

A Study Investigating the Critical Factors for the Successful Promotion of Cardiopulmonary Resuscitation (CPR) – Taking Miaoli County as an Example

Hung-Teng Chang¹, Chih-Yao Lo², Guan-Yu Chen³

¹*Assistant Professor, Department and Graduate Institute of Information Management, Yu Da University of Science and Technology*

²*Professor, Department of Health and Creative Vegetarian Science, Fo Guang University*

³*P.G. Department and Graduate Institute of Information Management, Yu Da University of Science and Technology*

Abstract- The main purpose of this study is to promote the early CPR implementation for OHCA (out-of-hospital cardiac arrest) patients by general public to further increase the survival rate of injured patients. Successful promotion of cardiopulmonary resuscitation (CPR) enables patients to receive emergency treatment early and saves more lives of general public, so its importance cannot be ignored. This study performed an expert survey, arranged relevant literature, and used modified Delphi method to develop the interview questionnaire to analyze the affecting factors (indicators). Lastly, this study used Analytic Hierarchy Process (AHP) to obtain the weights of various critical factors (indicators) for the successful promotion of cardiopulmonary resuscitation (CPR), and arranged and analyzed them.

The weights of various critical factors (indicators) for the successful promotion of cardiopulmonary resuscitation (CPR) can be learned from the research results to understand the critical factors for the successful promotion of cardiopulmonary resuscitation (CPR). The findings serve as reference for Emergency Medical Service Division and various fire prevention corps (teams) to propagate the information on CPR in the future to enable general public in the society to generally learn to perform cardiopulmonary resuscitation (CPR) and further increase the survival rate of OHCA patients.

Keywords: CPR(cardiopulmonary resuscitation), Modified Delphi Method (MDM), Analytic Hierarchy Process (AHP)

I. INTRODUCTION

In compliance with the provisions of Article 1 of the Fire Services Act, the three major tasks of fire services are “preventing fire disaster” and “providing rescue operation” and “first aid.” The workload of “first aid” is the heaviest. According to the latest statistics on the top 10 causes of death of people in Taiwan announced by Ministry of Health and Welfare(2016), cardiac diseases are in second place. In Taiwan, approximately 20,000 people die of cardiopulmonary arrest due to “cardiogenic factors” every year. A delay in the cardiopulmonary resuscitation (CPR) implementation by every 1 minute leads to a decrease in survival rate by 10%, and a delay by more than 10 minutes leads to a survival rate of approximately 0. Therefore, in the urgency of saving lives, the minutes and seconds matter. According to the statistics, in Taiwan, it takes approximately 8 to 10 minutes from the receipt of a call by emergency response dispatchers to the arrival of ambulance at the scene. If first aid procedures, such as CPR, are performed until an ambulance arrives at the scene, the golden rescue time will be missed (Fire Safety Monthly 2017.11). In order to improve rescue time, previous studies suggested that it is important to perform the CPR early. As a result, the successful promotion of cardiopulmonary resuscitation (CPR) and implementation of effective training to improve the first aid knowledge and skills of general public to achieve the reduction of loss of lives and properties of general public, as well as the protection of rights of rescuers and the rescued has become an issue worthy of promotion.

II. LITERATURE REVIEW

Based on the literature collected in this section, this study preliminarily analyzed how general public learned of the information on new knowledge and the training content of CPR First Aid Policy for the Public promoted by the government, as well as found out the effort directions for successful promotion of cardiopulmonary resuscitation (CPR).

2.1 Miaoli County Fire Bureau's Emergency and First Aid Promotion and Implementation Plan in 2018

This plan aims to promote the concepts of cherishing first aid resources, reducing resource, and encouraging general public to learn to perform CPR and follow the online instructions from the 119 command center to perform CPR, in order to improve the abilities of saving lives of people and self and achieve the objectives of completing CPR training for residents aged 16 to 65 set up by "Happy Miaoli, Happy City."

2.2 Cardiopulmonary Resuscitation (CPR) First-aid Course Planning of General Public Version Announced by Ministry of Health and Welfare and Miaoli County Fire Bureau

If the general publics are able to perform high-quality bystander CPR for OHCA patients early to enable them to receive first aid early, the survival rate of OHCA patients can be increased and more lives can be saved. Therefore, in order to improve general public's first aid knowledge and strengthen their skills, in recent years, Miaoli County Fire Bureau has devoted itself to holding CPR promotion courses to enable various units, staff of authorities(organizations), and general public to receive training and learn relevant new first aid knowledge and skills. For instance, Miaoli County has designed the training courses for no less than 3 hours and issued the CPR Certificate to those who pass the skill examination after the end of courses.

2.3 Protection of the General Public's Demand for First Aid Training

Although the first aid-related courses for general public are more elementary than the training for professional emergency medical technicians. Based on the nature of saving lives, general public also have to attended the training courses and pass the examination. However, the CPR First Aid Courses for the Public and Enforcement Rules promoted by the government should spread relevant information through channels, such as TV news and online media. In addition, the government should offer more registration and learning channels and frequently propagate and spread relevant information to enable general public to understand messages on knew knowledge and course content. The government should determine the course design directions that increase the learning intention of general public to make them willing to receiving training. However, if there isn't any applicable laws and decrees protecting those who perform first aid to save lives, general public may hesitate to do so and thus delay the gold rescue time for saving lives. As stated above, in compliance with the provisions of Paragraph 2, Article 14 of the "Emergency Medical Services Act," the provisions of exemption from personal liability for necessity in the Civil Code and Criminal Code apply to those, other than emergency medical technicians, who use emergency and first aid equipment or perform first aid measures to prevent others from urgent risk of life. The aforementioned provisions also apply to emergency medical technicians during off-duty period. Therefore, applicable laws and decrees have been amended for exemption from liability to enable general public to feel relieved to save people and perform first aid without worrying about being sued and thus miss the precious gold rescue time (Website of National Fire Agency, Ministry of the Interior).

III. RESEARCH METHOD

This study analyzed relevant literature, integrated the opinions from firefighters and emergency medical technicians of Miaoli County based on their practical experiences, collected the actual interview results of residents in Miaoli County, and used modified Delphi method and Analytic Hierarchy Process (AHP) as the main research tools. According to the research results, this study obtained the weights of critical factors (indicators) for the successful promotion of cardiopulmonary resuscitation (CPR). The research procedures are explained as follows:

3.1.Topic:

Based on the research background and motivation, this study determined the research topic (A Study Investigating the Critical Factors for the Successful Promotion of Cardiopulmonary Resuscitation (CPR)). The purpose of this study is to investigate the critical factors for successful promotion of cardiopulmonary resuscitation (CPR) and their relative weights, as well as to analyze their mutual correlation.

3.2. Literature Review:

This study collected the literature associated with first aid information, performed mutual discussions and analyses with experts, such as firefighters and emergency medical technicians in Miaoli County, and used the research methods, MDMand AHP to find out the critical factors for the successful promotion of cardiopulmonary resuscitation (CPR).

3.3. Investigation on Decision-making Hierarchical Structure:

- Decision-making factors: This study conducted a questionnaire survey on firefighters and emergency medical technicians, and arranged the returned questionnaires. This study integrated and analyzed the questionnaire survey results using “MDM” to establish the decision-making hierarchical structure.
- Decision-making scheme: This study collected relevant literature to find out the critical factors for successful promotion of cardiopulmonary resuscitation (CPR) as the decision-making factors.

3.4. Verification Procedures:

This study used “AHP” to compare relative weights of various decision-making factors. The research procedures are as shown as follows:

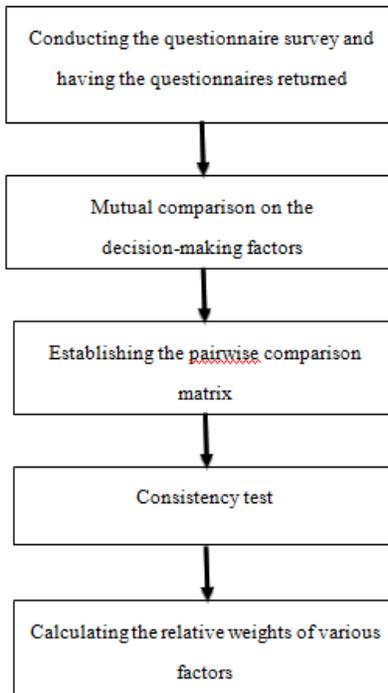


Figure 1 AHP Research Procedures

3.5. Analysis on Verification Results:

This study calculated the weights of various factors and arranged the order according to the analysis on the decision-making results and data to investigate the critical factors for successful promotion of CRP.

3.6. Conclusion and Suggestion:

This study provided the aforesaid analysis results to Emergency Medical Service Division and various fire prevention corps (teams) of Miaoli County Fire Bureau as reference for CPR promotion information in the future to enable general public to generally learn to perform CPR to further increase the survival rate of OHCA patients.

IV. RESULTS ANALYSIS AND DISCUSSION

This study enrolled residents in Miaoli County as the research subjects to investigate the critical factors for successful promotion of cardiopulmonary resuscitation (CPR). This study conducted a questionnaire survey to collect, analyze, and discuss the data, and arranged the significance and impacts of personal factors dimension information sources dimension.

4.1 Analysis on the first Delphi questionnaire survey results

For the “personal factors” dimension, all of the factors were retained after the discussion with the experts because their functionality met the standards.

For the “information sources” dimension, the mean of “tone of family/friend”(mean=3.33, standard deviation=0.50) was less than 3.5 points. Therefore, it was deleted after the discussion with the experts. The mean and standard deviation of all other evaluation factors all met the standards. Therefore, other factors were retained, as shown in Table 1.

Table 1: The first Expert Questionnaire Survey Results

| Goal | Criteria | Statistical Results (Average mean /Percentage) | Standard deviation | Decision-making Factors | Statistical Results (Average mean /Percentage) | Standard deviation | Accepted or Not |
|--|---------------------|--|--------------------|-------------------------|--|--------------------|-----------------|
| Critical factors for successful promotion of cardiopulmonary resuscitation (CPR) | personal factors | 4.17/83.4 % | 0.50 | Personality traits | 4.56/91.2% | 0.73 | Yes |
| | | | | Financial consideration | 3.78/75.6% | 0.97 | Yes |
| | | | | First aid concepts | 3.89/77.8% | 0.60 | Yes |
| | | | | Protection of rights | 4.44/88.8% | 0.88 | Yes |
| | Information sources | 3.76/75.2 % | 0.41 | tone of family/friend | 3.33/66.6% | 0.50 | No |
| | | | | Online information | 3.56/71.2% | 0.73 | Yes |
| | | | | TV news | 3.67/73.4% | 0.71 | Yes |
| | | | | Workplace need | 4.33/86.6% | 0.71 | Yes |
| | | | | Life education | 3.89/77.8% | 0.60 | Yes |

Source: Compiled by this study

4.2 Analysis on the second Delphi questionnaire survey results

According to the statistics, the mean of 8 evaluation criteria in the second Delphi questionnaire survey was greater than 3.8, and the level of agreement was above 70%, suggesting that the experts' opinions converged, as shown in Table 2.

Table 2: The Second Expert Questionnaire Survey Results

| Goal | Criteria | Statistical Results (Average mean /Percentage) | Standard deviation | Decision-making Factors | Statistical Results (Average mean /Percentage) | Standard deviation | Accepted or Not |
|--|---------------------|--|--------------------|-------------------------|--|--------------------|-----------------|
| Critical factors for successful promotion of cardiopulmonary resuscitation (CPR) | personal factors | 4.28/85.6% | 0.20 | Personality traits | 4.67/93.4% | 0.50 | Yes |
| | | | | Financial consideration | 3.89/77.8% | 0.60 | Yes |
| | | | | First aid concepts | 3.89/77.8% | 0.33 | Yes |
| | | | | Protection of rights | 4.67/88.8% | 0.50 | Yes |
| | Information sources | 4.14/82.8% | 0.18 | Online information | 3.89/77.8% | 0.33 | Yes |
| | | | | TV news | 4.00/80% | 0.00 | Yes |
| | | | | Workplace need | 4.56/91.2% | 0.53 | Yes |
| | | | | Life education | 4.11/82.2% | 0.33 | Yes |

Source: Compiled by this study

4.3 Establishing the hierarchical structure of evaluation criteria of critical factors for successful promotion of cardiopulmonary resuscitation (CPR)

Level 1 was the primary criteria

Including 2 dimensions, “personal factors” and “information sources.”

Level 2 was the secondary criteria

The 4 secondary criteria of the personal factors dimension were “personality traits,” “financial consideration,” “first aid concepts,” and “protection of rights.” The 4 secondary criteria of the information sources dimension were “online information,” “TV news,” “workplace need,” and “life education.”

4.4 Analysis on the primary criteria

Because the number of primary criteria ($n=2$) and number of comparisons $(2(2-1)/2=1$ time) could be regarded as a convergence effect, the primary criteria met the requirement for consistency.

4.5 Analysis on the secondary criteria

In terms of the analysis on the importance of the secondary criteria of personal factors dimension, the impact of “personality traits” was most significant (reaching 0.317), followed by “protection of rights” (0.296), “first aid concepts” (0.228), and “financial consideration” (0.160).

In terms of the analysis on the importance of the information sources dimension, the impact of “life education” was most significant (reaching 0.351), followed by “workplace need” (0.344), “TV news” (0.157), and “online information” (0.148).

4.6 Analysis on pairwise comparison matrix and weights of primary (secondary) criteria

For the analysis on the overall weights of factors, the order from the first to the eighth was as follows: life education (0.218), workplace need (0.214), personality traits (0.120), protection of rights (0.112), TV news (0.098), online information (0.092), first aid concepts (0.086), and financial consideration (0.060), as shown in Table 3.

Table 3: Order of Overall Weights of Primary (Secondary) Criteria

| Order of Weight | Decision-making Factors | Total Weight Distribution | Dimension |
|-----------------|-------------------------|---------------------------|---------------------|
| 1 | life education | 0.218 | Information sources |
| 2 | workplace need | 0.214 | Information sources |
| 3 | personality traits | 0.120 | personal factors |
| 4 | protection of rights | 0.112 | personal factors |
| 5 | TV news | 0.098 | Information sources |
| 6 | online information | 0.092 | Information sources |
| 7 | first aid concepts | 0.086 | personal factors |
| 8 | financial consideration | 0.060 | personal factors |

Source: Compiled by this study

V. CONCLUSION

1. According to the final analysis results, there were a total of 8 decision-making factors for reference of critical factors for successful promotion of cardiopulmonary resuscitation (CPR). The order of overall weights from the first to the eighth was “life education,” “workplace need,” “personality traits,” “protection of rights,” “TV news,” “online information,” “first aid concepts,” and “financial consideration.”

2. According to the AHP questionnaire results, the evaluation dimension of critical factors for successful promotion of cardiopulmonary resuscitation (CPR) were personal factors and information sources. The analysis showed that, the order of factors to which residents in Miaoli County attached high importance was as follows: “life education,” “workplace need,” “personality traits,” “protection of rights,” “TV news,” “online information,” “first aid concepts,” and “financial consideration.” The main reasons were that modern people attached high importance to their own health status, general public tend to be exposed to related education, social activities, and occasions in daily life, or receive information associated with health, first aid, and life in response to work performance requirement. In order to enable general public to engage in effective learning, trigger their intention to learn, and meet the actual needs, it is necessary to aggressively promote the learning of skills through participation in public affairs, encourage general public to accurately apply what they’ve learned to patients needing first aid, and formulate laws to protect the rights of rescuers. In this way, the chance of survival can be increased to save more lives of general public.

3. This study only investigated the general public in Miaoli County and the order of the best schemes they chose. Therefore, it is inappropriate to directly apply the results to other places.

VI. REFERENCES

- [1] Chen, W.L., Chen, T.H. (2011). Application of MDHP Method to Establish Apparel Design Indices, *Journal of Humanities and Social Sciences*, 7 (1): 49-59.
- [2] Chu, C.P., Theories and Practices of Analytic Hierarchy Process (AHP)–Teaching Handout, Department of Business Administration, National Dong Hwa University, 2009.
- [3] Duffield, C. (1988). The Delphi Technique. *The Australian Journal of Advanced Nursing*, 2(2),41-45.
- [4] Dunn, W. N., (1993). *Public Policy Analysis: An Introduction* (2nd Ed), New Jersey: Prentice Dubois, D. and H pard.
- [5] *Fire Safety Monthly*, 2017.11.
- [6] Hill, K. Q., & Fowles, J. (1975). The methodological worth of the Delphi forecasting technique. *Technological Forecasting and Social Change*, 7, 179-192.
- [7] Linstone, H. A., & Turoff, M. (1975). *The Delphi method: Techniques and applications*. New York, MA: Addison-Wesley.
- [8] Miaoli County Fire Bureau Emergency and First Aid Promotion and Implementation Plan, 2018.
- [9] Murry, J. W., & Hammons, J. O. (1995). Delphi: A versatile methodology for conducting qualitative research. *The Review of Higher Education*, 18(4), 423-436.
- [10] Rowe, G., & Wright, G. (1999). The Delphi technique as a forecasting tool: Issues and analysis. *International Journal of Forecasting*, 15, 353-375.
- [11] Saaty, T. L. ? Vargas, L. G. (1984). The Ligimacy of Rank Reversal, *OMEGA*, 12(5), pp. 513-516.
- [12] Saaty, T. L. (1980). *The Analytic Hierarchy Process*, New York, McGraw-Hill, USA.
- [13] Saaty, T. L.?1990?. *The Analytic Hierarchy Process*, RWS Publications, Pittsburgh, PA.
- [14] Stewart, T. R. (1987). The Delphi technique and judgmental forecasting. *Climatic Change*, 11, 97-113.
- [15] Sung, W.C., Application of Delphi Method, a Qualitative and Quantitative Analysis, to the Healthcare Management, *Journal of Healthcare Management – 2* (2), 2001.
- [16] Tseng, G.H., Teng, J.Y., Meaning, Feature and Application of Analytic Hierarchical Process (AHP) (I) (II), *China Statistics Journal – 27* (6,7), 1989.
- [17] Yang, C.H., Huang, M.T., Use of Modified Delphi Method and Analytic Hierarchy Process to Investigate the Critical Factors Affecting Group Purchase Behavior, *Journal of Chinese Management Review - 18* (1), February 2015.

Cardiopulmonary resuscitation (CPR) is one of the important clinical competencies for medical trainees. Since the introduction of the resuscitation order in place, to be missed or forgotten, as well as keeping track of the time and the cycles of CPR and recording administered drugs on a piece of paper. McCulloch et al.²⁸ investigated the influence of nontechnical skills on surgical outcomes and technical performance. Their results showed positive correlation between technical and nontechnical skills by reducing procedural errors. It was noted that improving situation awareness, in particular, led to a reduced procedural error rate. The most recent National Conference on Cardiopulmonary Resuscitation (CPR) and Emergency Cardiac Care (ECC) focused on improving the training protocol to include highlighting the multiple performance steps, providing timely feedback, and guiding practice with the mannequins (AHA, 1992). In a study comparing self-training to traditional training where modeling of instructor demonstrated CPR skills took place, the authors confirmed that such traditional methods were needed to obtain and retain resuscitation skills (Breivik, Ulvik, Blikra, & Lind, 1980). Following successful completion of a CPR class, lay people may hold a successful completion card for one year and those in medically related fields may hold cards for two years. You are administering cardiopulmonary resuscitation (CPR) chest compressions to a child. How far should the sternum be depressed by the compression? 1 to 1 1/2 inches. What should you do next? Perform a jaw-tongue lift and perform a visual check for the obstruction. Backblows are used to try to remove an airway obstruction for which of the following casualties? Infant only. You are administering rescue breathing to an adult casualty.