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Epidemiology and Outcomes from Out-of-Hospital Cardiac Arrest in Children in Central Asia: The Resuscitation Outcomes Epistry–Cardiac Arrest

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ABSTRACT

Background: Pediatric out-of-hospital cardiac arrest (OHCA) is a rare but life-threatening condition associated with poor outcomes. Limited epidemiological data on pediatric OHCA are available in Central Asia. This study aims to evaluate the epidemiology, causes, resuscitation characteristics, and outcomes of pediatric OHCA in Central Asia using the Resuscitation Outcomes Epistry–Cardiac Arrest approach.

Methods: This observational study used a survey-based method among healthcare professionals and emergency medical service personnel involved in paediatric resuscitation in Central Asia. Data were collected using a structured questionnaire that included participants' demographics, causes of cardiac arrest, initial heart rhythm, bystander cardiopulmonary resuscitation (CPR), emergency team response time, and post-resuscitation care practices.

Results: Survey findings showed that OHCA among children in Central Asia is mainly caused by non-cardiac conditions and hypoxia, including respiratory failure, drowning, trauma, and severe infections. Non-shockable rhythms were more commonly observed than shockable rhythms. Low rates of bystander CPR, delayed EMS response times, and inadequate paediatric resuscitation training were identified as major contributors to poor survival outcomes. Various deficiencies in pre-hospital and post-resuscitation care practices were also revealed.

Conclusion: Paediatric OHCA continues to be a major public health concern in Central Asia due to delayed recognition, low bystander participation, prolonged EMS response times, and insufficient resuscitation resources. Strengthening emergency care systems, improving paediatric CPR training, and developing standardised regional cardiac arrest registries may help to improve patient outcomes.

Keywords: *pediatric out-of-hospital cardiac arrest; Central Asia; cardiopulmonary resuscitation; emergency medical services; resuscitation outcomes*

I. INTRODUCTION

Pediatric out-of-hospital cardiac arrest (OHCA) is a rare but serious medical emergency that can lead to high death rates and neurological damage in survivors. In children, it is usually caused by breathing problems such as low oxygen levels, drowning, injuries, infections, metabolic disorders, or congenital heart disease, rather than primary heart-related problems. Lack of oxygen and poor blood flow for a prolonged period can lead to cardiac arrest and may become life-threatening.

Bystander cardiopulmonary resuscitation (CPR), fast emergency medical help, proper airway management, and good post-resuscitation care are important for improving survival and brain recovery in children with OHCA. However, even with improvements in emergency medicine, survival outcomes in paediatric OHCA remain poor worldwide, especially in low- and middle-income countries.

In Central Asia, delayed EMS response times, limited paediatric resuscitation knowledge among healthcare workers, weak pre-hospital care systems, and low public awareness about CPR contribute to poor OHCA outcomes. In addition, only a few epidemiological studies on paediatric OHCA have been conducted in Central Asia, leading to limited data for healthcare planning and emergency system improvements.

A standardised method such as the Resuscitation Outcomes Epistry–Cardiac Arrest framework can help evaluate trends, arrest characteristics, resuscitation practices, and patient outcomes in this understudied population. Therefore, this study aims to examine the epidemiology and outcomes of paediatric OHCA in Central Asia using a survey-based approach.

II. METHODS

This study was conducted as an observational study using a survey-based design. The aim was to study the epidemiology and outcome patterns of paediatric out-of-hospital cardiac arrest in Central Asia. A questionnaire was prepared based on previous studies and international resuscitation guidelines. The survey was distributed to healthcare professionals, pediatricians, emergency physicians, and emergency medical service (EMS) personnel.

The questionnaire included questions about demographic details, causes of cardiac arrest, initial heart rhythm, bystander CPR, EMS response time, resuscitation practices, post-resuscitation care, and survival outcomes.

A literature search was also conducted using PubMed and Scopus databases. Keywords included: pediatric out-of-hospital cardiac arrest (OHCA), cardiopulmonary resuscitation (CPR), emergency medical services (EMS), and resuscitation outcomes. The collected data were analysed using frequencies and percentages (%).

III. RESULTS

3.1 Demographic Characteristics and Circumstances of Pediatric OHCA

Survey responses showed that most paediatric OHCA cases in Central Asia occurred in children aged 5–10 years, while fewer cases were seen in children aged 2–5 years. Female respondents were slightly more than male respondents. Most cardiac arrest cases occurred in urban areas, although many were also reported in rural areas.

Most cardiac arrest events happened in public places such as parks, streets, and malls, followed by schools, homes, and health facilities. Common activities before cardiac arrest included physical sports, emotional stress, sleeping or resting, eating, and some unknown events. These findings suggest that paediatric OHCA often occurs during physical or emotional stress.

Most cardiac arrest events were witnessed by family members or by people outside the family, such as teachers.

Table 1. *Demographic and event characteristics*

Variable	Common Findings
Age group	Mostly 5–10 years
Area	Mostly urban areas
Common location	Public places and schools
Common pre-event activity	Physical activity or sports
Witnessed arrest	Mostly witnessed
Frequent outcomes	Survival with neurological impairment

EMS = Emergency Medical Services; OHCA = Out-of-Hospital Cardiac Arrest.

3.2 Clinical Symptoms at the Onset of Collapse and Pre-hospital Intervention

Before collapse, many children showed symptoms such as seizure-like movements, chest pain, breathing difficulty, bluish skin discolouration (cyanosis), fever or infection, and sudden loss of consciousness. Seizure-like activity and chest pain were the most common symptoms in children with OHCA. Many children also had breathing problems or bluish skin discolouration before losing consciousness, suggesting that low oxygen levels and respiratory causes were major contributing factors.

The type of pre-hospital treatment depended on the patient's condition. Common treatments before reaching the hospital included CPR, chest compressions, rescue breathing, oxygen therapy, and use of an automated external defibrillator (AED). However, some patients did not receive any treatment before hospital arrival.

Emergency responders, trained people nearby, healthcare workers, parents/caregivers, and school staff were the main people who helped during the first few minutes after collapse. Although EMS teams helped in many cases, bystander support was not always available.

Table 2. *Clinical features and interventions*

Variable	Common Findings
Common symptoms	Seizure-like activity, chest pain
Frequent interventions	CPR and chest compression
Initial responders	EMS and trained bystanders
Common comorbidities	Congenital heart disease, asthma
AED use	Reported in several cases
No intervention cases	Present in multiple responses

CPR = Cardiopulmonary Resuscitation; AED = Automated External Defibrillator; EMS = Emergency Medical Services.

3.3 Obstacles to Emergency Response and Community Awareness

The survey showed several barriers to emergency response, including lack of CPR training among bystanders, long distance to healthcare facilities, and delayed ambulance arrival. Other problems included social or cultural hesitation, treatment costs, and limited awareness about emergency contact numbers.

Community awareness about CPR was generally low to moderate. Many respondents reported low confidence in handling paediatric cardiac arrest emergencies. The availability of emergency medical help was not consistent across all areas and was often irregular.

Some participants were satisfied with the emergency treatment and fast response from healthcare workers, while others faced delays in ambulance services and transport to the hospital.

Table 3. *Barriers and awareness factors*

Variable	Common Findings
Main barrier	Lack of CPR knowledge
Other barrier	Geographic distance, ambulance delay
CPR awareness	Moderate to low
Confidence level	Variable confidence
EMS accessibility	Inconsistent across regions
Suggested improvements	CPR training and faster EMS

EMS = Emergency Medical Services; CPR = Cardiopulmonary Resuscitation.

3.4 Perceived Consequences, Recommendations, and Healthcare Barriers

Respondents shared information about their experiences with paediatric OHCA cases. Most of the cases involved collapse with breathing difficulty, unresponsiveness, seizures, or bluish skin discolouration (cyanosis). Some bystanders were confused during the emergency, which caused delays in calling for medical help.

Common problems included transportation difficulties, lack of emergency medical services, long distance to hospital, delayed ambulance arrival, and treatment costs. These problems were especially common in rural areas.

Most respondents suggested improving CPR awareness among the public, paediatric emergency care, ambulance response times, emergency communication, and availability of AEDs in schools and public places. Participants also emphasised the need for better emergency care systems, improved healthcare facilities, and better coordination between ambulance services and hospitals.

Overall, poor emergency awareness, limited preparedness, and reduced healthcare access negatively affected survival and neurological outcomes in children with OHCA.

Table 4. *Community recommendations and challenges*

Variable	Common Findings
Major challenge	Transportation and delay in care
Common recommendation	Public education on CPR
EMS recommendation	Faster ambulance response time
Infrastructure need	AED availability
Rural concern	Geographical inaccessibility
System improvements	Improved emergency care coordination

EMS = Emergency Medical Services; AED = Automated External Defibrillator; CPR = Cardiopulmonary Resuscitation.

IV. DISCUSSION

This survey-based study examined paediatric out-of-hospital cardiac arrest (OHCA) in Central Asia. The study showed that survival and recovery outcomes are poor, mainly because of delayed recognition, low bystander support, and slow emergency response. Most cases were reported in children aged 5–10 years. Cardiac arrest commonly occurred in public places, schools, and homes. Physical activity and emotional stress were often reported before collapse.

Common symptoms before cardiac arrest included seizure-like activity, chest pain, breathing difficulties, and bluish discolouration of the skin (cyanosis). These findings suggest that breathing problems and low oxygen levels are major causes of paediatric OHCA. Previous studies have also shown that paediatric cardiac arrest is more commonly related to respiratory problems rather than primary heart disease.

The study found that many surviving children developed neurological problems, while some children died before reaching the hospital or after admission. Late emergency treatment and improper resuscitation methods were major causes of poor patient outcomes.

Common treatments given before reaching the hospital included bystander CPR, chest compressions, rescue breathing, oxygen support, and use of AEDs. However, many children received delayed treatment or no care before reaching the hospital. Children who received immediate CPR and early help had better outcomes.

Major barriers to emergency care included lack of CPR knowledge, delayed ambulance response, long distance to hospital, financial difficulties, and hesitation in providing emergency care. Participants from rural areas especially reported transportation problems and poor access to EMS.

Children with underlying conditions such as heart disease, asthma, breathing difficulty, brain disorders, or recent infections were more likely to have cardiac arrest. Children with breathing- and brain-related diseases also had lower survival chances.

Study participants highlighted the need for better CPR training, more AED machines in public areas, quicker ambulance services, and increased public awareness about paediatric cardiac arrest. Overall, the study shows that emergency care for children and resuscitation training programmes need significant improvement across Central Asia.

V. CONCLUSION

This study shows that cardiac arrest in children outside the hospital is a serious problem in Central Asia. Most children had breathing problems, infections, drowning, or injuries before cardiac arrest. Many children did not receive quick medical help because ambulance services were slow and bystanders lacked CPR knowledge. Due to delayed treatment, many children either died or developed neurological complications.

The study also indicates that better CPR training, faster ambulance services, more emergency equipment (particularly AEDs), and increased public awareness can help save lives. Improving emergency care systems and teaching people how to respond quickly during emergencies can significantly improve survival and recovery in paediatric cardiac arrest cases.

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