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Research Article

Willingness to Pay in Choosing Pre-hospital Emergency Services in Iran: A Population-Based Discrete Choice Experiment

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Abstract

Providing pre-hospital emergency services is accessible in Iran but costly for the country's health system. This study calculated the willingness to pay (WTP) for pre-hospital emergency services in Iran. Discrete choice experiment (DCE) was used to measure the population's WTP for ambulance services focusing on time, price, and quality of services. Four hundred and sixty people in Rasht city, Iran, participated in this online survey. Participants preferred lower transfer fees (β = -0.7, $P < 0.05$), lower time of reaching to the scene (β = -0.061, $P < 0.05$), lower time to arrive to the hospitals (β = -0.038, $P < 0.05$), Private ambulance (β = -0.151, $P < 0.05$), and emergency medical services (EMS) technicians (β = 0.209, $P < 0.05$). Patients' WTP in selecting EMS services can help policymakers to provide the best services.

Keywords: Ambulance; Pre-hospital Emergency; Preferences; Willingness to Pay (WTP); Discrete Choice Experiment; Iran

1. Background

Pre-hospital emergency medical services (EMS) refers to EMS that provide emergency treatments, stabilize the patient's condition, and transfer the patient to the hospital for further medical services (1, 2). The type of services is dependent on the medical condition, characteristics of the patient (including age, gender, and the presence of co-morbidities) and many other factors (3). Time of service providing is the most critical issue in pre-hospital emergency care services and has a significant effect on patients' outcomes (3-7). Lower dispatch time, lower response time, and rapid arrival to the hospital and type of services provided to the patients are some dimensions of the quality of EMS services (8-10). The public sector is the main provider of EMS services in Iran. This system is known as Medical Emergency Center in Iran. Historically, Iran is the fourth country with a pre-hospital emergency worldwide, after the United States of America, Canada, and Australia (2). In Iran, the number of ambulances and pre-hospital emergency teams increase continuously while in 2018, 3800000 services were delivered by the Iranian EMS (every 8.3 seconds, a service was provided by EMS) (11). The public EMS in Iran is free of charge and available to everyone, and its purpose is to transfer critically ill patients to medical centers in emergency settings, however, a large number of patients who are transported by ambulance to hospitals are not in critical condition and do not need emergency services (12, 13). On the other hand, with the definite increase in crowding in the streets, the increase in response time is inevitable and can have regrettable consequences (14, 15). The time that takes for the emergency rescue teams to reach the patients is approximately 15 minutes in urban regions and 20 to 25 minutes in rural areas in Iran (11).

The cost of providing pre-hospital services is high. For example, it was 600 $US per patient in 2015 in the United States (16). Standard time of service delivery is very important and critical. However, the patients like to transfer the services better than the normal time and value each

minute time saving for EMS service delivery. Using a discrete choice experiment (DCE), the purpose of this study was to investigate the willingness of people to pay for time and quality of EMS services and the patient's preferences for the selection of EMS services. These findings are essential for health policymakers to notice the patient's priorities and their willingness to pay (WTP) for different EMS packages.

2. Objectives

This study calculated the monetary value of time and quality of EMS from the perspective of the population, which can be used for cost and economic estimates of EMS services.

3. Methods

This cross-sectional study employed a DCE to determine preferences and WTP for EMS service packages. Discrete choice experiment is a reliable method for valuing services, suitable for use in population-based surveys. Unlike direct questioning about preferences and WTP, DCE presents respondents with scenarios where they choose their preferred options based on specific attributes. The WTP and preferences are then inferred from these choices through statistical analysis. This DCE involved three phases: Designing scenarios, conducting surveys, and analyzing data.

3.1. Finding Attributes and Development of Scenarios

Initially, literature on factors related to pre-hospital emergency services was reviewed. Alongside this, semi-structured interviews were conducted to identify additional attributes not covered in the literature. The interview panel included two health economists, three EMS managers, three road traffic accident patients with EMS transfer experience, three emergency medicine specialists, and two health management specialists. The combined results from the literature and interviews helped identify and categorize various attributes, which were subsequently refined through an expert panel discussion. Seven key attributes were selected for inclusion in the DCE scenarios, with each attribute assigned specific levels:

-Ambulance type: Two levels were defined - public and private ambulances. This distinction was made based on expert panel input, which suggested that patients perceive private ambulances as offering higher-quality services.

-Transfer fee: Although EMS services are free in Iran, fees were introduced in the scenarios to estimate their monetary value. Four levels of fees were set at 1 million (4 USD), 3 million (12 USD), 5 million (20 USD), and 10 million (40 USD) Rials.

-Time until the ambulance arrives: This measures the time from the injury to the ambulance's arrival at the scene, with levels set at 3, 6, 10, and 15 minutes.

-Time to reach the hospital: This measures the time from arriving at the scene to reaching the hospital, also with levels at 3, 6, 10, and 15 minutes.

-Type of equipment: Three levels were defined: Essential equipment (basic necessities for an ambulance), normal equipment (standard equipment required in an ambulance), and complementary equipment (additional helpful but non-essential items).

- Emergency medical services personnel: This attribute distinguished between the personnel operating the ambulance, with two levels: Emergency medical services technician and nurse.

Given the complexity of including all possible combinations ($2 \times 4 \times 4 \times 4 \times 2 \times 3 = 768$ potential scenarios), an orthogonal method was employed to reduce the number to a manageable 26 scenarios (13 pairs). Each survey scenario presented participants with a hypothetical road traffic accident requiring EMS services, where they had to choose between two options based on their preferences. Each choice was iteratively presented with varying attribute levels to capture a comprehensive range of preferences. The scenarios and their respective choice sets are detailed in Appendix 1 of the study document.

3.2. Conducting the Survey

The survey was conducted from November 2021 to March 2022 in Rasht, the largest city in northern Iran and the capital of Guilan province. The survey was administered online, with convenience sampling used to select participants. The inclusion criteria included access to the internet to answer questions, being at least 15 years old, and agreeing to participate in the survey. A list of phone numbers from residents in the Rasht district was obtained from the Iranian Telecommunication Center. These individuals were called to participate in the survey. During the phone call, informed consent was obtained first. Then, participants received necessary explanations and instructions on how to complete the survey and the study's purpose. After successfully answering a qualifying question, a link to the survey was sent via text message to their phones. Out of 986 calls made, 870 answered the entrance question correctly, and 568 agreed to participate in the survey. Ultimately, 492 participants completed the survey in full (response rate = 80.9%). The questionnaire included a "trap" scenario to filter out inattentive responses, using extremely rational attributes. Participants who selected the non-rational choice were excluded from the study (32 participants excluded). Data was collected through an online questionnaire hosted on the Iranian website Porsline (https://survey.porsline.ir/s/FcJoG0g). Research indicates that using online methods for data collection in DCE is effective and does not lead to biased results (17).

3.3. Data Analysis

A conditional logistic regression estimator was employed to analyze the survey results. In this model, the dependent variable was the participant's choice in each scenario, while the independent variables included the attributes of the choices and participants' characteristics. All variables were converted into dummy form, and the regression model was re-estimated to identify the participants' most significant preferences. Willingness to pay was calculated by dividing the cost coefficient's first difference by the coefficient of the considered attributes. The analyses were conducted using STATA SE software, version 13.1. The significance level for the study was set at 95%, and the exchange rate used was 250,000 Iranian Rials to US dollars. The study received ethical approval from the Research Deputy of Guilan University of Medical Sciences (ethics code: IR.GUMS.REC.1399.673).

4. Results

Of the 460 study participants, 48% were men and 95% resided in urban areas. Age distribution was as follows: Forty nine percent were aged 20 - 29 years, 28% were 30 - 39 years old, 17% were over 40 years old, and 6% were under 20 years old. Regarding monthly income, 30% earned between $80 and $200, 26% earned more than $200, 24% earned less than $20, 12% earned between $40 and $80, and 8% earned between $20 and $40. Additional demographic details of the participants are provided in Table 1.

Table 1. Demographic Characteristics of Participants (N = 460)

Variables	Frequency	Percent
Gender		
Male	222	48
Female	238	52
Address		
City	436	95
Village	24	5
Marital status		
Single	264	58
Married	195	42
Level of education		
Reading and writing/ sub-diploma	12	3
Diploma	85	18
Associate degree	36	8
Bachelor	133	29
Above bachelor	193	42
Employment status		
unemployed	30	6
Housekeeper	44	10
Student	110	24
Private	172	38
Public	102	22

The majority of participants (77.2%) rated their health status between 7 and 9 out of 10, with an average score of 7.76 for the total sample (Figure 1A). Additionally, most participants had a moderate view of their economic situation, with an average score of 5.61 (Figure 1B), and they placed high importance on their health, with an average score of 8.1 (Figure 1C). The distribution of the financial situation across the sample appears to be normal.

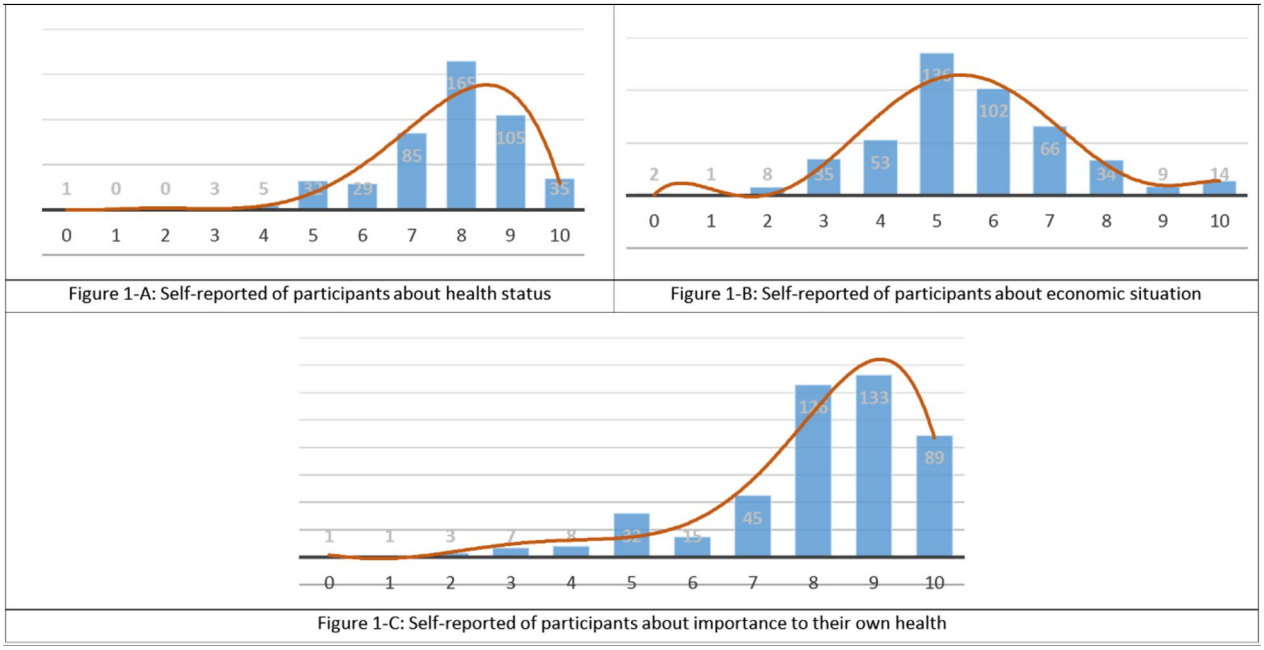

Figure 1. Self-Reported findings about participants' health status, economic status, and the importance of their health

The study of participants' preferences for selecting pre-hospital emergency services demonstrated significant coefficients for all attributes. The transportation cost had a coefficient of -0.7 [95% CI (-0.752 to -0.644)], time until the ambulance arrives was -0.061 [95% CI (-0.07 to -0.05)], and time to reach the hospital was -0.038 [95% CI (-0.05 to -0.03)]. The type of public ambulance was associated with a coefficient of -0.151 [95% CI (-0.23 to -0.07)], and pre-hospital emergency personnel had a positive coefficient of 0.209 [95% CI (0.11 to 0.31)]. Standard equipment and essential equipment had coefficients of -0.7874 [95% CI (-0.98 to -0.77)] and -1.235 [95% CI (-1.38 to -1.09)], respectively. The WTP for each of the pre-hospital emergency service characteristics also demonstrated significant values ($P < 0.05$), confirming the participants' preferences.

Table 2 illustrates that people expressed negative preferences for higher transfer fees, longer times until the ambulance arrives, and longer times to reach the hospital. There was also a preference against public ambulances in favor of private ones, and against standard and essential equipment compared to full services. Conversely, there was a positive preference for pre-hospital emergency personnel over nurses. These results highlight the attributes that are most and least favored in the decision-making process for pre-hospital emergency services.

Table 2. People's Preferences in Choosing the Type of Pre-hospital Emergency Service

Variables	Coefficient	Standard Deviation	P-Value	Lower Limit	Upper Limit
Transfer fee	- 0.7	0.2812	0.00	- 0.752	- 0.644
Time until the ambulance arrives	- 0.061	0.007	0.00	- 0.07	- 0.05
Time to reach the hospital	- 0.038	0.007	0.00	- 0.05	- 0.03
Public ambulance	- 0.151	0.042	0.00	- 0.23	-0.07
Emergency medical services technician	0.209	0.049	0.00	0.11	0.31
Standard equipment	- 0.874	0.051	0.00	- 0.98	- 0.77
Essential equipment	- 1.235	0.074	0.00	- 1.38	- 1.09

People's WTP for various features of pre-hospital emergency services indicated that participants value private over public ambulances, with a WTP of $34.507. They also value reductions in response times; specifically, they are willing to pay $13.896 for every minute reduction in ambulance arrival time and $8.813 for every minute decrease

in the time to reach the hospital. Regarding ambulance equipment, participants prefer less comprehensive equipment if it means a cost reduction, with a WTP of $200. Four hundred and forty five to downgrade from full to standard equipment and $283.038 to downgrade from full to essential equipment. Additionally, they are willing to pay $47.98 more for the service of pre-hospital emergency personnel over nurses.

Table 3. Willingness to Pay for Attributes Added for Pre-hospital Emergency Service Scenarios

Variables	Standard Deviation	P-Value	WTP	Z	Lower Limit	Upper Limit
Public ambulance	9.667284	0.000	-34.507	-3.57	-53.4545	-15.5595
Time until the ambulance arrives (per minute)	1.647792	0.000	-13.8963	-8.43	-17.1259	-10.6667
Time to reach the hospital (per minute)	1.503295	0.000	-8.81267	-5.86	-11.7591	-5.86626
Standard equipment	13.28108	0.000	-200.445	-15.09	-226.476	-174.415
Essential equipment	20.22987	0.000	-283.038	-13.99	-322.688	-243.389
Emergency medical services technician	11.73152	0.000	47.9808	4.09	24.98746	70.97416

Figure 2 displays the ranking of each variable studied, highlighting the preferences for various attributes of pre-hospital emergency services. The diagram illustrates the upper limit, lower limit, and coefficients of analysis for each variable. The most favored attribute was the presence of emergency medical personnel, indicating a high value placed on skilled care during emergencies. Following this, participants highly preferred a 6-minute transfer time to the hospital and a 6-minute ambulance arrival time, the shortest times evaluated. Additional rankings of preferences for other attributes are detailed in Figure 2.

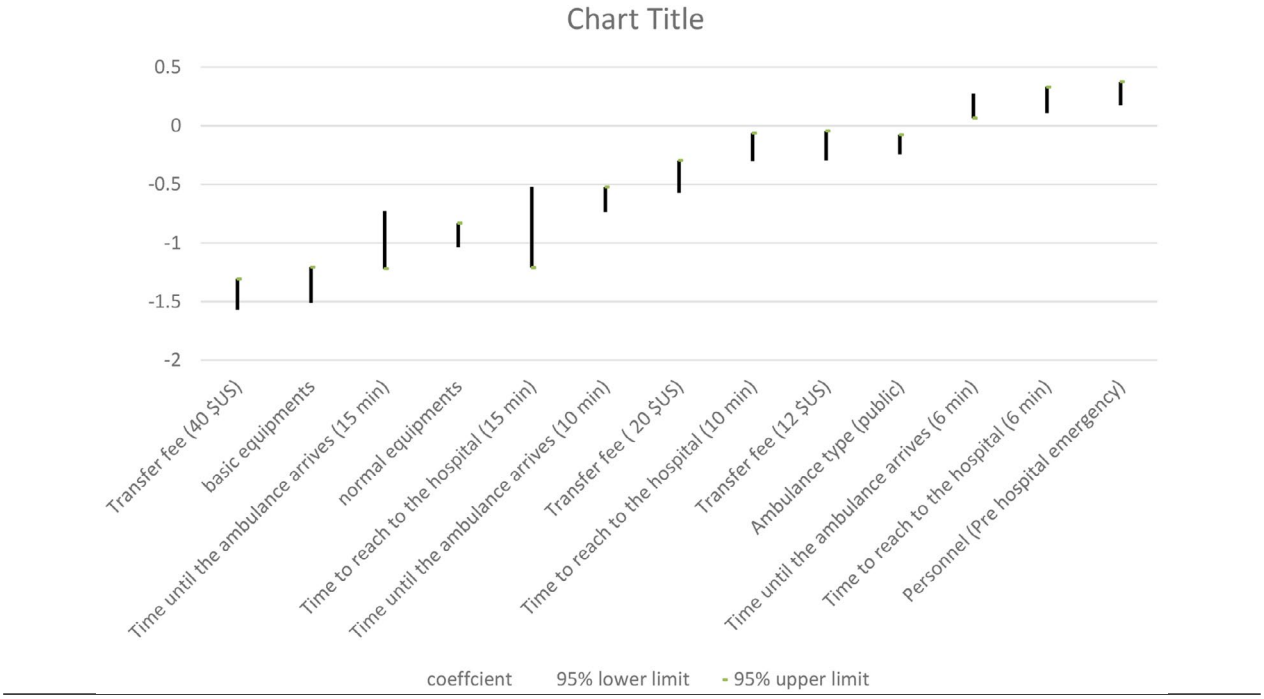

Figure 2. Ranking attributes and levels based on the conditional logistic regression

Appendix 2 details the preferences in choosing the type of pre-hospital emergency service by different demographic groups. For age groups, participants under 25 years old (first group) favor public ambulances more, while those over 45 years old (third group) show less preference for lower transfer fees and essential equipment compared to other age groups (Appendix 2A).

When analyzing data segregated by gender, all coefficients were significant among male participants ($P < 0.05$). For both males and females, the highest preference was for "pre-hospital emergency personnel," and the lowest was for "primary and normal emergency equipment" (Appendix 2B).

Education level analysis revealed that among those with high school or less (first group), all variables except "time" and "type of ambulance" were significant. University degree holders (second group) showed no significant preference for "type of personnel." The highest preference in the first group was for "Personnel," while in the second group, it was for "type of ambulance." The third group (higher university degrees) prioritized "Personnel" and "Time to reach the hospital," with the least preference for "essential and standard equipment" and "type of government ambulance" (Appendix 2C).

Economic status division into poor, middle class, and rich groups revealed significant preferences across almost all variables except for "transfer time to the hospital" in the poor group and "type of personnel" in the middle class. The poor group preferred personnel and the type of ambulance the most, while the middle class favored essential equipment and "Time to reach the hospital." The rich group prioritized EMS personnel and the time until the ambulance arrives, with less preference for essential and standard equipment and public ambulances (Appendix 2D).

5. Discussion

The study highlights Iranian preferences for EMS service features, notably favoring EMS technicians over nurses for pre-hospital care, and emphasizing the importance of reduced response and hospital arrival times. This aligns with international findings from Guatemala and Colombia, where cost and time are crucial factors in choosing EMS services (18, 19).

In Iran, the WTP for using a private ambulance is significant at $34.5 USD, reflecting a preference for private over public ambulances (20). The value of time is highly rated, with individuals willing to pay $13.9 USD for each minute saved on the ambulance's arrival and $8.81 USD per minute saved on the journey to the hospital. These values far exceed the WTP for quicker emergency department services, highlighting the critical nature of timely pre-hospital care (21).

Regarding equipment, there is a clear preference for fully equipped ambulances, with individuals willing to pay significantly less for standard or basic equipment. This underscores the importance of comprehensive service capabilities in EMS.

Furthermore, there is a substantial WTP an additional $47 USD for the service of EMS technicians as opposed to nurses (12). This preference suggests that the qualifications and type of healthcare provider are crucial to public perception and confidence in pre-hospital care.

These preferences appear consistent across various demographic groups, indicating a low price elasticity of demand for EMS services. This suggests that the demand for these services remains relatively unchanged by price, emphasizing the essential nature of EMS and the uniformity of public expectations regardless of demographic differences (22-24). This finding is critical for policymakers and healthcare providers aiming to optimize EMS systems to meet public expectations and needs effectively.

This study highlights that time is a critical factor for the population when choosing pre-hospital services. Health policymakers and pre-hospital emergency managers could adopt several strategies to reduce the time interval between the call and the patient's arrival at the medical center. Improving and upgrading dispatch systems could minimize the time from "operator's decision to send a team and appropriate equipment to the scene" to "their arrival at the patient." Additionally, optimizing the location of ambulance centers closer to accident-prone areas and creating better access routes for ambulances, such as dedicated lanes on highways for emergency vehicles, could significantly enhance response times.

As demonstrated in the study by Alnazi et al. (25), arrival times to accident sites and hospitals are notably longer in rural areas compared to urban settings. This study also indicated that while participants favored lower service fees, these were not as crucial as reduced waiting and transfer times or the professionalism of the emergency personnel. The low price elasticity of demand (PED) for EMS services explains this preference for reduced time over cost (24).

The provision of free pre-hospital emergency services in Iran has led to increased noncritical use of ambulances, contributing to longer wait times, reduced access to equipment, and the employment of non-EMS professionals in pre-hospital emergency services (26-29). Introducing a reasonable fee for non-essential cases could help generate funds for improving services while ensuring the financial protection of the population. Such fees should not lead to catastrophic expenditures or financial hardship but could effectively reduce non-essential uses of EMS, freeing up resources for more critical cases (30, 31). Future studies on the cost-effectiveness of methods to decrease non-essential EMS usage are necessary to develop sustainable EMS.

5.1. Conclusions

The preferences for EMS services in Iran are closely linked to the cost of services and the time it takes to re-

ceive them. While efforts by the public sector to reduce out-of-pocket payments for EMS services are important, they are insufficient because payments are not the primary determinant of service quality. Other critical factors, such as time-of-service delivery, the type of equipment available, and the qualifications of EMS personnel, also play significant roles in shaping the quality of EMS services.

Authors' Contribution:

EE and LK prepared the draft, EHR proposed the study, AS gathered the data, reviewed the literature, EHR analyzed the data, BZ supervised the study. All authors read the draft and final manuscript.

Conflict of Interests:

Authors declared no conflict of interests.

Data Reproducibility:

The data set presented in the study is available on request from the corresponding author after publication. The data are not publicly available.

Ethical Approval:

The study received ethical approval from the Research Deputy of Guilan University of Medical Sciences (ethics code: IR.GUMS.REC.1399.673

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Informed Consent:

During the phone call, informed consent was obtained from all participant.

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