comparison	Probably favors the comparison	Does not favor either the intervention or the comparison	Probably favors the intervention	Favors the intervention	Varies	Don't know
RESOURCES REQUIRED	Large costs	Moderate costs	Negligible costs and savings	Moderate savings	Large savings	Varies	Don't know
CERTAINTY OF EVIDENCE OF REQUIRED RESOURCES	Very low	Low	Moderate	High			No included studies
COST EFFECTIVENESS	Favors the comparison	Probably favors the comparison	Does not favor either the intervention or the comparison	Probably favors the intervention	Favors the intervention	Varies	No included studies
EQUITY	Reduced	Probably reduced	Probably no impact	Probably increased	Increased	Varies	Don't know

JUDGEMENT							
ACCEPTABILITY	No	Probably no	Probably yes	Yes		Varies	Don't know
FEASIBILITY	No	Probably no	Probably yes	Yes		Varies	Don't know

TYPE OF RECOMMENDATION

Strong recommendation against the intervention <input type="radio"/>	Conditional recommendation against the intervention <input type="radio"/>	Conditional recommendation for either the intervention or the comparison <input type="radio"/>	Conditional recommendation for the intervention <input checked="" type="radio"/>	Strong recommendation for the intervention <input type="radio"/>
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CONCLUSIONS

Recommendation

We suggest the use of an AED by lay rescuers for all children over age 1 year suffering a non-traumatic out-of-hospital cardiac arrest (*weak recommendation, very low certainty evidence*).

We can not make a recommendation for or against the use of an AED by lay rescuers for all children below age 1 year suffering a non-traumatic out-of-hospital cardiac arrest

Justification

Overall justification

The available data suggest a benefit of the use of an AED in OHCA of children. However, data are of very low certainty and there is a substantial imbalance between intervention and control groups suggesting possible selection bias. For children > 1 year suffering an out-of-hospital cardiac arrest, the effect is considered strong enough in favor of the intervention to recommend for use of an AED by lay rescuers. Considering the existing evidence in adults and the presumed higher incidence of shockable rhythms in primary cardiac arrest, the writing group made a best practice statement for cardiac arrest of presumed cardiac origin such as for sudden witnessed collapse.

For children younger than 1 year of age, the data preclude any conclusion. Not only does the confidence interval cross "0", the intervention group only included 12 infants with only 1 survivor. There is a risk of delaying CPR while applying an AED in a population in whom respiratory causes of cardiac arrest predominate. Infants who do have a shockable rhythm may benefit from application of an AED.

Detailed justification

Desirable Effects

Survival and survival with favorable neurologic outcome were improved in all age groups > 1 y ears.

Subgroup considerations

The children and adolescents who suffer a sudden witnessed a cardiac arrest, which may indicate a primary cardiac origin, are more likely to have an initial shockable rhythm and delivery of a shock is the only effective therapy. In this population, early defibrillation is highly desirable.

Implementation considerations

Placement of AEDs continues to increase, and in many locations, such as schools and youth sports venues, is required by law. In locations where an AED already exists, it is appropriate to apply the AED to a child in cardiac arrest.

Monitoring and evaluation

Research priorities

There are no randomized controlled trials of AED application in children, only observational trials.

There are limited data on the interaction between high-quality CPR with and without AED application. This is particularly important in light of the importance of rescue breaths with chest compressions in pediatric cardiac arrest.

There are limited data on whether AED application alters outcomes based on the type of CPR provided, i.e. chest compression only or standard CPR with compressions and rescue breathing.

Only short term/surrogate outcomes were evaluated, future studies should document survival/neurologically intact survival to beyond 30 days.

Is there a difference in survival following AED application in children with primary cardiac arrest compared to those in whom a primary cardiac etiology is not suspected.

If AEDs are placed where there are children age 1-12, does the use of the pediatric pads which attenuate the energy dose, increase survival and safety?

Does the AED aid lay rescuers in providing CPR?

There is no information about possible advantages of using the pediatric modifications for the younger children, especially those < 8 years or 25 kg. The application of an AED may be beneficial beyond shock delivery, such as directing the rescuer to the appropriate actions and performing AED. The mechanisms potential human factors and behavioral change are not understood.