



*Pisco Med Publishing*

## **Study of Patient Safety Culture Based on IPGA Matrix Analysis**

**Mei Ge<sup>1,2</sup>, Zhongping Deng<sup>2,3</sup>, Binshi Qi<sup>4</sup>**

**1. Shenzhen Polytechnic, Shenzhen, Guangdong 518055, China.**

**2. City University of Macao, Macao 999078, China.**

**3. Foshan Polytechnic, Foshan, Guangdong 528137, China.**

**4. Enoch Medical Centre, Macao 999078, China.**

---

**Abstract:** Objective: in order to prevent medical risks and ensure patient safety, building the hospital patient safety culture has become an important issue that hospitals concern. Method: this paper adopts hospital patient safety questionnaire (SAQ) developed by Dr. Sexton, including 30 questions in six dimensions, and adds two measurement dimensions of “work and life coordination” and “resilience” in combination with hospital situations in Macao. The questionnaire totally has 46 questions in eight dimensions. The hospital safety culture is assessed based on IPGA matrix analysis model. Conclusion: it helps the hospital adopt interventional measures in time, concern medical care personnel and improve patient safety culture.

**Keywords:** IPGA Model; Medical Service; Patient Safety Culture

---

### **Introduction**

Quality and safety are the core contents and permanent themes of medical services. Patient safety culture as one part of overall culture of the hospital is deemed as the core mechanism of the hospital’s organizational environment. Patient safety in the hospital with higher sense of patient safety culture can be guaranteed more efficiently.

Certain hospital in Macao is a large general hospital, and committed to medical service quality management. In recent years, as emergencies increase, the patient safety culture is paid much attention. In order to improve medical quality and strengthen patient safety, the hospital introduced mature overseas questionnaire and added two measurement dimensions of “work and life coordination” and “resilience” according to actual situations of medical service. During Nov. 1, 2019 and Dec. 31, 2019, the hospital carried out questionnaire on safety culture aiming at all medical care staff of the hospital to know current status of patient safety culture in the hospital. The investigation is of great research significance in improving medical service quality, increasing satisfaction of patients and promoting continuous improvement of medical care quality.

### **1. Definition of patient safety culture**

At present, definitions of patient safety culture are described in different ways. In 2003, scholars such as Singer put forward definition of patient safety culture for the first time. They believed patient safety culture is the culture that medical care personnel affect attitudes and behaviors of patient safety and guarantee patient safety through shared faith, attitudes, value and behavior method. It can also be interpreted as a kind of behavior integrating Hippocrates’ “first do no harm” into every medical department and every operating item of the organization, and placing “safety” as priority. Professor Keyser, the expert in health, culture and safety in USA defines patient safety culture as an overall mode of individual’s or mechanism’s behavior which try to minimize harms caused to patients during service process based on common faith and value. According to European Society for Health Quality, the patient safety culture is the comprehensive behavior mode of individuals and organizations ceaselessly minimizing harms suffered to patients based on common faith and value. In 2019, Chinese Hospital Association (CHA) issued Patient Safety Goals (2019 Edition), and emphasized the importance of active

safety event report and patient safety culture development. Relevant studies show developing patient safety culture, which is an important approach to evaluate medical care quality, recognize and prevent malpractice, is the foundation for medical safety guarantee. Medical institutions can reduce fatality rate and improve patient safety by improving level of patient safety culture so as to improve medical service quality. On account of that, the common ground of the definitions of patient safety culture lies in the sum of individual behavior, habits, norms, value and basic cognition for patient safety of medical staff.

## **2. Questionnaire of patient safety culture**

The Safety Attitudes Questionnaire (SAQ) developed by Dr. Sexton contains 30 questions in six dimensions, respectively 6 questions for teamwork awareness, 7 questions for department safety awareness, 4 questions for pressure bearing capacity, 4 questions for hospital management cognition, 4 questions for work status and 5 questions for job satisfaction. In recent years, medical care personnel left office or changed career successively due to job pressure and job burnout, resulting in insufficient medical care personnel. Many scholars pointed out through research that job burnout and job-life unbalance would generate negative influence on patient safety. Therefore, the questionnaire develops a New-SAQ, which still uses the 30 questions in six dimensions on SAQ questionnaire, and adds seven questions for “job-life coordination” and 9 questions for “resilience”. The “resilience” is quoted from the dimension of emotional exhaustion on Maslach burnout inventory developed in 1976, which adopts reverse scoring. Thus, this paper totally provides 46 questions in eight dimensions to help hospitals find problems early, adopt interventional measures in time, care for medical care personnel, strengthen safety culture awareness of hospitals and patients, and improve medical service quality.

## **3. IPGA (Importance-Performance Gap Analysis)**

Lin, Chan and Tsai developed the Importance-Performance Gap Analysis (IPGA model) in 2009. IPGA model integrates IPA model and gap analysis model through function conversion. For function conversion, the gap between importance degree ( $I_j$ ) and satisfaction degree ( $P_j$ ) of the assessment project through paired samples t-test is checked. There is a negative gap if  $P_j$  is smaller than  $I_j$  ( $P_j < I_j$  remarkable), and then the computation formula of relative satisfaction degree ( $RP$ ) =  $-(P_j / P) - 1$ ; formula of relevant importance degree ( $RI$ ) =  $(I_j) / (I)$ . The space is divided to four quadrants with  $RI$  as vertical axis,  $RP$  as horizontal axis, and fixed point of intersection as the original point (0, 1). The matrix graph (as shown in Fig.1) is analyzed on that basis to mark relative location of each item through conversion of horizontal and vertical coordinate function, make priority of improvement, and reasonably configure resources.

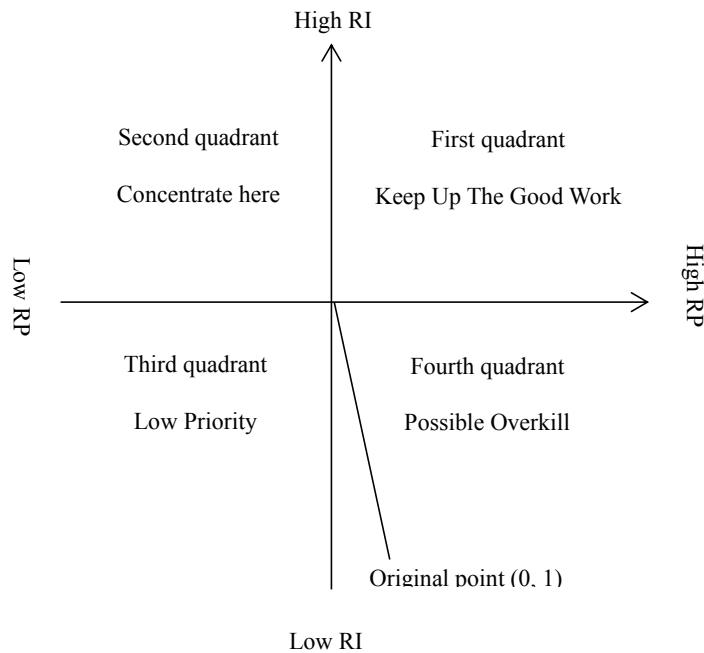


Fig.1 IPGA Analysis Matrix Model

Based on IPGA model, simple analysis matrix graph can be drawn for patient safety culture investigation to distinctly present opinions of medical care personnel on patient safety. It helps hospital managers rapidly judge the management connotation of four quadrants, analyze concentrate contents in the second quadrant, and configure medical resources to priority so as to effectively improve patient safety culture.

According to IPGA analysis matrix model in Fig.1, the management connotations that each quadrant stands for are as follows:

The first quadrant “Keep Up the Good Work” is on the right upper area of 2D matrix, showing high satisfaction and high importance degree, and positive gap; the factors in this quadrant shall keep on.

The second quadrant “Concentrate here” is on the left upper area of 2D matrix, showing low satisfaction and high importance degree, and negative gap; factors in this quadrant shall be improved, and the farther the factor is from the central coordinate (0, 1), the more urgent the improvement is.

The third quadrant “Low Priority” is on the left lower area of 2D matrix, showing low satisfaction and low importance degree and negative gap; since the importance degree in this quadrant is low, the improvement sequence is secondary.

The fourth quadrant “Possible Overkill” is on the right lower area of the 2D matrix, showing high satisfaction and low importance degree, and positive gap; however, due to low importance degree, the supply of factors in the quadrant exceeds demands; besides, the farther the factor is from the central coordinate (0, 1), the higher resource transfer acceptance degree will be; the resources shall be transferred in priority.

#### 4. Questionnaire survey

This study applies transverse questionnaire survey, and adopts convenience sampling with medical care personnel in certain hospital in Macao as research objects. How some special employees are excluded, such as new staff worked for less than one month, outsourced environmental medical care personnel and medical care personnel remaining at post without wage. The questionnaire is released from Nov. 1, 2019 to Dec. 31, 2019, totally 60 days. Totally 600 pieces of questionnaire were released and 572 pieces were recovered. Except the 30 pieces of invalid questionnaire, 542 pieces of effective questionnaire were recovered, with effective recovery rate of 90.3%.

The New-SAQ adopted in this study covers 6 questions for “teamwork”, 7 questions for “department safety

awareness” , 5 questions for “job satisfaction” , 4 questions for “pressure bearing capacity” , 4 questions for “hospital management cognition” , 4 questions for “work status” , 9 questions for “resilience” and 7 questions for “job-life coordination” , totally 46 questions in eight dimensions. In combination with IPGA theoretical basis, every question has two items of importance degree and actual satisfaction degree. However, due to question meaning in the dimension of “pressure bearing capacity” , it is unable to combine with IPGA theory. Therefore, it adopts the single item of actual agreement degree. The questionnaire adopts the five-score Likert Scale, and has been revised and pre-tested by nine hospital management experts (one hospital president, one vice president, one director of the nursing department, three botanic physicians and three head nurses) in hospital management, public health management, medical care and nursing. The internal consistence Cronbach’  $\alpha$  value is 0.90, showing favorable consistence of the questionnaire.

After being recovered, the questionnaires were analyzed by SPSS 22.0 software according to methods of descriptive statistics, independent sample t-test, and single factor variation analysis. At last, based on IPGA gap analysis, this paper drew the IPGA analysis matrix graphs with Excel software.

## **5. Research results**

### **5.1 Reliability analysis**

The questionnaire for patient safety culture contains 46 questions in eight dimensions, covering importance degree, satisfaction degree and agreement degree. The internal consistence Cronbach’  $\alpha$  value of the overall questionnaire is 0.965; Cronbach’  $\alpha$  value of Ij for each dimension is 0.845 ~ 0.942, of Pj for each dimension is 0.757 ~ 0.901, and of agreement degree for pressure cognition in each dimension is 0.921. Aforesaid data shows favorable internal consistence of the questionnaire.

### **5.2 Sample structure analysis**

The sample structure in this study shows mainly departments are special departments (including intensive care unit, emergency clinic, operating room, and cardiac catheterization room) accounting for 28.1%; most respondents are females, accounting for 77.9%; ages of the respondents are from 31 to 40, accounting for 36.3%; most of the respondents work at non-leader post (82.3%); main post is medical care personnel (40.4%); the length of service in this hospital is mostly 11-20 years (25.2%); length of service in current department is mainly 5-10 years, accounting for 27.3%; the degree of education is mostly junior college/university (86.1%); most respondents are front-line medical care personnel, accounting for 71.9%.

### **5.3 Analysis on patient safety culture cognition situations**

The questionnaire for patient safety culture contains 46 questions in eight dimensions, in which 42 questions are for seven main dimensions, covering Ij and Pj respectively. The overall Ij of medical care personnel for all cognition dimensions of patient safety culture is 4.16, and average overall Pj is 3.55, showing positive attitude of medical care personnel to patient safety; however, the patient safety culture implementation strategy of the hospital at present falls below the expectation of medical care personnel.

The dimension that medical care personnel attach the most attention to is “teamwork” , averagely 4.36. It shows that the hospital promotes education and training for communication and teamwork and urges medical care personnel to feel priority of teamwork for patient safety. However, the average number of dimension “resilience” that medical care personnel do not satisfy the most is 3.34. That is because of medical care personnel’ s exhaustion and high pressure caused by personnel turnover, increased patients and longer working hours, and COVID-19 epidemic.

## **5.4 Analysis on cognition difference of medical care personnel for patient safety culture**

This questionnaire further carries out independent sample t-test and single factor variation analysis according to different individual data of medical care personnel, and further applies LSD to post verification and discussion about difference in I<sub>j</sub> and P<sub>j</sub> of medical care personnel on patient safety cognition as reference for hospital managers.

The I<sub>j</sub> results show hospital care personnel with different education degrees have great difference for five dimensions of patient safety cognition, respectively department safety awareness ( $t = -2.337, p < 0.01$ ), hospital management cognition ( $t = -3.478, p < 0.01$ ), work status ( $t = -3.242, p < 0.001$ ), resilience ( $t = -2.215, p < 0.01$ ) and job-life coordination ( $t = -2.252, p < 0.01$ ). The I<sub>j</sub> of medical care personnel with education degree of junior college or higher for aforesaid five dimensions is higher, showing the influence of education degree on importance degree of patient safety; moreover, personnel with higher education degree recognize higher and pays higher attention to patient safety.

The P<sub>j</sub> results show different medical care personnel in main work unit are of great difference in seven dimensions of patient safety cognition, respectively teamwork ( $F = 18.071, p < 0.001$ ), department safety awareness ( $F = 7.261, p < 0.001$ ), job satisfaction ( $F = 6.294, p < 0.001$ ), hospital management cognition ( $F = 12.010, p < 0.001$ ), work status ( $F = 13.257, p < 0.001$ ), resilience ( $F = 7.015, p < 0.001$ ) and work-life coordination ( $F = 7.019, p < 0.001$ ). It means medical care personnel in different departments have obvious difference in satisfaction degree of patient safety recognition.

## **5.5 IPGA for each dimension of patient safety culture cognition**

The seven dimensions in safety culture investigation have significant difference in I<sub>j</sub> and P<sub>j</sub> through paired sample t-test, and the average I<sub>j</sub> of each dimension is higher than P<sub>j</sub>, showing negative gap. Then, RI and RP are calculated through formula; IPGA matrix graph is drawn (Fig.2) with RI as vertical axis, RP as horizontal axis and fixed intersection point as original point (0, 1). The space is divided to four quadrants. Thus, this paper acquires key factors for priority of improvement in the second quadrant “concentrate here”, calculates distance from coordinate of each dimension in the matrix and the original point (0, 1) and rank on that basis. The order is “hospital management cognition”, “teamwork” and “department safety awareness”. It means the hospital managers are over optimistic in-patient safety culture promotion and management effects, nonconforming to expectation of medical care personnel, and causing gap between managers and medical care personnel for patient safety cognition. Therefore, with limited resources, the hospital shall input resources preferentially into key improvement dimension of “hospital management cognition”, followed by “teamwork” and “department safety awareness”.

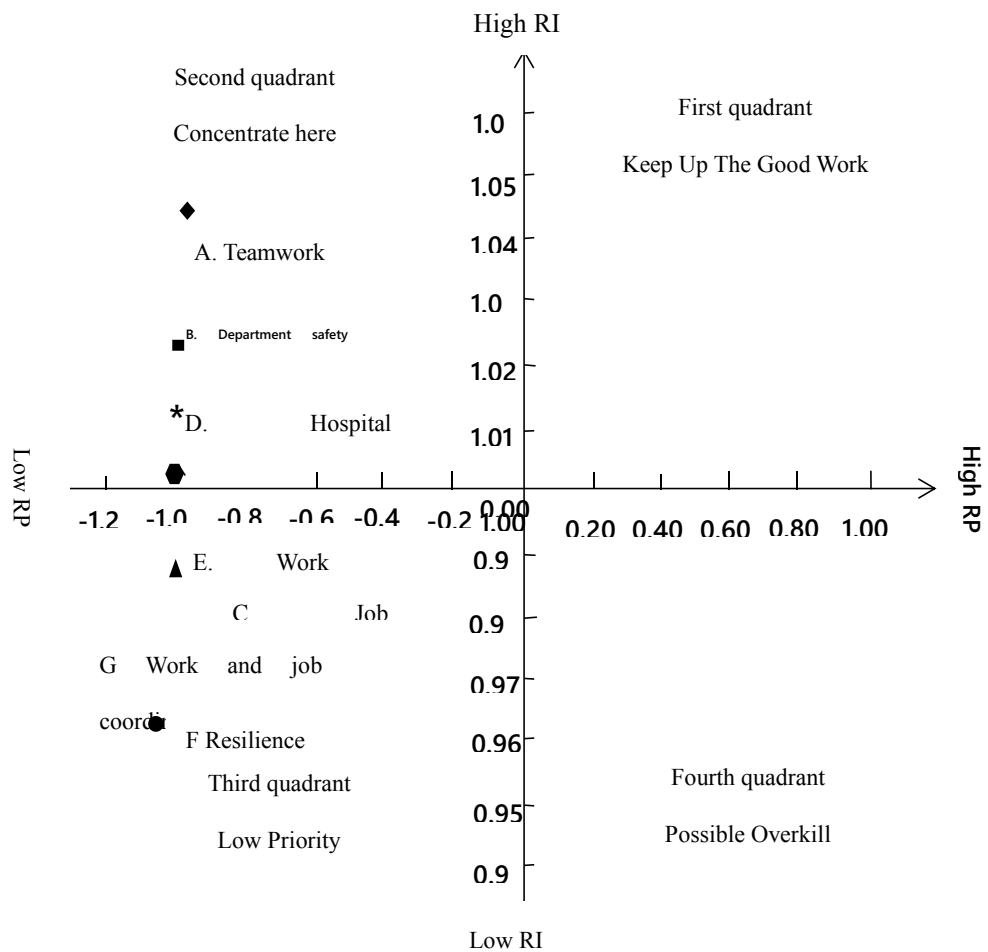


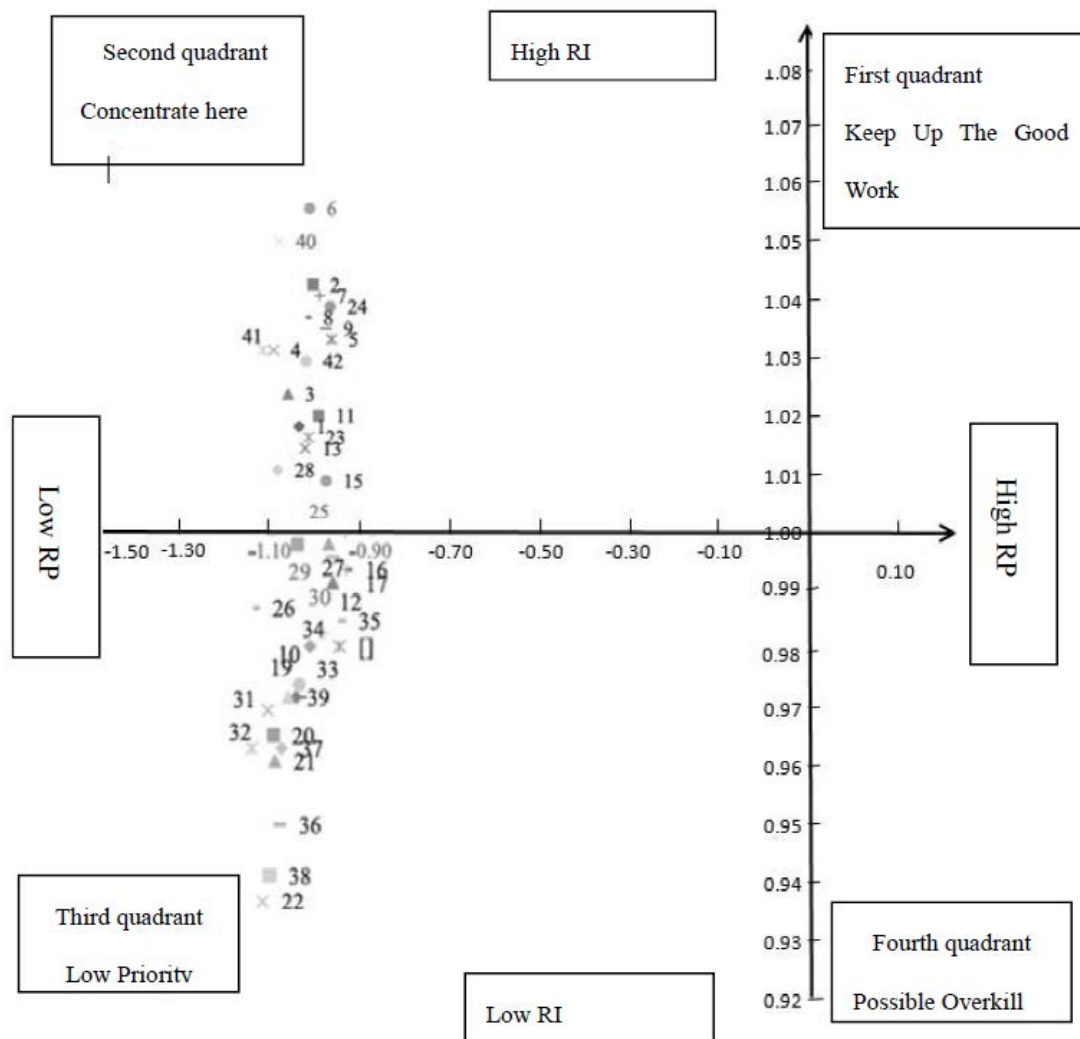
Fig. 2 IPGA matrix graph of patient safety culture survey dimensions

### 5.6 IPGA for patient safety culture cognition

Through paired sample t-test, for each question of patient safety culture survey, the actual  $P_j$  is lower than  $I_j$ , with negative gap. It shows that the patient safety culture is under the expectation of medical care personnel in the hospital at present, and till needs to be improved greatly.

IPGA 2D matrix graph (Fig.3) is drawn based on IPGA mode and meanwhile according to calculation results of RI and RP. The graph shows 19 questions in five dimensions (6 questions for “teamwork”, 5 questions for “department safety awareness”, 2 questions for “job satisfaction degree”, 3 questions for “hospital management cognition” and 3 questions for “job-life coordination”) are in the second quadrant “concentrate here”, and are items that the medical care personnel believe should be improved the most. After calculating the distance between every question and the central point (0, 1), the question farther from the central point is the key factor which should be improved more preferentially. The priority should be arranged according to that sequence, respectively “sleep quality”, “high passion for work in my department”, and “I can sufficiently get supports required when taking care of patients”, etc.

Fig.3 IPGA matrix analysis graph for each question of patient safety culture survey



## 6. Conclusion and suggestions

The dimension of “hospital management cognition” shall be improved in priority, followed by “teamwork” and “department safety awareness”. The study result is to improve the dimension of “hospital management cognition” preferentially, showing the gap between leader’s management level and cognition of medical care personnel for patient safety. Former scholars pointed out that leaders shall be insightful and inspiring to help develop positive patient safety cognition. In other words, the leadership of hospital management is the key to affect promotion of patient safety culture. Therefore, the leadership level of the hospital’s management is crucial for improvement of patient safety culture.

This paper suggests the hospital pay high attention to leadership level of leaders in each department, actively carry out leaders training to cultivate innovative leaders, focus on developing open communication ability, listen to opinions of medical care personnel, urge medical care personnel to value potential issues regarding patient safety, and stimulate medical care personnel to actively take part in safety management so as to minimize the gap between leaders and medical care personnel for patient safety cognition.

The secondary dimensions for improvement are “teamwork” and “department safety awareness”. Medical service needs cooperation of professional team. Study shows the higher the teamwork is, the more the safety awareness will be improved; while teamwork needs learning. Thus, perfecting team resource management measures could improve patient safety culture. However, the key of success is the support of hospital management layer. Therefore, the hospital management is suggested to improve cognition of “teamwork” and “job-life coordination”, establish open communication and discussion platform for internal team, and regularly carry out team case discussion meeting and cross-team cooperation project. In that way, medical care personnel could sufficiently communicate, gain support and share knowledge, eliminate boundary between teams, create teamwork awareness, meet expectation for teamwork and create patient safety culture of the hospital.

## References

- [1] WHO. World Health Organization (2018) Patient safety [EB/OL]. [2018-03-09]  
<https://www.who.int/zh/news-room/facts-in-pictures/detail/patient-safety>.
- [2] Alswat, K., Abdalla, RAM., Titi, M.A., et al. Improving patient safety culture in Saudi Arabia (2012-2015) : trending,improvement and benchmarking[J]. BMC health services research, 2017, 17.
- [3] Reis, C.T., Paiva, S.G., Sousa, P., The patient safety culture: a systematic review by characteristics of Hospital Survey on Patient Safety Culture dimensions [J]. International Journal for Quality in Health Care, 2018, 30 (9) : 660-677.
- [4] Gu, W., Ye, J.J., Investigation and Analysis of Current Situation of Patient Safety Culture in Certain Grade A Level III Hospital [J]. China Health Standard Management, 2018, 9(22): 12-15.
- [5] Fang Wang, F., Fang, J., et al. A Comprehensive Study of Domestic and Overseas Patient Safety Culture [J], Military Medical Journal of Southeast China, 2019, 21 (5): 501-505.
- [6] Chinese Hospital Association. Patient Safety Goals (2019 Edition) [J]. Shanghai Nursing Journal, 2019, 19 (7): 13.
- [7] Fan, C.F., Mao, G.X., et, al.Establishment of Patient Safety Culture Assessment System Model for Certain Level III Hospital in Taizhou [J], Journal of Medical Theory and Practice, 2020, 33 (11), 1891-1892.

### **Fund Program:**

Projects funded by the Macau Fund in 2021

Item Number: MF2032

Project Title: Empirical Research on Individual Behavior and Effective Prevention under the New Coronary Epidemic-Analysis Based on Risk, Budget, Information and Effective Prevention