



Assessment and Solution for the Future Trend of the Medical Interpretation Market in China

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Abstract

Across the past decade, the number of foreigners coming to China is increasing, accompanied by increasing multilingual interpretation needs. The demand is most pronounced in the realm of medical and healthcare related translation, due to its high degree of required professionalism and high frequency in daily life. However, China has been lagging in medical interpretation solutions. Although in the past decade, relevant authorities and hospitals have taken measures to respond to this emerging problem, the effectiveness of solutions remains in question. The gap between demand and supply in medical interpretation in China has been widening. To meet the growing demand, we have mapped out a new business plan. We will establish a mobile platform linking both the demand side (foreigners who have medical interpretation needs) and the supply side (qualified medical interpreters) to provide real-time and highly customized interpretation. This paper theorizes the gap between demand and needs at a macro level, the desirability of potential customers at a micro level, and finally demonstrates the details of our business model. To test this theory, we adopted three methodologies— linear regression, personal interviews, and surveys based on convenience sampling. We conclude with a discussion of our business as a pioneer of high potential and prospects in the Chinese market.

Keywords: *medical interpretation; market analysis; human translation; telecommunication*

1.Introduction

Medical interpretation is a branch of professional interpretation, applied in medical scenarios where doctors and patients have language barriers to conduct efficient communication. It has been demonstrated that, for patients from culturally and linguistically diverse backgrounds, language barriers contribute to poorer quality of care and patient safety [1]. People who have language barriers are less satisfied with the care that they do receive and may be at increased risk of experiencing medical errors [2]. Hence, medical interpretation plays a

vital role in facilitating doctor-patient communication and improving the efficiency of the diagnosis.

With the growth of China's internationalization, the number of foreigners coming to China has been rising remarkably, including tourists (Figure 1), international students (Figure 2), and immigrants (United Nations Department of Economic and Social Affairs, 2018) (Figure 3). Given these trends, we might expect that the problems of language barriers in medical activities will become more pronounced in China, accompanied by a notable uptrend in the demand for medical interpretation.

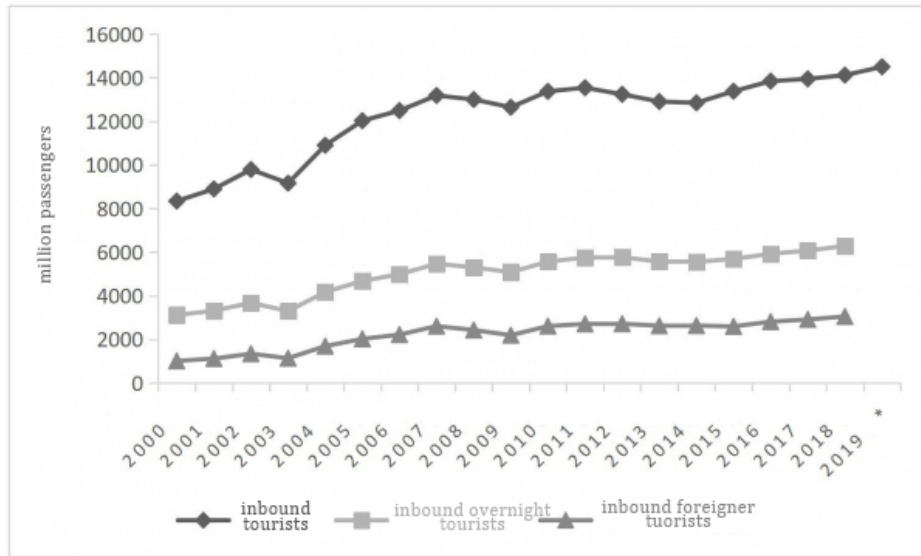


Figure 1. Number of foreign tourists (Note: China Tourism Academy)

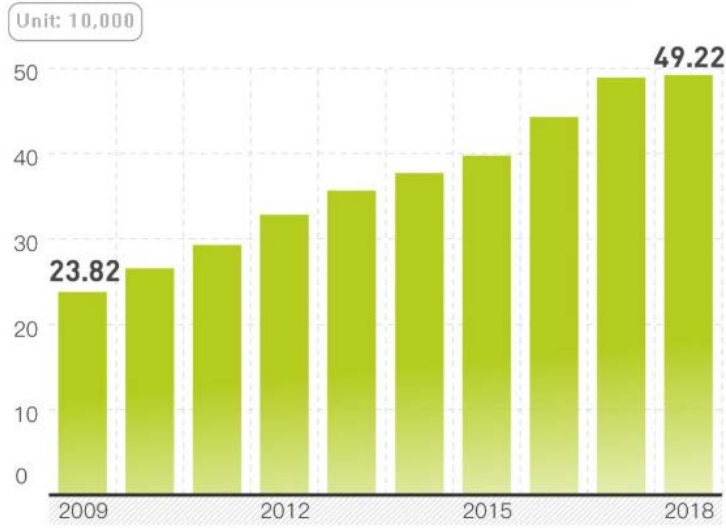


Figure 2. Growth of the number of international students in China (Note: The Ministry of Education of China)



Figure 3. Number of immigrants to the Chinese Mainland (Note: United Nations Department of Economic and Social Affairs)

Nevertheless, compared with American and European countries, China has lagged in the study of medical interpretation both in academic research and practice [3]. Only in the most recent decade, this issue has attracted the attention of academics, the government, and medical institutions. In cities with a higher degree of internationalization, such as Beijing, Shanghai, and Guangzhou, the government has promulgated relevant indicative policies to supervise the construction of foreign language services in hospitals. Medical institutions in these areas have begun to require foreign language proficiency of the staff. In addition to these solutions, translation firms also tended to expand their business in the field of medical help.

These existing solutions have limitations. They are insufficient to meet the demand. Current policies lack coherence as well as practical support for the hospitals which must attempt to turn those policies into action. Take Shanghai as an example, relevant policies about medical interpretation services in hospitals were issued mainly when important international events took place, such as the Expo in 2010. Nevertheless, further policies were difficult to identify in the years that followed, until the outbreak of COVID-19. The supply of interpretation services varies in medical institutions of different grades, which means only a few 'AAA' hospitals perform relatively better in providing interpretation services. A large number of medium-sized or small hospitals and community medical stations lack corresponding measures. As for the translation firms, the prices remain at a high level, with half a day or one day set as a defaulted minimum charge unit. Also, negotiation in advance is required, which lacks flexibility and time efficiency. The mode of medical interpretation provided by translation firms is too rigid to adjust to short-time or just-in-time needs.

In response to the gap between demand and supply of medical interpretation in China, in this study we propose a mobile platform operating based on telecommunication technology to provide Just-In-Time (JIT) human medical interpretation service for foreigners in China. This platform will work by matching professional interpreters according to patients' customized needs in 5 minutes while charging based on a flexible timing mechanism. Characterized by high accessibility, time efficiency, and professionalism, this proposed business solution offers highly differentiated value within the growing market of services related to medical care in China.

The rest of this paper will analyze both the demand

and supply sides to demonstrate the potential of our target market. Then we will discuss our business model to prove our viability and efficiency.

2.Literature Review

Studies on language barriers to communication in healthcare started early in western countries, especially in countries with higher levels of immigration. On the National Institute of Health (NIH) website, the research literature in this field dates back to the 1960s, and the number of studies has been rising year by year, with 1557 articles published in 2021(Figure 4). Scholars in Europe and the U.S. have conducted a great deal of scientific research on medical interpretation activities based on field observations, interviews, data analysis, focused on the patient experience [4,5], the role of interpreters [6], and corresponding addresses [7,8].

Western researchers have come up with multiple solutions in the field of medical interpreting. A study conducted in a German pediatric hospital explored the viability of telephone interpreters, which showed a certain degree of similarity to our business considering the characterization of time-efficiency and telecommunication [9].

In contrast, China's professional medical interpretation has a shorter history, lagging behind western developed countries in terms of market size and development level [3]. China's current medical interpretation has not yet been professionalized, the number of interpreters is very small, and the academic community has not given enough research to the problem [10]. So far journal articles and academic papers published on CNKI amount to 109, which indicates China's research in this field is still in its infancy.

However, the number of studies in China shows a rapid upward trend (Figure 5). Scholars used field survey as the major methodology to conduct research in critical districts where the population density of foreigners are relatively higher, typical samples are Pudong International Community [11], and Clifford Community [10]. Important conclusions are drawn in recent studies. In more than 72% of all medical activities involving foreigners, cross-language communication is achieved with the help of interpretation [10]. For scenarios that require English translations, hospitals or clinics accounted for 78.6%, second to public transportation (82.5%) [12]. Significant demand is identified in medical interpretation.

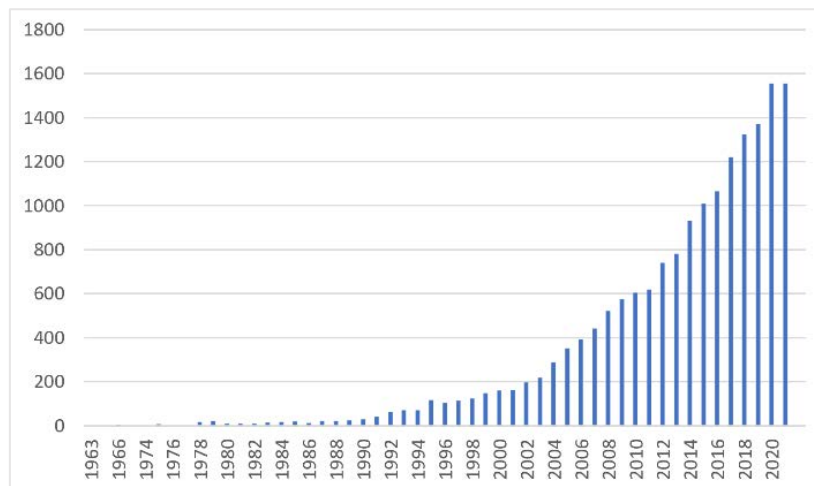


Figure 4. Number of literatures on medical interpretation published on NIH (Note: National Institute of Health Official Website)

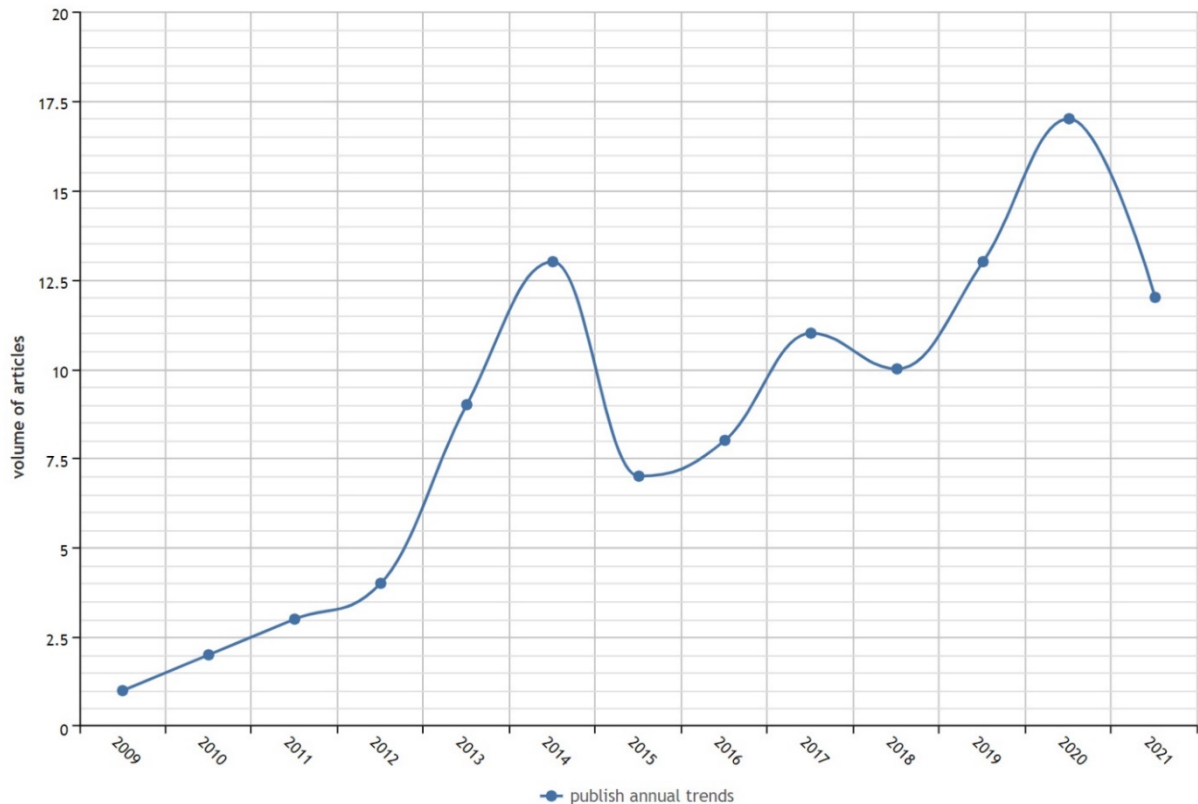


Figure 5. Number of literature on medical interpretation published on CNKI (Note: China National Knowledge Infrastructure)

Solutions designed to meet China's current medical interpretation needs are few, and individuals continue to face shortages and ineffective delivery of services within this market, opening up new market prospects [2]. However, further research is needed to determine the extent of this demand, and the services which will be most effective in meeting that demand.

3. Methodology

To address this gap in the research literature related to the market demand for medical interpretation services in

China, we sought to test the following hypotheses:

H1: Tourist demand will increase within China following the Covid-19 pandemic.

H2: Current medical interpretation services are insufficient for addressing existing demand.

H3: In China, the majority of individuals with language barriers find it problematic in various scenarios, especially when they encounter emergencies.

H4: In China, the majority of individuals with language barriers prefer translation with emotions.

H5: In China, the majority of individuals with language barriers prefer human translation in the emergency situations (especially healthcare).

To test these hypotheses, we employed the following methods.

3.1. Linear regression model

Time series forecasting uses historical observations and patterns to predict future values for specific activities. Classic time series methods include Autoregressive integrated moving average, Exponential smoothing, and Linear regression. We have decided to use the linear regression model as we are looking to forecast a long-term trend after the recovery stage of the tourist market. We rejected ARIMA and Exponential smoothing because both methods do not support time series with seasonal components and are regularly used for the short-term forecast.

The linear regression model compares an independent variable (time index variable) to a dependent variable (quantity of inbound tourists). We use regression to estimate the trend line, and the accuracy of the line is directly correlated to the size of the residual (the vertical distance between the predicted trend line and each data point).

As the countries continuously integrate with each other, we are expecting a strong positive rate of growth of foreign visitors, as listed in the H1. The fundamental idea of this model is to explore the correlation between time and potential customers in the market. This model enables us to predict values of predictors that are not in the present data collection, thus forecasting the future size of the market from a macro point of view.

3.2. Interview

To test H2 and H3, we conducted interviews with both the supply side (hospitals) and the demand side (potential customers). Since the answers gathered from interviews are all open-ended, we designed several core questions and went deep gradually during our interviews to get a whole picture of our future market.

3.2.1 hospitals

To obtain direct information about the current medical interpretation market in China, we organized an interview with a staff working at Nanjing Gulou Hospital on 28th March 2022. We asked several questions mainly concerning the construction of foreign language services in the hospital, the number of foreign patients, and the demand for interpretation services in detail. Based on the interview, we obtain the deficiencies of the current interpretation service in the hospital and the potential demand for our platform.

3.2.2 potential customers

In order to approach our potential customers' opinions, we organized several interviews with people of various identities from 14th to 20th March 2022, including college students, senior high school students, and adults with different degrees of language barriers. We asked several questions in terms of situations where the foreign population needs human translation the most and factors that influence the choice of translation tools (human translation or AI translation). The results will help us identify the value proposition and the customer segment of our business plan.

3.3. Survey

Following on the previous methodology testing the future size of the market for medical translation, we want to test whether there is enough desirability for our solution. Therefore, we designed a questionnaire to test H4, H5, and also H3. We assigned questionnaires based on the Convenience Sampling method, which involves respondents in close proximity. In our case, our sampling population is from the workplace, schools, clubs, communities, families, and the internet. This method is a type of non-probability sampling used when gathering information from the entire population is impossible. Convenience Sampling could provide us with opinions on newly launched ideas, preferences, and advantages as much as possible in time efficiency.

4. Results

4.1. Linear regression model

The linear regression model equation is as follows:

$$Y_i = B_0 + B_1 X_i \quad (1)$$

Y_i is the quantity of inbound tourists at the input index year.

B_0 is the y intercept, which represents the predicted value of tourists at 2006.

B_1 is the slope, which represents the quantity of tourists increasing per year.

The equation for A (B_0) and B (B_1) is as follows:

$$b = \frac{n\sum ty - \sum t\sum y}{n\sum t^2 - (\sum t)^2} \quad (2)$$

$$a = \frac{\sum y - b\sum t}{n} \quad (3)$$

n is the number of statistics (years) we used in modeling.

t is the time index assigned to specific years.

All data is collected from World Tourism Organization.

Input data:

Table 1: Linear regression analysis

Linear model	regression				
	t(i)	year	y (inbound travelers)	ty	t ²
	1	2006	4991.34	4991.34	1
	2	2007	5471.98	10943.96	4
	3	2008	5304.92	15914.76	9
	4	2009	5087.52	20350.08	16
	5	2010	5566.45	27832.25	25
	6	2011	5758.07	34548.42	36
	7	2012	5772.49	40407.43	49
	8	2013	5568.59	44548.72	64
	9	2014	5562.2	50059.8	81
	10	2015	5688.57	56885.7	100
SUM	55		54772.13	306482.46	385

From the statistics, we obtain the value of a, b, n as 5128.163333, 63.46357576, and 10, respectively.

Therefore, the following are our predicted trends for 2016-2025.

Table 2: Forecast

Forecast (2016-2025)		
Y(i)	year	predicted value (travelers)
Y(11)	2016	5826.262667
Y(12)	2017	5889.726242
Y(13)	2018	5953.189818
Y(14)	2019	6016.653394
Y(15)	2020	6080.11697
Y(16)	2021	6143.580545
Y(17)	2022	6207.044121
Y(18)	2023	6270.507697
Y(19)	2024	6333.971273
Y(20)	2025	6397.434848

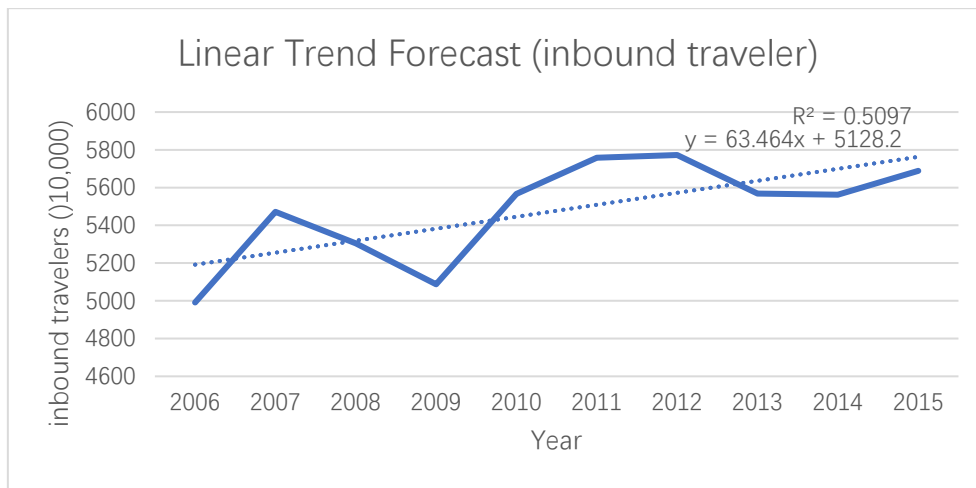


Figure 6: linear trend forecast of the quantity of inbound travelers

The table and graph above show a visual representation of a positive correlation between time interval and quantity of travelers. Therefore, it is justified

that, neglecting COVID-19's influence on recent statistics, there will be a constantly growing demand in the market.

4.2. Interview

4.2.1 hospitals

Through conversations with the staff in Nanjing Gulou Hospital, we have obtained some information regarding the current supply of interpretation services in hospitals and consumers' demand for our service. Details of the interview are recorded in Appendix A and the summary of the interviewees' answers is as followed.

Summary:

1)The supply of interpretation services in hospitals is insufficient to meet the demand of foreign patients. Although all employees have a certain degree of English level, high-quality interpretation service cannot be guaranteed. Also, Digital Hospital does not provide bilingual languages as well.

2)The hospital does not provide an interpretation of minority languages, which is the biggest flaw since some patients who are not familiar with English or Chinese may have difficulties in asking for service in the hospital.

3)The hospital does not have plans for improving interpretation service yet, considering the cost of

improving the service is too expensive. The current deficiencies of the relevant service in the hospital may not be solved for a long time.

4.2.2 potential customers

Through conversations with different units of the population, we got potential customers' pain-points, preferences, and expectations about business. Details of the interview are recorded in Appendix B and the summary of the interviewees' answers is as followed.

4.3. Summary:

1)Customers have a higher demand for human translation in emergencies, especially in medical help since they may not be able to express their feelings clearly and accurately.

2)The price of our service will influence most customers' demand unless they are at the most urgent moment.

4.4. Survey

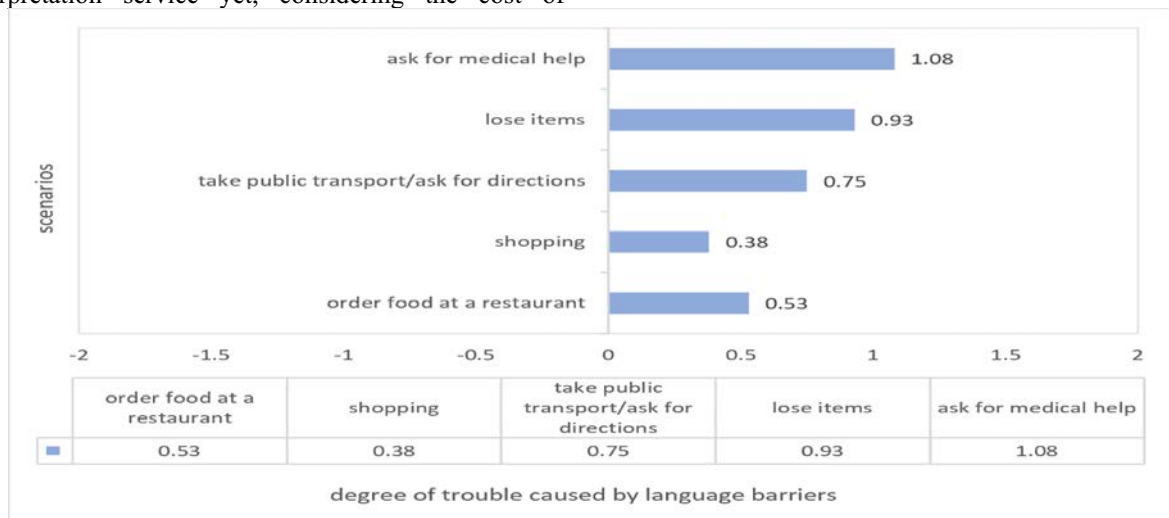


Figure 7: Degree of trouble caused by language barriers in different scenarios

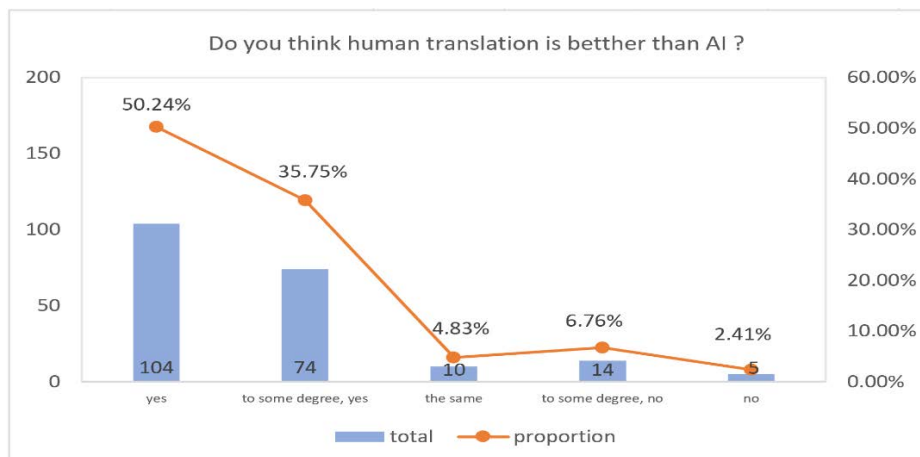


Figure 8: Desirability of translation tools (human translation & AI translation)– based on quality ranking

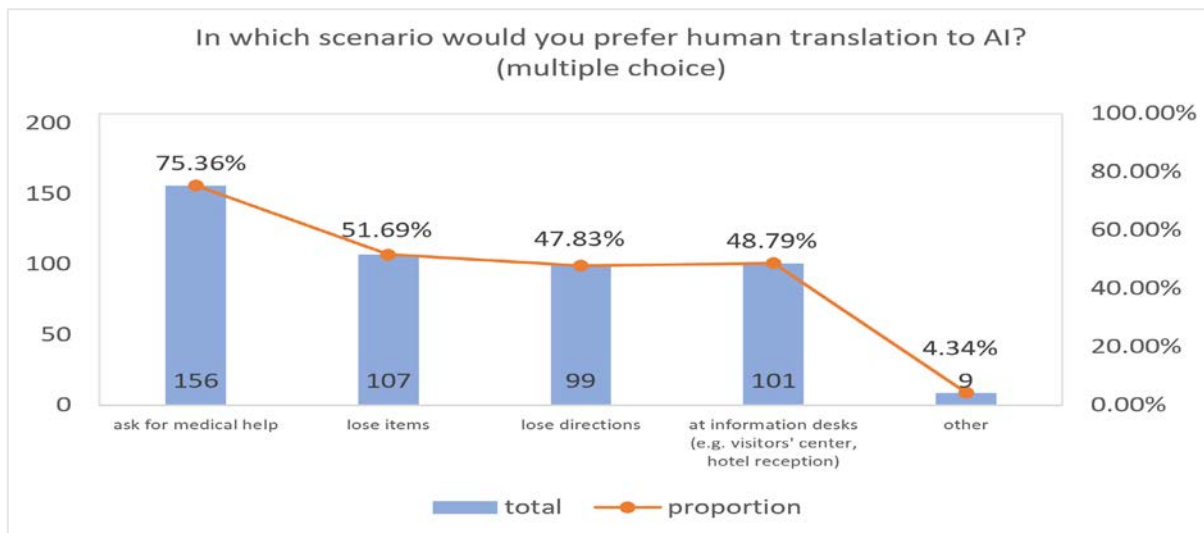


Figure 9: Desirability of translation tools (human translation & AI translation)– based on scenarios

From Figure 7, the population was asked to rate the degree of difficulties in different scenarios with a rating of -2 being very comfortable, and 2 being most stressful. The overall distribution of ratings between 0.38-1.08 shows that our sampled population (207 in total) all agree to a different extent that language barriers cause difficulties in the given scenarios. Among those, medical help was considered the most serious. The positive response in the metrics proves that all the sampled population find difficulties in language barriers with the existing solutions (e.g. AI translation), especially in emergency situations.

From Figure 8, just under 86% of the sample prefers human translation to AI. From Figure 9, seeking assistance in healthcare accounted for three-quarters of the votes, proving that human translation service is especially demanded in medical help.

Therefore, we can conclude that in the current market, the population is not satisfied with AI in complicated situations, and human translation is especially preferred in medical assistance.

5. Conclusion

Significant conclusions drawn from our research are as follows: (1) growing demand and shortage of supply in the medical interpretation service in China (H1, H2 Methodology), (2) strong desirability for healthcare interpretation (H3 Methodology), and (3) customers' preference for human service, especially in emergency

situations (H4, H5 Methodology).

In order to overcome current deficiencies in the existing market and address the particular needs we have identified from our research, we propose a new business solution– a mobile application platform (e-Delta) focused on remote medical interpretation. Our business targets a niche market of foreign patients in China who struggle to access healthcare services because of language difficulties. We aim to solve the customer's pain-point of both being unable to express their need with present solutions, and being mentally pressurized under an emergency. To answer the problem of language barriers between patients and healthcare providers, our solution is to provide a digital platform by which we offer Just-In-Time proficient medical translation to customers.

We mainly provide human translation services backed up by telecommunication technologies, which means customers can choose diverse communication forms such as voice, video, or text. A subordinate service is the AI translation, which functions as a digital dictionary for searching words and translating simple phrases. But we won't invest too much in the AI section for our focus is the real-time human translation service. Customers can easily get access to human translation service in 5 minutes through the real-time matching mechanism. Appointments are also available if there's any need. Our company promotes the value of high accuracy, customization of customers' preferences, time efficiency, and warranties.

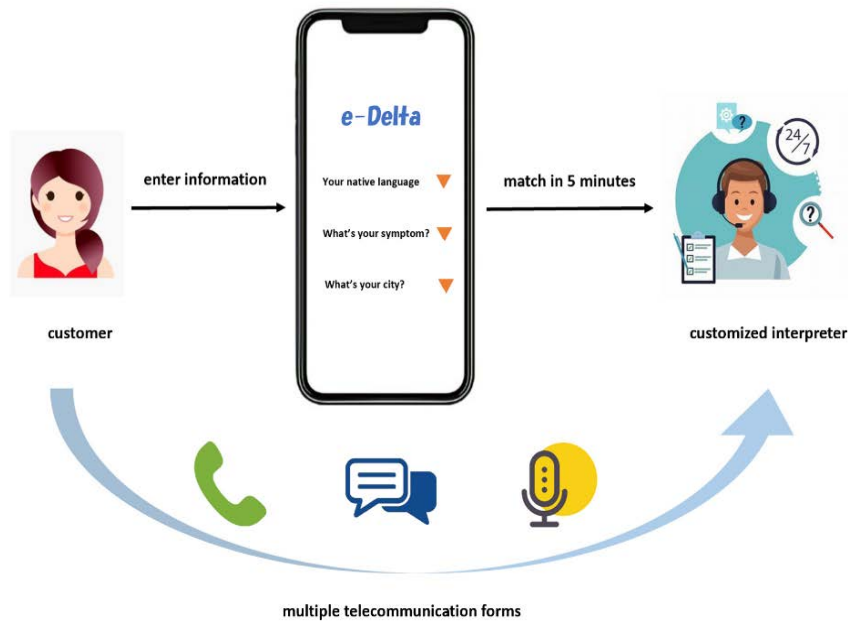


Figure 10: Business illustration

Since inaccurate translation could potentially result in fatality and serious judicial cases, our company ensures that our employees obtain Translation/Interpretation qualifications. For interpreters, our standard is earning a certificate in CATTI (China Accreditation Test for Translator and Interpreters), with the minimum requirement being level three; for medical proficiency, we require at least a Bachelor’s Degree in Pharmacy or Medicine. These qualities would allow fluent communication and reliable translation of medical terms. In order to eliminate the risk of miss-matching skillset and demand, we offer the flexibility to customize the academic field the interpreter specializes. We achieve this by assigning keywords, ratings, qualifications, and prices to each interpreter. Then, we would allocate services in accordance with the customer’s selected boundaries. On top of this, our utilization of the internet also helps achieve flexible work hours for interpreters as well as

increases productivity during emergencies. For warranties, our company allows high transparency and validity of our employee’s profiles, partnerships, and free trials to avoid asymmetric information, thereby building up our company’s reputation. Since privacy is of high significance to users, especially when it comes to medical assistance or healthcare, we issue privacy warranties to both customers and our interpreters.

Our business has proven to have strong desirability throughout the methodologies analyzing demand and supply. Considering the viability factor of our business, we conducted a survey for potential customers about price factors in the United Kingdom. In the distribution of our survey, we used a stratified sampling method, classifying the population into different 5 different age groups. Then, we selected ten strata at random. The results are shown below.

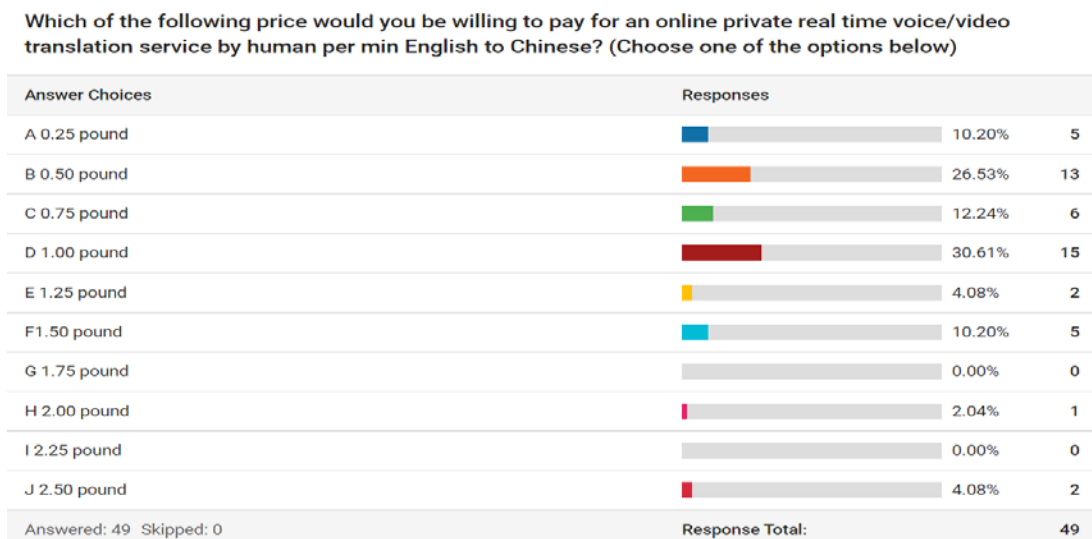


Figure 11: Desirability of pricing– based on the UK

For we are an online service platform, the dynamic daily traction of our business matters. Based on the desired prices of the majority, we calculated the expected daily revenue of our platform.

Since 1) the operation of our business relies to a high degree on human resources, which consist of an overwhelming proportion of our cost, and 2) the fixed cost and investment in the infant stage allocated to each day is relatively small and can be neglected in daily profit calculation, we used the wages paid for interpreters as the primary factor to account our variable cost.

Assumptions (UK patients):

1) According to Nanjing Gulou (AAA) hospital's statistics, 10,000 overseas patients visit the hospital per year.

2) According to the National Bureau of Statistics of China (NBSPRC), 13.2% of inbound travelers come from European countries.

3) There are 813 Tertiary Hospitals (AAA) in China.

Therefore, on average, 1,073,160 patients from European countries seek medical assistance per year in China, which is 2940 patients per day.

Assumptions (Generated income):

1) The most popular price is one-pound sterling per minute.

2) The average time every occasion of medical assistance last is twenty minutes. Thus each patient is 20£, which in total will generate 58800£, exchanging for 491,399¥ per day.

3) We would hire 3000 medical interpreters who specialize in English to Chinese translation services.

4) The average wage for interpreters is 1000¥ per day. Our daily cost of wages is 300,000¥.

Therefore, our estimated revenue is 191,399¥ per day.

For the survey is sampling (Methodology 3), we selected subjects because of their convenient accessibility. Since convenience sampling is a non-random sampling technique, and the sample's representativeness to the whole population depends on the ability of the researcher to select the sample, it may lead to bias between samples and results. Therefore, the results of experiments using convenience sampling are often not reliable enough to represent a well-defined population. Convenience sampling, however, can still be useful for preliminary understanding of the subject or for building hypotheses.

In our interview (Methodology 2) and assumption in the financial aspect of our business model, we utilized the information from interviewing the staff of one of the best hospitals in Nanjing city. The statistics we received are reliable but not enough to be extrapolated to the rest of

China. Different regions have different frequencies of travelers or migrants from abroad, therefore it would be inconstant to assume all the other similar hospitals receive the same number of patients as Nanjing Gulou Hospital.

For our business model's viability, our sampling regions are limited to the UK, which only accounts for 13.2% of the inbound travelers. On top of this, the UK has a stronger currency than China, which would mean our service is relatively cheaper than their expectation and thus makes us profitable. However, most Asian countries have a weaker currency. Therefore, we can only assume we are profitable selling to European customers. Also, we will do further research on the detailed cost items of our business.

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