



Research article

Factors influencing civil servants' willingness to implement cardiopulmonary resuscitation in Chongqing, China: Based on the theory of planned behavior

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ABSTRACT

Background: Timely bystander cardiopulmonary resuscitation is the key to improving the survival rate of out-of-hospital cardiac arrest. Civil servants are potential bystander CPR providers. This study aimed to explore civil servants' willingness to implement CPR in Chongqing, identify the influencing factors and mechanisms affecting civil servants' willingness to perform CPR, and then seek countermeasures to improve civil servants' willingness to implement CPR.

Methods: We introduced the theory of perceived risk into the theory of planned behavior, developed a 7-point Likert scale based on the extended theory of planned behavior, and conducted a questionnaire survey on civil servants in Chongqing, China. Descriptive statistical analysis and one-way ANOVA were employed to explore respondents' willingness and differences. Structural equation modeling was used to analyze the relationship between attitude, subjective norm, perceived behavioral control and perceived risk and respondents' willingness to implement CPR.

Results: A total of 1235 valid questionnaires were included for analysis. 50.1 % of respondents were willing to implement CPR. Male, over 40 years old, living with the elderly, having previous experience performing CPR on another person, and having higher CPR knowledge scores were associated with a more positive willingness to perform CPR. Attitude, subjective norm and perceived behavioral control had significant positive effects on willingness, and the standardized regression coefficients were 0.164, 0.326 and 0.313, respectively. The perceived risk has a significant negative effect on willingness, and the standardized regression coefficient was -0.109 . The four latent variables accounted for 44.2 % of the variance in the willingness of civil servants to implement CPR.

Conclusions: The willingness of civil servants in Chongqing to implement CPR needs to be improved, and the countermeasures to enhance the subjective norm and perceived behavioral control of civil servants should be emphasized, such as developing a social support network for rescuing conduct, establishing regular training mechanisms and improving the practical

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applicability and popularization of the Chinese-style "Good Samaritan Law" etc., to improve the willingness of civil servants in Chongqing to implement CPR.

1. Introduction

Out-of-hospital cardiac arrest (OHCA) is the leading cause of death worldwide, defined as the loss of functional cardiac mechanical activity in association with an absence of systemic circulation [1]. In China, about 1.03 million people develop OHCA each year, and the survival rate of OHCA patients discharged from the hospital is only 1.15 % [2]. The best rescue time for patients with cardiac arrest is within 4 mins [3], timely initiation of Cardiopulmonary Resuscitation (CPR) improves patient survival and long-term outcomes [4]. However, it takes 5–8 mins for emergency medical services (EMS) to arrive [5]. Therefore, bystanders at the scene are an important force in providing timely CPR until EMS arrives. Bystander CPR is a life-saving technique that involves early identification of OHCA, initiation of chest compressions, mouth-to-mouth ventilation, and early electrical defibrillation before the arrival of EMS [6]. A meta-analysis noted that the 1-year survival rate for OHCA patients who received bystander CPR was 12.3 % [7]. Fordyce reviewed 8269 OHCA events and found that patients who received bystander CPR and defibrillation in public settings were more likely to survive and have a favorable neurological outcome, with an OR(Odds Ratio) of 4.46 [8]. Despite the fact that bystander CPR improves survival and prognosis quality for OHCA patients, its actual prevalence is modest. The global bystander CPR rate was about 44.8 % [9], and only 17 % of bystanders in the 7 geographic regions of China performed CPR [10]. To increase patient survival and lower the burden of OHCA disease, it is crucial to explore ways for better bystander CPR implementation.

According to some behavioral theories, for difficult-to-execute behaviors, such as bystander CPR, it makes more sense to study dispositional predictors of behavior, such as behavioral intentions, than actual behavior [11]. The 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiovascular Care (ECC) first introduced a "training and implementation" approach, placing equal importance on improving the willingness of bystanders to perform CPR as they do on acquiring the skills to do so [12]. Some cross-sectional findings indicate that less than 50 % of high school students are willing to provide CPR [13], only 34.1 % of college students are willing to provide CPR to strangers [14], and the public is less likely to perform CPR on strangers [15]. Overall, bystander's awareness of CPR is low, and more research is needed to fully understand the malleable mechanisms that influence the willingness of bystanders to perform CPR.

In the current research on the factors influencing bystanders' CPR willingness, some scholars have explored the effects of socio-demographic characteristics, such as gender [16], age [17], education [18] and ethnicity [19] on willingness. However, these individual objective attribute factors are difficult to change. Further, scholars have analyzed the influence of other contextual factors such as knowledge of performing CPR and previous CPR experience on an individual's willingness to perform CPR [20,21]. Interventions such as education and training can help increase an individual's willingness to perform CPR. However, the specific path of their effect on individuals' willingness to perform CPR is still unclear. To encourage people to perform CPR voluntarily, it is still necessary to study the deeper psychological motivational factors and clarify the psychological path of their effect on behavior and behavioral facilitation mechanism. The theory of planned behavior (TPB) states that an individual's willingness to behave is the best indicator of their propensity to perform a particular behavior, and all variables that may influence behavior can act on it by influencing their willingness to behave [22]. TPB has been successfully applied to the field of pro-social behaviors, such as understanding the mechanisms that enable behaviors such as blood donation, organ donation, and volunteering participation [23–25]. Bystander CPR is pro-social and altruistic conduct to promote the welfare of others. Researchers such as Vaillancourt [26], Mao [14] and Zhou [27] have employed TPB to explore the willingness of the old population, college students, and medical students to perform CPR, constructing a theoretical model of willingness-centered bystander CPR. These TPB-based studies of bystanders' willingness to perform CPR, however, currently lack well-established scales, which makes it difficult to standardize the assessment of behavioral willingness and the intensity of each contributing factor. Furthermore, individual perceived risk considerations, such as bystander concerns about the unfavorable effects of rescue conduct, such as legal disputes [18], disease transmission [28] and social opinion [29] on behavioral willingness, are not included in the original TPB model. Therefore, it is necessary to broaden the dimensions of affecting factors and to explain the routes between elements in order to gain a deeper knowledge of the willingness to implement CPR.

Civil servants are those who perform public duties, whose salaries and benefits are provided by the state treasury and are integrated into the state administration system [30]. The professional characteristics of civil servants require a strong sense of social responsibility [31] and altruistic motivation [32]. Civil servants are also a group with a high commitment to the public interest [33]. High commitment and altruism motivate civil servants to tend to perform more altruistic behaviors [34]. Therefore, Civil servants are a crucial group potentially highly likely to effectively implement bystander CPR. The findings of Zheng [35] et al. showed that 91.9 % of civil servants believed that they should be rescuers more than the general public. Chongqing Municipality is located in the relatively impoverished western region of China, with a relative lack of EMS resources, and the predominantly mountainous terrain increases prehospital time and reduces the spatial accessibility of prehospital emergency services [36]. Mutual aid and public self-rescue are therefore especially crucial. Exploring the current situation of civil servants' willingness to implement CPR and its influencing factors in Chongqing, and seeking countermeasures to improve civil servants' willingness to implement CPR, which will help to take the lead in forming a team of civil servants who are skilled in CPR and foster a positive social environment for public self-rescue and mutual aid.

The present study contributes to advancing and extending previous studies in numerous ways. Firstly, we expanded the original TPB model to include perceived risk factors, which helps to deepen the understanding of bystanders' willingness to implement CPR. Second, we developed a standardized scale based on the expanded TPB model, which can be widely used for the standardized

measurement of bystanders' willingness to perform CPR and their influencing factors. Third, we analyzed the antecedent variables that may affect the variables of the extended TPB model to propose more targeted strategies to improve CPR implementation willingness. Finally, for the first time, we explored the CPR implementation willingness of civil servants to clarify their willingness and drivers, which can help to promote the process of first aid volunteerization.

2. Theories and hypotheses development

2.1. Theoretical backgrounds

TPB was proposed by American scholar Ajzen in 1991 and has been widely used to understand a broad spectrum of health behaviors and pro-social behaviors. Its effectiveness is well supported by empirical evidence. According to Ajzen, behavioral intention (INT) is a key determinant of behavioral performance, which is determined by three variables: attitudes (positive or negative evaluations of the behavior), subjective norm (social pressures to perform the behavior), and perceived behavioral control (an assessment of the ability to perform the particular behavior) [22]. Previous studies have shown that the more positive an individual's attitude toward a behavior, the more positive their subjective norms, and the greater their perceived behavioral control, the greater their intention to perform a behavior [37–39]. TPB is an expansive theoretical model, and researchers can add variables to improve the predictive power of the model [22].

2.2. Expanded TPB and research hypotheses

Attitude (ATT) is the positive or negative assessment that a person gives to a particular behavior, measured from his or her point of view [22]. According to TPB, attitude is a positive predictor of behavioral intention. Mugion [40] and Zhang [41] et al. explored the determinants of citizens' blood donation and garbage sorting behaviors based on TPB, and both pointed out that attitude has a positive influence on behavioral intention. When it comes to bystander CPR, a person may be more inclined to assist if they feel more subjectively that bystander CPR played a significant role in the patient's lifesaving and that performing bystander CPR will increase their sense of social value. In a study on college students' willingness to perform CPR, Magid [42] found that attitude was the strongest predictor of CPR willingness. So, we developed Hypothesis 1.

H1. ATT toward bystander CPR would have a positive effect on the willingness to perform CPR.

Subjective norm (SN) refers to the social pressures that individuals feel about whether or not to adopt a particular behavior [22]. Ajzen notes that subjective norm has a positive effect on behavioral intention. Wu [43] and Rochelle [44] et al., identified factors affecting volunteers' willingness to participate in mobile population health volunteering, and the public's willingness to engage in organ donation, and both noted that subjective norm has a positive impact on behavioral intention. When it comes to bystander CPR, the more someone perceives the support of significant others in performing CPR, the more likely he or she is to be driven by this mental strength and be inclined to provide CPR to the patient. Xia [45] investigated the willingness of nursing practitioners to perform CPR outside of the hospital and found that subjective norm was a strong predictor of willingness to behave. So, we developed Hypothesis 2.

H2. SN toward bystander CPR would have a positive effect on the willingness to perform CPR.

Perceived behavioral control (PBC) is an individual's judgment and evaluation of his or her ability to perform a particular behavior or cope with a difficult situation [22]. An individual is generally more likely to engage in a behavior if they believe they have a greater sense of control over that behavior. White [46] analyzed the psychological drivers behind influencing people to make charitable decisions and showed that perceived behavioral control was most closely related to behavioral intention. When it comes to bystander CPR, bystanders are more likely to spontaneously provide CPR if they feel confident in performing it. So, we developed Hypothesis 3.

H3. PBC toward bystander CPR would have a positive effect on the willingness to perform CPR.

Perceived risk theory (PRT) was originally designed to understand purchasing behavior, defined as the combination of uncertainty and severity of consequences [47] as well as the expected loss associated with a purchase, and as a disincentive to purchase behavior [48]. Perceived risk (PR) is defined in this study as bystanders' subjective expectation of the loss they might experience while performing CPR and as a deterrent to performing CPR. According to Cunningham and Featherman [49], perceived risks include performance risk, financial risk, time risk, safety risk, psychological risk, social risk, and privacy risk. Typically, researchers include different risk variables as needed. Among the perceived risk factors affecting bystanders' willingness to perform CPR, concerns about legal disputes, disease transmission, and social opinion correspond to financial, safety, and social risks, respectively. We then develop Hypothesis 4 in light of this.

H4. PR toward bystander CPR would have a negative effect on the willingness to perform CPR.

According to TPB, behavioral intention is the direct antecedent of behavior, while some external variables, such as socio-demographics, the environment in which individuals live, and individual experience, may indirectly affect behavioral intention and ultimately behavior by influencing various elements such as behavioral attitude and subjective norm [50]. The present study focused on the effects of the environment in which individuals live and the individuals' prior CPR experiences on the willingness of bystanders to perform CPR. We then develop Hypothesis 5 in light of this.

H5. Personal characteristics, personal environment and previous CPR experience have impacts on bystanders’ willingness to perform CPR.

Based on the above analysis, we constructed a theoretical framework for our study (Fig. 1).

3. Materials and methods

3.1. Study design

Cluster sampling was adopted in this study. With the coordination of the Chongqing Municipal Health Commission and the informed consent of the investigation units and subjects, the investigators conducted a unified questionnaire survey of civil servants in 37 municipal-level directly affiliated organizational units in Chongqing Municipal Municipality. The questionnaire was filled out online by scanning the QR(Quick Response) code, and an account was only allowed to fill it out once.

3.2. Participants

The study included 1272 civil servants in 37 municipal government agencies in Chongqing. Excluding the civil servants who returned invalid questionnaires (incomplete answers, inconsistencies, and answers lower than 2 mins were counted as invalid questionnaires), a total of 1235 civil servants were finally included for analysis.

3.3. Questionnaire

In this study, a structured decision-making approach was adopted to develop the scale, that is, the scale was constructed through the interactive work form of the core working group and the issue group. The core working group is composed of key researchers. The issue group consisted of volunteers and secondary researchers, including 20 civil servants and 3 experts (a professor of statistics, a professor of social psychology, and an expert in related fields of Chongqing Municipal Health Commission). According to the theoretical framework established in the early stage of this study, the core working group established the initial scale through literature research. Then, 20 civil servants were invited to test the initial scale and revised it for the first time according to their opinions. Then, three experts from the issue group scored each item on the scale from the aspects of formal validity, content validity and readability. According to the score, the core working group revised item by item to form the final scale.

The questionnaire for the present study consisted of three parts: basic information about the participants, a test of participants’ CPR knowledge, and the Expanded TPB-based CPR Implementation Willingness Scale for Civil Servants (Supplementary Materials).

- (1) Basic information about the participants, including gender, age, education level, whether they live with an elderly person, whether they have encountered situations where others needed CPR, whether they have performed CPR on someone else, and previous CPR training experience.
- (2) A test of participants’ CPR knowledge, including 8 CPR-related questions. For every right response, one point was given, for a maximum of eight points. A score of five or higher was considered to be a strong CPR knowledge score.
- (3) The Expanded TPB-based CPR Implementation Willingness Scale for Civil Servants, including 15 measurement items, 3 for attitude [26], 3 for subjective norm [51], 3 for perceived behavioral control [26], 3 for perceived risk [52] and 3 for CPR implementation willingness [53]. The scale was in the form of a 7-point Likert scale, with response options ranging from "very disagree" (1 point) to "very agree" (7 points) for each entry. A score of 6 or higher suggests a willingness to implement CPR. The Cronbach’s α coefficient of the scale was 0.814, among which ATT was 0.885, SN was 0.925, PBC was 0.890, PR was 0.787, and

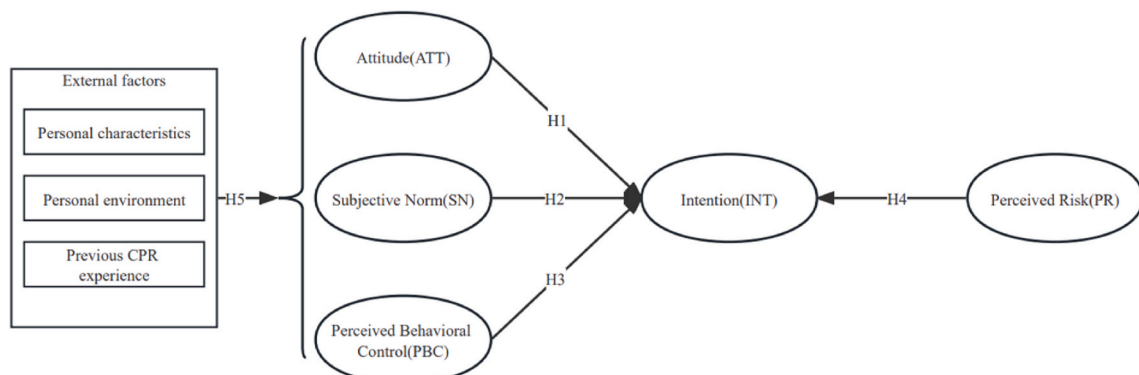


Fig. 1. The theoretical framework of study.

INT was 0.808. The KMO(Kaiser-Meyer-Olkin) value was 0.838($P < 0.05$). The reliability and validity of the scale are good, and it can effectively measure the relevant latent variables.

4. Statistical analysis

We conducted the statistical analysis using SPSS (version 26.0, Win) and Amos (version 26.0, Win). First, the results of participants' basic information and the Expanded TPB-based CPR Implementation Willingness Scale for Civil Servants were descriptively examined, and Cronbach's α coefficient and KMO value of the questionnaire were calculated. Second, one-way ANOVA was conducted on the scores of the extended TPB variables of different participant subgroups to test the influence of external factors such as personal environment and previous CPR experience on the willingness of civil servants to perform CPR and other Expanded TPB variables (H5). Finally, structural equation model (SEM) was adopted to test the research hypothesis1-4. The measurement model, which assesses how well each measurement item characterizes the corresponding latent variable, and the structural model, which assesses the link between the latent variables, make up SEM. Confirmatory factor analysis (CFA) was utilized to test the reliability and validity of the measurement model. SEM was constructed by Maximum likelihood estimation (ML), and hypothesis testing was conducted to examine the association between latent variables in the extended TPB model. Statistical significance was defined as $P < 0.05$.

5. Results

5.1. Basic information and CPR knowledge of participants

According to Table 1, out of 1235 civil servants, 584 (47.3 %) were men and 651 (52.7 %) were women. The average age of the participants was $38.5(\pm 9.13)$ years old, with the majority of them being under 40 years old (60.3 %). The majority of them (84.5 %) had a bachelor's degree or higher. 46.6 % of the respondents were living with the elderly. 6.9 % of the respondents had encountered a situation where someone else needed CPR, and just 2.1 % (26 individuals) had performed CPR on others. Only 21.5 % of the participants had previously participated in CPR training. Only 20.8 % of the participants had relatively high CPR knowledge scores (scores ≥ 5). Respondents who had previously received CPR training had greater CPR knowledge scores than those who had not, with 38.3 % of them scoring ≥ 5 ($P < 0.001$).

5.2. Participants' willingness to perform CPR and predictors

The mean score of respondents' willingness to implement CPR was 5.64 ± 1.22 , ranging from 1 to 7. 50.1 % of respondents were willing to implement bystander CPR; 78.9 % of respondents were willing to implement CPR to acquaintances (colleagues, friends, etc.) and 48.6 % respondents were willing to implement CPR to strangers. The results of other latent variables in the extended TPB scale were as follows: ATT scored the highest (mean score 6.65 ± 0.98 , range 1–7); followed by SN (mean score 5.99 ± 1.38 , range 1–7). The measurement results of the extended TPB variables are shown in Table 2.

5.3. Participants' characteristics and differences in the extended TPB variables scores

According to the participants' characteristics, one-way ANOVA was performed(Table 3). The results showed that male, over 40 years old, living with the elderly, having previous experience performing CPR on another person, and having higher CPR knowledge scores were associated with a more positive willingness to perform CPR.

The other TPB variables were analyzed and the results indicated that participants who were male, over 40 years old, and living with

Table 1
Basic information and CPR knowledge of participants.

Variables	Group	Frequency (%)
Gender	Male	584(47.3)
	Female	651(52.7)
Age (years old)	< 40	745(60.3)
	≥ 40	490(39.7)
Education level	College degree or below	191(15.5)
	Bachelor's degree or above	1044(84.5)
Whether they live with an elderly person	Yes	575(46.6)
	No	660(53.4)
Whether they have encountered situations where others needed CPR	Yes	85(6.9)
	No	1150(93.1)
Whether they have performed CPR on someone else	Yes	26(2.1)
	No	1209(97.9)
Previous CPR training experience	Yes	266(21.5)
	No	969(78.5)
CPR knowledge (point)	≤ 4	978(79.2)
	≥ 5	257(20.8)

Table 2
The extended TPB variables measurement results.

Variables	$\bar{X} \pm SD$	Score $\geq 6, n(\%)$
ATT	6.65 \pm 0.98	1127(91.3)
CPR is valuable(ATT1)	6.72 \pm 0.97	1150(93.1)
CPR is important(ATT2)	6.64 \pm 1.12	1139(92.2)
Will be Satisfied(ATT3)	6.60 \pm 1.17	1121(90.8)
SN	5.99 \pm 1.38	812(65.7)
Family support(SN1)	5.93 \pm 1.57	855(69.2)
Colleague/friend support(SN2)	5.95 \pm 1.50	848(68.7)
The mainstream social values support(SN3)	6.09 \pm 1.37	901(73.0)
PBC	4.57 \pm 1.84	374(30.3)
Identify patients who need CPR(PBC1)	4.26 \pm 2.05	370(30.0)
Feel confident about performing CPR(PBC2)	4.20 \pm 2.15	394(31.9)
Feel confident about performing CPR with 120 doctors' telephone guidance(PBC3)	5.25 \pm 1.87	636(51.5)
PR	5.04 \pm 1.45	419(33.9)
Fear of legal disputes(PR1)	5.30 \pm 1.65	610(49.4)
Fear of contagious disease(PR2)	4.74 \pm 1.78	443(35.9)
Fear of public opinion(PR3)	5.08 \pm 1.78	561(45.4)
INT	5.64 \pm 1.22	619(50.1)
Perform CPR for everyone(INT1)	5.37 \pm 1.58	610(49.4)
Perform CPR on acquaintances(INT2)	6.28 \pm 1.10	975(78.9)
Perform CPR on strangers(INT3)	5.29 \pm 1.58	600(48.6)

NOTE: \bar{X} : Mean; SD: Standard deviation.

Table 3
Differences in participants with different characteristics and expanded TPB variables.

Variables	Score of ATT ($\bar{X} \pm SD$)	Score of SN ($\bar{X} \pm SD$)	Score of PBC ($\bar{X} \pm SD$)	Score of PR ($\bar{X} \pm SD$)	Score of INT ($\bar{X} \pm SD$)
Gender					
Male	6.67 \pm 0.96	6.15 \pm 1.34	4.91 \pm 1.74	4.88 \pm 1.59	5.76 \pm 1.24
Female	6.64 \pm 1.01	5.85 \pm 1.40	4.27 \pm 1.81	5.18 \pm 1.30	5.55 \pm 1.20
P-value	0.648	0.000	0.000	0.000	0.003
Age(years old)					
< 40	6.65 \pm 0.99	5.89 \pm 1.44	4.36 \pm 1.82	5.05 \pm 1.42	5.54 \pm 1.23
\geq 40	6.65 \pm 0.97	6.14 \pm 1.28	4.88 \pm 1.81	5.03 \pm 1.50	5.80 \pm 1.20
P-value	0.985	0.003	0.000	0.770	0.000
Education level					
College degree or below	6.58 \pm 1.00	6.06 \pm 1.32	5.08 \pm 1.66	4.71 \pm 1.71	5.81 \pm 1.24
Bachelor's degree or above	6.67 \pm 0.98	5.98 \pm 1.40	4.48 \pm 1.85	5.10 \pm 1.39	5.62 \pm 1.22
P-value	0.235	0.447	0.000	0.001	0.047
Whether they live with an elderly person					
Yes	6.68 \pm 1.00	6.08 \pm 1.31	4.55 \pm 1.82	5.09 \pm 1.38	5.72 \pm 1.15
No	6.63 \pm 0.97	5.91 \pm 1.44	4.58 \pm 1.85	5.00 \pm 1.52	5.58 \pm 1.28
P-value	0.447	0.033	0.752	0.310	0.040
Whether they have encountered situations where others needed CPR					
Yes	6.61 \pm 1.01	6.07 \pm 1.32	5.22 \pm 1.71	4.89 \pm 1.56	5.81 \pm 1.18
No	6.66 \pm 0.98	5.98 \pm 1.39	4.52 \pm 1.84	5.05 \pm 1.45	5.63 \pm 1.22
P-value	0.656	0.565	0.001	0.335	0.197
Whether they have performed CPR on someone else					
Yes	6.58 \pm 1.36	6.19 \pm 1.55	5.76 \pm 1.93	4.76 \pm 1.49	6.19 \pm 1.24
No	6.66 \pm 0.98	5.99 \pm 1.38	4.54 \pm 1.83	5.05 \pm 1.45	5.63 \pm 1.22
P-value	0.688	0.454	0.001	0.314	0.021
Previous CPR training experience					
Yes	6.57 \pm 1.17	5.93 \pm 1.41	5.12 \pm 1.66	4.74 \pm 1.60	5.71 \pm 1.22
No	6.68 \pm 0.93	6.01 \pm 1.38	4.42 \pm 1.85	5.12 \pm 1.40	5.63 \pm 1.22
P-value	0.113	0.445	0.000	0.000	0.307
CPR knowledge(point)					
\leq 4	6.67 \pm 0.95	6.00 \pm 1.39	4.47 \pm 1.84	5.12 \pm 1.43	5.61 \pm 1.23
\geq 5	6.61 \pm 1.09	5.97 \pm 1.38	4.96 \pm 1.75	4.73 \pm 1.51	5.79 \pm 1.20
P-value	0.406	0.747	0.000	0.000	0.040

NOTE : \bar{X} : Mean; SD: Standard deviation.

the elderly had higher subjective norm scores; participants who were male, over 40 years old, college degree or below, had experienced CPR training, had performed CPR on another person, and had higher CPR knowledge scores related higher perceived behavioral control scores; participants who were male, college degree or below, had CPR training experience, and had higher CPR knowledge scores related lower perceived risk.

5.4. Measurement model, reliability and validity

Confirmatory factor analysis was conducted to assess the reliability and validity of the measurement model and to validate the structure between the items and constructs in the scale. The measurement model's reliability and convergent validity were evaluated in this study by calculating factor loadings, composite reliability (CR), and the average variance extracted (AVE). As presented in Table 4, all of the CRs and AVEs were greater than 0.6 and 0.5, respectively. The CRs vary from 0.790 to 0.930 and the AVEs from 0.558 to 0.818. The construction of the measurement model was both reliable and convergent. Additionally, there was good discriminant validity between the latent variables in the measurement model, as shown by Table 5's square roots of the AVE values all exceeding the correlation coefficients between the latent variables. The latent variables were well-characterized by the measurement items in our well-constructed measurement model, which has a high degree of validity and reliability.

5.5. Structural equation model and hypothesis testing

The structural equation model was fully constructed to test the hypotheses 1-4. The goodness of fit of the model was: $\chi^2 = 110.809$, $\chi^2/df = 1.385$, TLI = 0.996, CFI = 0.997, RMSEA = 0.018, SRMR = 0.044. The results of hypothesis testing are shown in Table 6 and Fig. 2, which support hypotheses 1-4, that is, ATT, SN and PBC have significant positive effects on willingness, and the standardized regression coefficients are 0.164, 0.326 and 0.313, respectively. The PR has a significant negative effect on willingness, the standardized regression coefficient is -0.109. The four latent variables accounted for 44.2% ($R^2 = 0.442$) of the variance of civil servants' willingness to implement CPR. Among them, SN has the largest predictive effect on civil servants' willingness to implement CPR, followed by PBC.

6. Discussion

This study conducted a cross-sectional survey of civil servants' willingness to implement CPR and contributing factors in Chongqing, the largest municipality in China. A scale based on the extended TPB model was used as the measurement tool. Results showed that 50.1% of civil servants in Chongqing were willing to provide bystander CPR, which was higher than the implementation willingness of the general public in China (21.2%) [54], but lower than that of Chinese healthcare workers (73.9%) [55]. Civil servants have a strong sense of volunteerism and are dedicated to supporting different levels of volunteering [56], and their first aid literacy is higher than that of the general public [57], which makes them more inclined to perform bystander CPR. Nonetheless, compared to healthcare workers, their willingness to perform CPR was lower, possibly due to a lack of confidence in the CPR technique. SEM results indicated that attitude, subjective norm, and perceived behavioral control had significant positive effects on civil servants' willingness to implement CPR, while perceived risk had a significant negative effect.

Subjective norm was the strongest predictor of civil servants' willingness to implement CPR (H2), which is consistent with the findings of Ye [58] on civil servants' emergency response behaviors in the face of an epidemic. Among the subjective norms, the

Table 4
Composite reliability and convergent validity.

Scale items	Factor Loadings	P-Value	CR	AVE
ATT				
ATT1	0.793	0.000	0.889	0.729
ATT2	0.929	0.000		
ATT3	0.834	0.000		
SN				
SN1	0.937	0.000	0.930	0.818
SN2	0.971	0.000		
SN3	0.796	0.000		
PBC				
PBC1	0.867	0.000	0.894	0.737
PBC2	0.904	0.000		
PBC3	0.802	0.000		
PR				
PR1	0.767	0.000	0.790	0.558
PR2	0.655	0.000		
PR3	0.811	0.000		
INT				
INT1	0.765	0.000	0.821	0.606
INT2	0.728	0.000		
NT3	0.838	0.000		

Table 5
Discriminant validity.

Constructs	ATT	SN	PBC	PR	INT
ATT	0.854				
SN	0.486	0.904			
PBC	0.298	0.468	0.858		
PR	0.029	-0.172	-0.156	0.747	
INT	0.412	0.570	0.531	-0.209	0.778

Note : The diagonal bold text is the open root value of AVE, and the lower triangle is the Pearson correlation of the latent variables.

Table 6
Hypothesis testing results.

Hypothesis	Path	Path coefficient	P-Value	Result
H1	ATT→INT	0.164	0.000	Supported
H2	SN→INT	0.326	0.000	Supported
H3	PBC→INT	0.313	0.000	Supported
H4	PR→INT	-0.109	0.000	Supported

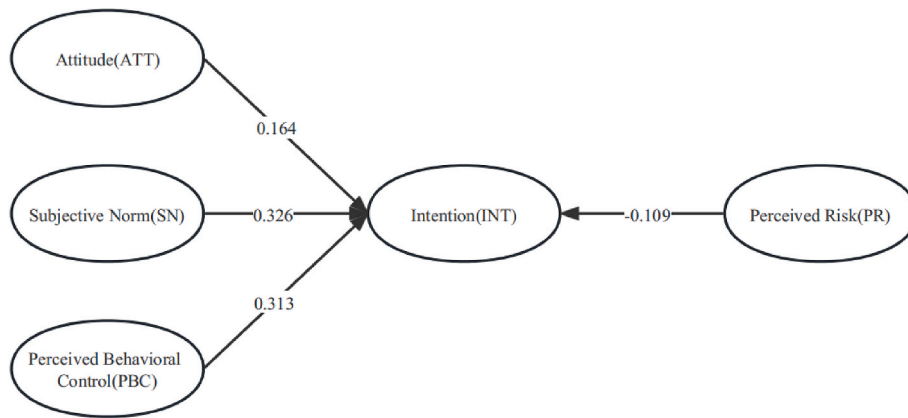


Fig. 2. Standardization results of structural equation modeling.

requirement of mainstream social values scored the highest. Mainstream social values are the centralized expression of social value orientation, and according to the role of civil servants as social managers, leading social trends and exemplary compliance with social norms are the obligations that civil servants should fulfill [59]. As per Zheng’s findings [60], a civil servant’s willingness to encourage a behavior increases with their perception of the conduct’s social expectations. Civil servants internalize social norms and values during their long-term practice. These internalized norms and values are the foundation of their helping behavior [61]. Family members, friends, and coworkers’ attitudes and actions regarding helping behaviors can also act as catalysts, encouraging people to engage in helping behaviors [61]. In particular, under the Chinese Confucian culture, individuals tend to consider the perceptions of acquaintances such as family members and colleagues when performing particular behaviors [62]. Therefore, subjective norm may have a greater effect on civil servants’ behavioral intentions. The analysis of variance between participant characteristics and the extended TPB variables revealed a positive correlation between higher subjective norm scores and living with an elderly person. According to previous studies, the average age of OHCA patients in China is 67.35 years old and the senior population has a high frequency of OHCA, with the majority of OHCA cases occurring at home or in residence [2]. Civil servants living with the elderly were more likely to perceive rescue behavioral norms when presupposing OHCA scenarios, and were driven by this mental strength to be more willing to help the patient when witnessing OHCA. This suggests that to increase civil servants’ willingness to perform CPR, we should focus on how to enhance civil servants’ perceived supportive beliefs about rescuing behaviors from significant others and mainstream social values.

Perceived behavioral control is another factor that has a significant impact on civil servants’ willingness to implement CPR (H3). Only 30.3 % of respondents in this survey, reported a strong sense of perceived control, 69.1 % of civil servants expressed a lack of confidence in their ability to perform CPR independently, and only 30.0 % reported being able to recognize patients in need of CPR. Firstly, ignorance of knowledge of first aid and lack of confidence in first aid skills are barriers to an individual’s willingness to provide CPR in an emergency [63]. The results of this study showed that only 20.8 % of the civil servants obtained higher CPR knowledge scores. CPR training is the primary method to improve the level of knowledge and skills. However, the coverage of CPR training in China is not extensive [64], and only 21.5 % of civil servants in this study had undergone CPR training. Therefore, in order to improve

the CPR knowledge and abilities of civil servants, the Chinese government ought to consider expanding CPR training and exploring CPR training mechanisms. Second, personal experience affects perceived behavioral control. The results of this study showed that respondents who had previously encountered others in need of CPR, had performed CPR on someone else, and had CPR training experience reported stronger perceived behavioral control. Individuals who have experienced CPR firsthand are better equipped to retain CPR knowledge. Furthermore, the majority of the rescuers found performing CPR to be a positive experience and would be willing to perform CPR again [65]. This suggests that a scenario-setting approach may bring better effects during training civil servants. Finally, during emergencies, bystanders are under stress and frequently distracted by the patient's hazardous circumstances, which makes it challenging to concentrate on independent rescue [66]. Studies have indicated that providing bystanders with professional guidance over the telephone increases the rate of spontaneous CPR implementation by bystanders [67]. The current study found that if participants received telephone guidance, their confidence scores in conducting CPR increased from 4.20 ± 2.15 to 5.25 ± 1.87 . Therefore, telephone-guided bystander CPR should be developed and promoted to boost the rescuer's confidence.

Although the score of ATT (H1) is relatively high (6.65 ± 0.98), it only explains the slight difference in the willingness to implement CPR. According to previous findings, attitude is the strongest predictor of students' willingness to perform CPR [42]. Such a difference may stem from the generally higher education level of the civil servants in this study, with 84.5 % having a bachelor's degree or above, coupled with a higher level of first aid literacy among civil servants [57], resulting in a relatively positive attitude toward bystander CPR. On the other hand, it may also be related to the particularity of the profession of civil servants. Civil servants are willing to make self-sacrifices for the benefit of the public and not for their own benefit [58]. Therefore, civil servants generally show a positive attitude towards bystander CPR, believing that bystander CPR is important and valuable and that there is a sense of accomplishment in saving lives by implementing CPR. In this context, attitude may not be the most important factor influencing willingness. Considering the positive attitude of civil servants towards bystander CPR, future work on first aid socialization can explore how to develop civil servant first aid volunteer teams, establish appropriate mechanisms for civil servant first aid volunteering, and then improve the level of first aid socialization and volunteerism.

The various risks perceived by the respondents in the process of implementing CPR have a significant negative impact on the willingness to implement(H4). Among the three perceived risks, civil servants are more concerned about the negative consequences (legal disputes, public opinion) than about their own harm (contagion risk). The general impression and evaluation of the individual behavior of civil servants will constitute a personified government credit [68]. In actuality, due to the special nature of their work, civil servants face more scrutiny from public opinion. Furthermore, China is experiencing a fast social transformation, and the public's expectation of civil servants' ability to govern is growing [69]. Considering that legal disputes and negative social opinions may reduce public trust and worsen their professional image and reputation, civil servants may be less willing to implement CPR. On January 1, 2021, the Civil Code of the People's Republic of China officially came into effect, which stipulates that if the recipient is harmed by the voluntary emergency relief act, the salvor shall not bear civil liability. This is the Chinese-style "Good Samaritan laws", which helps to change the indifference of bystanders who "want to save but dare not save" to some extent.

Finally, among the participants' socio-demographic characteristics, gender and age were also influential factors in the willingness to implement CPR. The willingness of male civil servants was stronger than that of female civil servants, which is consistent with the results of Huang [70] et al. There could be some psychological and social components to this. For example, women may be more lacking in courage to perform CPR [71]. Some studies have shown that women are more reluctant to perform mouth-to-mouth ventilation [72,73], which may also be another barrier to performing CPR in women. The willingness of civil servants aged under 40 was significantly lower than that of civil servants aged ≥ 40 . Since the older civil servants have more life and practice experience, they may be more composed in emergencies. This experience and maturity may make civil servants more confident in dealing with emergencies such as OHCA. Long-term experience also tends to provide senior civil servants with a stronger knowledge of social responsibility, a greater appreciation for public welfare, and a willingness to actively participate in emergency assistance.

7. Conclusions and suggestions

7.1. Conclusions

Improving the willingness of civil servants to implement CPR is conducive to increasing the actual implementation rate of bystander CPR. This study is the first study to explore the willingness of civil servants to implement CPR in China. We introduced the theory of perceived risk into the theory of planned behavior, constructed an extended TPB, and verified the effectiveness of this extended TPB theoretical model in explaining civil servants' willingness to implement CPR through SEM. The willingness of civil servants to perform CPR was positively impacted by attitude, subjective norm, and perceived behavioral control; while perceived risk negatively impacted willingness. Subjective norm was the most powerful predictor of all of these. Based on these findings, in future research, we can consider conducting intervention studies in the areas of attitude, subjective norm, perceived behavioral control and perceived risk, with an emphasis on the need to develop a social support network for bystander CPR and establish a CPR training mechanism for civil servants, etc., then enhance civil servants' perceived supportive beliefs about rescue behaviors from significant others and the mainstream values of society as well as their confidence in implementing bystander CPR.

7.2. Suggestions

To improve the willingness of civil servants to implement CPR, practice strategies that should be considered in focus include the following: Firstly, developing a social support network for rescuing conduct. In daily health education and the annual "China CPR

Week" propaganda and education activities, various forms of CPR publicity activities can be carried out by fully combining traditional media such as television and radio and new media such as Weibo, WeChat and TikTok, strengthening the publicity of the importance of bystander CPR and the socialization vision of first aid, so as to enhance the public's awareness of voluntary bystander CPR and form a social consensus and norms for bystander CPR. Then, the availability of social first aid resources, such as community first aid stations and automated external defibrillators (AEDs), should be guaranteed, as well as public awareness of information on these social first aid resources, in order to enhance material and information support for rescue behaviors. Furthermore, significant others around the civil servants can be included in the intervention, e.g., utilizing peer-modeled and family-modeled media campaigns to increase the emotional support of the civil servants' family and peers for rescuing behavior.

Secondly, enhancing perceived behavioral control and civil servants' confidence in implementing bystander CPR. Mechanisms for regular training of civil servants in CPR should be instituted. According to the training interval recommended by the American Heart Association, CPR training for civil servants can be conducted every 1–2 years. During the training process, the method of scenario setting should be fully utilized to allow trainees to role-play and practice their skills. Then, telephone and video-guided bystander CPR techniques should be developed and promoted to improve civil servants' confidence in performing CPR.

Finally, improving the practical applicability and popularization of the Chinese-style "Good Samaritan Law". Introducing more detailed and operational legal provisions on exemption from liability for public first aid, and using various judicial interpretations to enhance the applicability of the Chinese-style "Good Samaritan Law" and then protecting legitimate rights and interests of rescuers. In addition, various media intermediaries need to be utilized to conduct legal literacy campaigns to promote a positive public perception of bystander rescue behaviors, to reduce bystanders' concerns about legal disputes, and then to improve civil servants' willingness to implement CPR.

8. Limitations

The present study has several limitations. First, the explanatory power of our theoretical model for CPR implementation willingness in this study was 44.2 %, which still has the potential to be improved. We still need to further explore more predictors of CPR implementation willingness. Therefore, future studies could continue to integrate more independent variables, such as descriptive norms, self-efficacy and personal moral norms [25,74], or look for theoretical models that cover more independent variables, such as the integrated behavioral model, in order to improve the predictive power of bystanders' willingness to implement CPR. Second, measuring the actual bystander CPR rate is a major challenge, and this study only measured CPR implementation willingness. However, there is a gap between behavioral willingness and behavior. Future research could explore how to measure actual CPR behaviors and utilize theories that may close the "intention-behavior gap", such as the temporal self-regulation theory [75], in order to improve bystander CPR rates. Finally, this study only measured the willingness of well-educated civil servants, so the findings cannot be generalized to other populations. In future studies, we will cover population samples of all populations, which will help to report universal conclusions.

Data availability statement

Data will be made available upon request made to the principal investigator, Dr. Yan Zhang (zhangyan@cqmu.edu.cn). Data associated with this study has not been deposited into a publicly available repository, because data included in article/supp. material/ referenced in article.

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Ethics declarations

This study was reviewed and approved by the Ethics Committee of ChongQing Medical University, with the approval number: 2021017. All participants/patients (or their proxies/legal guardians) provided informed consent to participate in the study.

CRedit authorship contribution statement

Ying Chen: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Huixian Zhou:** Data curation, Methodology, Writing – original draft. **Chuan Pu:** Conceptualization, Project administration, Supervision. **Feng Chen:** Project administration, Supervision, Investigation. **Dianguo Xing:** Conceptualization, Project administration, Resources, Supervision. **Jiani Mao:** Data curation, Investigation, Writing – original draft. **Ling Jia:** Investigation, Writing – original draft. **Yan Zhang:** Supervision, Validation, Writing – original draft, Writing – review & editing, Project administration, Resources.

Declaration of competing interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e29803>.

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