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A Survey on the Current Status of Usage and Awareness of Out-of-Hospital Automated External Defibrillators in Deyang City

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Abstract: *Objective*: To understand the current awareness and willingness to learn about the use of out-of-hospital automated external defibrillators (AEDs) in Deyang City, providing a basis for improving the success rate of rescue operations. *Methods*: A questionnaire survey was conducted among residents in Deyang City from January 2025 to October 2025, covering residents' basic information, awareness of AED-related knowledge, and attitudes towards AED usage. *Results:* A total of 1,886 questionnaires were collected, with 1,823 valid questionnaires, yielding an effective rate of 96.66%. Among the 1,823 respondents, 692 (37.96%) had received cardiopulmonary resuscitation (CPR)-related learning or training, 619 (33.96%) could accurately describe the name of an AED, 417 (22.87%) could clearly describe the function of an AED, and 308 (16.89%) could accurately describe how to use an AED. Among them, 1,549 (84.97%) were willing to provide assistance to patients experiencing cardiac arrest; 1,731 (94.95%) were willing to provide assistance under the premise of knowing how to use an AED; and 1,750 (95.99%) were willing to learn about AED-related knowledge. Among the 91 individuals unwilling to provide rescue, 75 responded with reasons. Among them, 36 cases (48.00%) were reluctant to rescue due to a lack of relevant first aid knowledge, 32 cases (42.67%) expressed concerns about exacerbating the patient's condition due to improper operation, and 4 cases (5.33%) were unwilling to interact with strangers due to personal reasons. *Conclusion:* Currently, residents in Deyang City have limited knowledge about AEDs but demonstrate a strong willingness to learn and apply them. Measures need to be taken to enhance their understanding and application of AEDs.

Keywords: Out-of-hospital cardiac arrest; Automated external defibrillator; Deyang City; Knowledge, attitude, and practice; Public first aid

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1. Introduction

Cardiovascular disease has now become the leading cause of threat to human health worldwide. Among them,

Out-of-Hospital Cardiac Arrest (OHCA) is widely recognized as a severe public health issue that endangers lives due to its sudden onset, rapid progression, and poor prognosis. Data shows that the number of sudden cardiac deaths in China exceeds 540,000 annually, ranking first globally, yet the success rate of rescue remains around 1%, significantly lower than the average level in developed countries in Europe and America [1]. After cardiac arrest, the patient's survival rate decreases exponentially over time. Implementing high-quality cardiopulmonary resuscitation (CPR) within the "golden 4 minutes" and using an Automated External Defibrillator (AED) can significantly improve the patient's survival rate. However, factors such as long-standing weak public awareness of first aid, low skill penetration rate among the public, and insufficient AED deployment have limited improvements in the prognosis of OHCA patients in China [2]. In recent years, at the national level, great importance has been attached to the construction of the pre-hospital emergency care system. On the one hand, it has explicitly proposed to strengthen the popularization of emergency care knowledge and skills among the general public; on the other hand, it has also provided legal immunity protection for good-faith rescuers from a legal perspective, aiming to eliminate public concerns about providing assistance [3]. As an important industrial hub in Sichuan Province and a key node city in the Chengdu-Chongqing Economic Circle, Deyang City is experiencing a significant trend of population aging and is home to numerous industrial enterprises, thus facing considerable challenges related to cardiovascular diseases [4]. However, at present, there is a lack of systematic research on the awareness rate, willingness to use, and mastery of operational skills regarding Automated External Defibrillators (AEDs) among the public in Deyang City. This study aims to objectively evaluate the current awareness and willingness to learn about the use of out-of-hospital AEDs among residents in Deyang City through a large-scale questionnaire survey. It also analyzes the key factors influencing the public's willingness to provide assistance, with the intention of providing a scientific basis for relevant departments to optimize the allocation of emergency care resources and formulate precise training policies.

2. Data and methods

2.1. General information

A total of 1,886 questionnaires were distributed to permanent residents of Deyang City, Sichuan Province, from May 2024 to October 2025, with 1,886 questionnaires collected. After excluding invalid questionnaires with excessively short response times, regular response patterns, or missing key information, a final total of 1,823 questionnaires were included. The general information of the study subjects is shown in **Table 1**. This study complies with the Declaration of Helsinki and has obtained informed exemption.

Table 1. Comparison of baseline demographic and clinical characteristics between two groups of patients

Item	Category	Number of cases (n)	Composition ratio (%)
Gender	Male	895	49.09
	Female	928	50.91
Age (years)	18–30	456	26.01
	31–45	684	37.52
	46–60	485	26.60
	> 60	198	10.86

Table 1 (Continued)

Item	Category	Number of cases (n)	Composition ratio (%)
Education Level	Junior high school or below	345	18.92
	High school / Secondary specialized	522	28.63
	College / Bachelor's degree	854	46.85
	Master's degree or above	102	5.60
Residential Area	Urban	1350	74.05
	Rural	473	25.95
Occupation Type	Enterprise / Institutional Employee	620	34.01
	Student	285	15.63
	Freelancer / Self-employed	450	24.68
	Retiree	215	11.79
	Other	253	13.88

2.2. Inclusion criteria

(1) Aged 18 years and above;
(2) Residing in the urban area of Deyang City for a period of 6 months or more;
(3) Having complete baseline data.

2.3. Exclusion criteria

(1) Individuals engaged in emergency medical professions, who do not represent the general public's cognitive level;
(2) Migrants with an expected residence period of less than 6 months;
(3) Individuals with cognitive, visual, or auditory impairments that prevent them from independently reading the questionnaire or understanding and answering its contents with the assistance of an investigator;
(4) Those who withdraw from the survey midway, refuse to answer key questions, or fill out the questionnaire with obvious logical errors.

2.4. Methodology

This study referenced domestic and international literature and the Knowledge-Attitude-Practice (KAP) theoretical model. It employed a self-designed questionnaire titled "Survey on Public Awareness and Willingness for AED Use and Emergency Response in Deyang City". which was validated through expert panel discussions and pre-survey revisions. The questionnaire demonstrated good reliability and validity, with a Cronbach's α coefficient of 0.86 and a Content Validity Index (CVI) of 0.92. The questionnaire primarily encompassed three dimensions: residents' basic information, awareness of AED-related knowledge, and attitudes and willingness towards AED use. The survey was conducted using a combination of online and offline methods. Offline surveys were conducted randomly in high-traffic areas such as Deyang Confucian Temple Square, Wanda Plaza, and community health service centers, while online surveys were distributed through community grid groups. Offline investigators, who underwent unified training, were responsible for on-site explanations and quality control. Data entry employed a double-entry method by two individuals.

2.5. Observation indicators

The observation indicators and their definitions in this study are as follows: CPR training prevalence rate: the proportion of surveyed individuals who have participated in CPR-related courses or skill training; AED name recognition rate: the proportion of individuals who can accurately identify and describe AED as an automated external defibrillator; AED function awareness rate: the proportion of individuals who can correctly describe the primary function of AED as treating ventricular fibrillation and eliminating abnormal heart rhythms; AED operation proficiency rate: the proportion of individuals who can correctly describe the standard operating procedure of AED; basic willingness to rescue rate: the proportion of individuals who express willingness to actively rescue patients with cardiac arrest under any circumstances; willingness to rescue rate after skill empowerment: the proportion of individuals who express willingness to actively rescue patients on the premise of having mastered the use of AED; willingness to learn rate: the proportion of individuals who express willingness to participate in AED and first aid knowledge training. Among those who express unwillingness to rescue, they are classified into three types based on their core obstacles: capability panic (due to a complete lack of relevant knowledge and skills), consequence concern (fear of worsening the condition or assuming subsequent responsibility due to improper operation), and social avoidance (unwillingness to interact with strangers for personal reasons).

2.6. Statistical methods

Data analysis was conducted using SPSS 22.0 statistical software. Count data were expressed as rates (%), and differences between two groups were compared using the χ^2 test. A p-value < 0.05 was considered statistically significant.

3. Results

3.1. Awareness of AED-related knowledge and skill attainment

The survey results revealed that less than 40% (37.96%) of the respondents had received CPR-related education or training, and there was a clear decreasing trend of "name recognition > functional understanding > operational proficiency". See **Table 2**.

Table 2. Awareness of AED-related knowledge and skill proficiency levels

Indicator	Positive response / compliance cases (n)	Proportion (%)
Exposure to CPR-related learning or training	692	37.96
Can accurately describe the name of an AED	619	33.96
Can clearly describe the purpose of an AED	417	22.87
Can accurately describe the steps for using an AED	308	16.89

3.2. AED usage and willingness to learn

The survey results showed that a majority of the respondents expressed a willingness to provide assistance (84.97%), and an overwhelming majority expressed a willingness to learn (95.99%). Furthermore, the proportion of those willing to provide assistance when equipped with relevant skills was even higher compared to the basic willingness to assist (94.95% vs. 84.97%, $\chi^2 = 100.602$, $p < 0.001$). See **Table 3**.

Table 3. AED usage and willingness to learn

Indicator	Positive response / compliance cases (n)	Proportion (%)
Willingness to provide aid to a sudden cardiac arrest victim	1549	84.97
Willingness to provide aid when equipped with AED skills	1731	94.95
Willingness to learn AED-related knowledge*	1750	95.99

Note: Compared to the proportion of those willing to assist without mastering AED usage methods, *$p < 0.05$.

3.3. Analysis of factors impeding assistance

Among the 91 respondents who explicitly stated their unwillingness to provide assistance, 75 provided specific reasons and were successfully categorized. The primary factors impeding assistance were fear of inadequate ability (48.00%) and concerns about consequences (42.67%). See **Table 4**.

Table 4. Analysis of factors impeding assistance (n = 75)

Reason category	Specific description	Number of cases (n)	Proportion (%)
Competence panic	Lacking any first-aid knowledge and thus afraid to act	36	48.00
Concern over consequences	Worried that incorrect operation might worsen the patient's condition	32	42.67
Social avoidance	Personal reluctance to engage with strangers	4	5.33
Other	Other reasons	3	4.00

4. Discussion

Through a questionnaire survey of 1,823 residents in Deyang City, this study reveals that the overall awareness rate of out-of-hospital Automated External Defibrillators (AEDs) and the willingness to provide assistance in the region exhibit a contradictory state of "high willingness but low capability". Specifically, the residents' awareness of AEDs in Deyang City presents an inverted triangular structure, with 33.96% having heard of AEDs, but only 16.89% mastering the correct operational procedures, significantly lower than the levels in first-tier cities such as Shanghai and Shenzhen, as well as in developed countries [5]. Sudden cardiac arrest occurs abruptly, with an extremely short window for rescue, making it difficult for the emergency response system alone to arrive at the scene within the optimal rescue time window. If on-site witnesses lack AED-related skills, even when AED equipment is within reach, it is difficult for it to be effective. The results of this study indicate that only 37.96% of the surveyed individuals reported having received CPR-related education and training, suggesting that most residents in Deyang City may lack basic identification and response capabilities when faced with sudden cardiac arrest.

However, it is noteworthy that the citizens of Deyang demonstrate a high willingness to provide assistance and enthusiasm for learning, in stark contrast to their relatively low level of awareness, which aligns with the research conclusions of Jiao Guangyuan regarding the positivity of the Chinese public's attitude towards first aid [6]. Among those unwilling to provide assistance, a complete lack of first aid knowledge, as well as concerns about exacerbating the patient's condition or assuming subsequent liability due to improper operation, are the primary obstacles to providing aid. Despite the issuance of Article 184 of the Civil Code, which provides strong legal protection for the public's emergency rescue actions, this study still reveals that a considerable portion of the

population remains unwilling to provide assistance due to concerns about their own technical abilities or potential consequences, possibly due to insufficient promotion and dissemination [7]. This phenomenon reflects a lack of knowledge and training in first aid, as the public may still generally hold incorrect perceptions that AED operation is complex and high-risk. However, in reality, the original intent behind AEDs is to enable "foolproof operation" to reduce the cognitive load on users, and they feature automatic rhythm analysis capabilities, ensuring that they will not deliver a shock when it is inappropriate to do so [8]. Therefore, eliminating technical fears may be the key to increasing the rescue rate among residents in Deyang City.

Based on the above findings, this study suggests that, in response to the current situation of low awareness, efforts should not be limited to popular science dissemination through posters and leaflets. Instead, specific CPR/AED practical training should be carried out in communities, enterprises, and schools. This will not only effectively enhance the public's first aid skills but also significantly reduce the psychological stress levels of rescers, thereby facilitating a comprehensive improvement in the willingness to rescue and the success rate of patient assistance [9]. On the other hand, it is essential to further promote relevant legal exemption clauses and disseminate the safety principles of AEDs to alleviate the public's irrational fear that improper operation might worsen the patient's condition. Moreover, incentive measures could be adopted to enhance the willingness of bystanders to provide assistance, thereby enabling everyone to "dare to rescue, be capable of rescuing, and know how to rescue".

5. Conclusion

In summary, the general public in Deyang City currently has limited knowledge about AEDs and a low proficiency rate in core operations. Despite a widespread strong willingness to learn and apply AEDs, the main obstacles to providing assistance stem from a lack of skills and concerns about the consequences. Therefore, it is recommended that relevant departments in Deyang City align with the public's willingness by vigorously promoting practical first-aid skills training to increase the out-of-hospital AED usage rate and improve the success rate of resuscitation for patients with cardiac arrest.

Disclosure statement

The authors declare no conflict of interest.

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