Explore the factors that influence the performance of doctors in the online healthcare community

1 Introduction

1.1 Background

Online healthcare community, also known as Internet medicine, is a new application of the Internet in the medical industry. Doctors can through online medical community to establish contact with the patient, provide patients with text, graphic and telephone counseling and referral, remote clinic, appointment booking after management, the family doctor service, can not only convenient real-time control over his patient, also can increase accordingly the doctor's personal awareness, make its get corresponding remuneration [1-3]. Online medical community (Internet medical) uses the Internet and information technology to break the time and space constraints, help patients quickly and correctly recognize their own conditions and quickly seek medical treatment, and relieve the tension and lack of offline medical services [1].

Based on this, this paper studies the factors affecting doctors' performance in the online medical platform from the perspective of patients. On the online medical platform, patients decide whether to ask for help from a doctor by looking at the doctor's information displayed on the web page. Therefore, factors such as the professional title of doctors and the patients served will have a guiding effect on whether patients choose doctors or not. At the same time, when doctors provide medical help to patients, they will charge a certain fee. Take a good doctor on the online medical website as an example, doctors have three types of services: question-and-answer, graphic consultation and telephone consultation. The prices of consultation services vary according to the different types of services and doctors. The price of service will affect the number of patients a doctor serves, which in turn will affect the doctor's performance. The purpose of this study is to take Haofu Online medical website as an example, to explore the factors affecting the performance of doctors in the online medical platform, and to provide a theoretical basis for the healthy development of China's online medical community. For patients, by integrating the useful information scattered in the virtual network, they can enjoy high-quality medical services more conveniently and quickly, and gain good medical experience, thus establishing doctor-patient trust. For doctors, they can understand the medical needs of online patients and provide personalized and high-quality medical services. For online medical community operators, they can understand the demands of doctors and patients, improve the operation and management system, and promote the sustainable and healthy development of online medical cause.

1.2 Literature review

The theory of information asymmetry mainly refers to the fact that in market activities, the parties involved in the transaction have different information and influence on the transaction or service, and the party with less information is in a disadvantaged position in the transaction. Generally speaking, the product provider has more information than the buyer and can help the provider gain trading advantage [6]. In the online medical platform, doctors are in the information advantage. Compared with patients, they know more about the diagnosis and treatment plan of the disease, while patients know less about the technology and

professional ethics of doctors. Therefore, it is impossible to judge whether the treatment plan of doctors is appropriate. Although the online medical platform can help doctors make use of their spare time and alleviate the shortage of existing medical resources in China from two aspects of time and space, according to the information asymmetry theory, doctors will guide patients to make decisions in favor of doctors when conducting online medical consultation. As patients are at the disadvantage of information, when using online medical platform, they can only communicate with doctors by text and voice, and cannot judge the degree of concern and understanding of patients' condition. In this case, the medical advice received by patients from doctors is somewhat blind [7]. At the same time, because doctors are on the information advantage side, control the pricing power of medical services.

Peter Drucker first put forward the concept of customer perception in 1954. Weingand (1997) divided customer perception into four levels: basic value, expected value, expected value and expected value. Carrolll J M (2011) proposed in his study that perceived value can improve patients' trust in doctors, thus improving doctors' personal performance. In the online medical platform, patients, as customers, can learn about the factors affecting the consultation price, such as doctor qualification and platform reputation, through the introduction on the web page. On the other hand, after receiving the service, patients will judge the expected effect and diagnosis process according to their own conditions, and then give feedback and evaluation through the online medical platform, thus affecting the perception and choice of other consumers and affecting the work performance and personal performance of doctors [8].

According to walters' research, price has a direct impact on performance [9]. In online medical platform, service price has two influences on doctors' performance. On the one hand, when the price of doctors' services is low, patients are more inclined to buy consulting services, thus increasing the number of patients served by doctors and improving performance. On the other hand, if doctors can bring patients higher perceived value, such as higher qualifications and richer experience, patients can accept higher service fees than other doctors, so doctors can set higher service prices.

2 Method

2.1 Methodology

In this paper, multiple linear regression will be used to examine the factors affecting physician performance. Relevant hypothesis testing and suggestions are proposed based on the regression results of the model. Furthermore, stepwise linear regression was used to explore the best model.

2.2 Hypothesis

According to previous studies, the number of thank-you letters, the number of gifts, and the popularity of recommendations are all reputational feedback variables, and the level of reputational feedback variables can reflect the quality of a doctor's reputation. When doctors have good reputational feedback, patients will believe that doctors can provide better medical services for patients who have purchased services, including accurate disease diagnosis and effective treatment [4]. Therefore, every specific variable in the reputation feedback variable can improve the performance of doctors on the online medical platform. Based on this, we propose the following hypothesis:
H1: The number of thanks letters has a positive impact on the performance of doctors on online medical platforms.
H2: The number of gifts has a positive impact on the performance of doctors on online medical platforms.
H3: Popular has a positive effect on the performance of doctors on online medical platforms.

Articles published by doctors can not only show their own professional knowledge and relevant treatment experience, but also gain more attention and trust from patients [5]. In the online medical community, doctors, as the main body of online medical services, obtain economic benefits and online popularity by

publishing medical science articles. By browsing the articles displayed on doctors' personal home pages, patients have a certain cognition of doctors' medical knowledge and scientific research ability, so patients are sensitive to the articles published by doctors and the number of articles. The number of published articles can measure the educational learning ability of doctors to a certain extent. The stronger the ability is, the richer the mastery of relevant medical knowledge will be, and the higher the corresponding service performance will be. Therefore, this paper takes the number of articles published by doctors as an indicator to influence doctors' performance. Based on this, we propose the following hypothesis:

H4: The number of published articles has a positive impact on the performance of doctors on online medical platforms.

Users in the medical profession, doctors voting, the voting results can directly show the patient's attitude to the doctor's degree of satisfaction, satisfaction is higher, the doctor just like to be patient, the higher authority, and some in the social status of the improved according to the above analysis theory, the attitude to the doctor's degree of satisfaction in the field of medical image, show their status so this variable will affect their performance in the medical profession. Based on this, we propose the following hypothesis:

H5: Attitude satisfaction has a positive impact on the performance of doctors in online medical platform

In online medical treatment, doctors will choose a price strategy that matches their own medical strength and effort, and doctors with higher degree of professionalism, faster response in doctor-patient interaction and focus on content output of business ability will get a higher price. Therefore, in online medical services, the higher the price of doctors' services, the lower the purchase intention of patients. Based on this, we propose the following hypothesis:

H6: Service price has a negative impact on the performance of doctors on the online medical platform.

The time for a doctor to open a personal website is a measure of the time for doctors to provide medical services in the online medical community. The earlier a doctor opens a personal website, the longer the cumulative exposure time for patients on the Internet, the more likely it is to serve more patients and create more performance. Based on this, we propose the following hypothesis:

H7: The opening days have a positive influence on the performance of doctors on online medical platform.

3 Analysis

3.1 Data sample

The sample data used in this paper are all from the online medical platform named HaoDF (www.haodf.com). I collected a total of **779** doctors' personal web pages from the Good Doctor online platform. In the study, the number of patients served by the doctor was used as the doctor's performance, and the data field influencing the doctor's performance was found from the personal web page for recording. Specific selection of the following eight types of independent variables:

1. Letter: The number of thanks letters
2. Gift: The number of gifts
3. Popular: The popular number on the website
4. Article: The number of published articles
5. AttitudeSatisfaction: Attitude Satisfaction
6. Price: The price of consultation
7. Days: The number of open days

## 3.2 EDA

3.2.1 summary

Once you have the data, first look at the overview of the data. As you can see from the summary output, all of the variable data types are numeric. Note that the maximum value of the Sentiment variable is 1. And the results show that there is no missing data.

```
##      Letter              Gift            Popular          Article
##  Min.   :   0.00   Min.   :   0.0   Min.   :3.300   Min.   :   0.00
##  1st Qu.:  11.00   1st Qu.:  12.0   1st Qu.:3.900   1st Qu.:   1.00
##  Median :  23.00   Median :  35.0   Median :4.100   Median :   7.00
##  Mean   :  46.92   Mean   : 118.3   Mean   :4.138   Mean   :  23.41
##  3rd Qu.:  50.00   3rd Qu.: 121.0   3rd Qu.:4.300   3rd Qu.:  20.00
##  Max.   :1211.00   Max.   :2027.0   Max.   :5.000   Max.   :1434.00
##  AttitudeSatisfaction    Price             Days          Performance
##  Min.   :0.7500     Min.   :  36.0   Min.   : 104.0   Min.   :   10
##  1st Qu.:1.0000     1st Qu.: 180.0   1st Qu.: 899.5   1st Qu.:  282
##  Median :1.0000     Median : 360.0   Median :1633.0   Median :  663
##  Mean   :0.9897     Mean   : 488.1   Mean   :1935.0   Mean   : 1657
##  3rd Qu.:1.0000     3rd Qu.: 600.0   3rd Qu.:2912.5   3rd Qu.: 1747
##  Max.   :1.0000     Max.   :6000.0   Max.   :4105.0   Max.   :27932
```

3.2.2 Variable correlation

To see the relationships between variables, I drew a variable correlation diagram. In this figure, the names of variables are on the diagonals. The lower left part is a scatter diagram of two variables to see the relationship between variables. The upper right is the Pearson correlation between the two variables.

We can draw two conclusions from the figure. First, independent variables and dependent variables do have a correlation, and some variables have a strong correlation. Second, the correlation between independent variables is not strong, that is, the problem of collinearity of independent variables is preliminarily excluded.
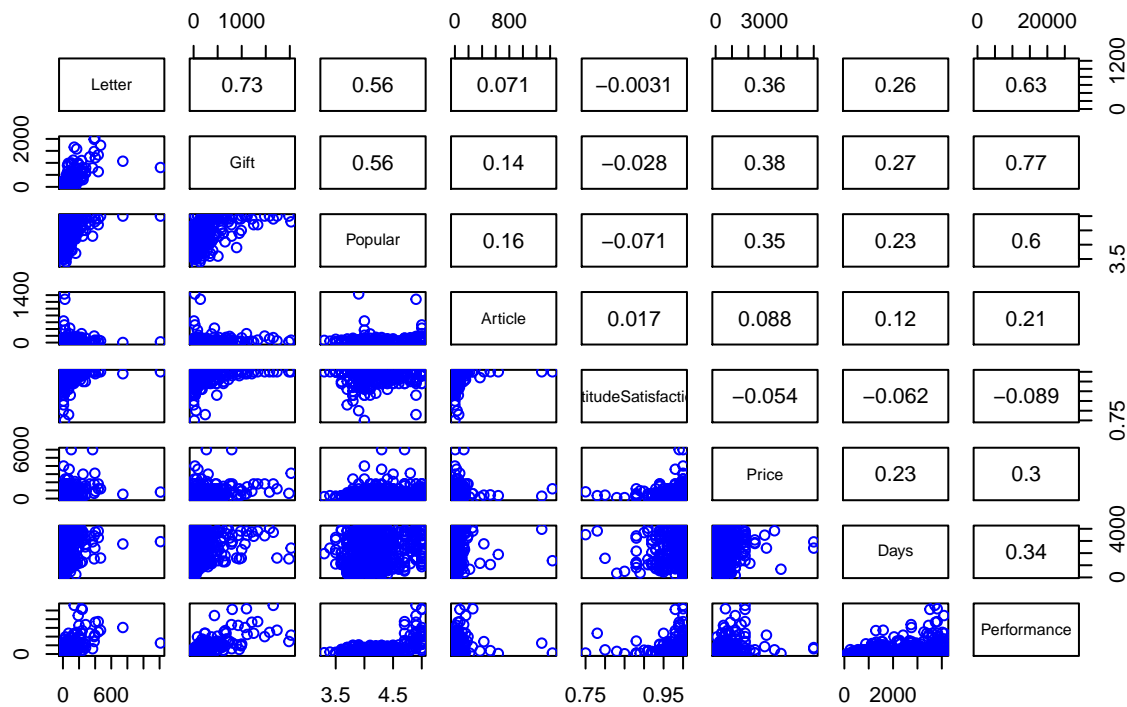
In order to further demonstrate the Pearson correlation coefficient between variables, I established the correlation coefficient matrix.
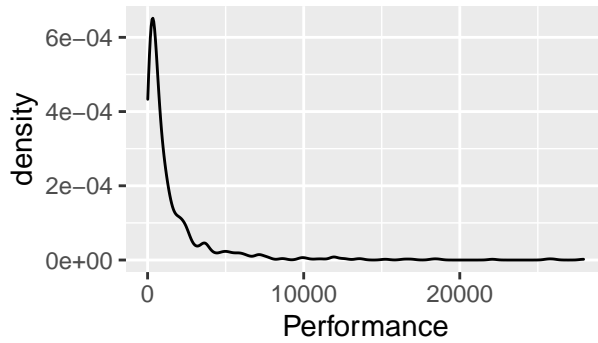
```
##                        Letter        Gift      Popular     Article
## Letter             1.000000000  0.72770563  0.55862595 0.07078244
## Gift               0.727705626  1.00000000  0.56310676 0.13982924
## Popular            0.558625947  0.56310676  1.00000000 0.16275566
## Article            0.070782438  0.13982924  0.16275566 1.00000000
## AttitudeSatisfaction -0.003051059 -0.02779019 -0.07137462 0.01726362
## Price              0.358341972  0.37714273  0.34630930 0.08822992
## Days               0.256483361  0.27307351  0.23231600 0.11874340
## Performance        0.626519488  0.77174508  0.60355493 0.20686425
##                    AttitudeSatisfaction       Price        Days Performance
## Letter                     -0.003051059  0.35834197  0.25648336  0.62651949
## Gift                       -0.027790190  0.37714273  0.27307351  0.77174508
## Popular                    -0.071374621  0.34630930  0.23231600  0.60355493
## Article                     0.017263622  0.08822992  0.11874340  0.20686425
## AttitudeSatisfaction        1.000000000 -0.05367026 -0.06184323 -0.08860437
## Price                      -0.053670257  1.00000000  0.23372358  0.30446427
## Days                       -0.061843232  0.23372358  1.00000000  0.34222195
## Performance                -0.088604366  0.30446427  0.34222195  1.00000000
```
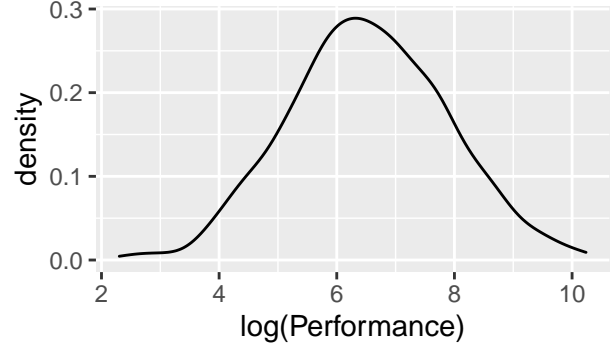
3.2.3 Variable distribution

An important assumption of linear regression is that the variables are normally distributed. In this part, I'm going to check to see if the data is normally distributed. The variable that does not accord with normal distribution is rectified.

1. **Performance Variable.** This variable is left-skewed and needs to be treated logarithmically. As can be seen from the figure below, the corrected data distribution basically conforms to the normal distribution.

2. **Letter.** This variable is left-skewed and needs to be treated logarithmically. As can be seen from the figure below, the corrected data distribution basically conforms to the normal distribution.

3. **Gift.** This variable is left-skewed and needs to be treated logarithmically. As can be seen from the figure below, the corrected data distribution basically conforms to the normal distribution.

4. **Popular.** This variable basically conforms to the normal distribution and does not need to be processed.

5. **Article.** This variable is left-skewed and needs to be treated logarithmically. As can be seen from the figure below, the corrected data distribution basically conforms to the normal distribution.

6. **AttitudeSatisfaction.** The variable is right-skewed and requires exponential processing.

7. **Price.** This variable is left-skewed and needs to be treated logarithmically. As can be seen from the figure below, the corrected data distribution basically conforms to the normal distribution.

8. **Days.** This variable basically conforms to the normal distribution and does not need to be processed.
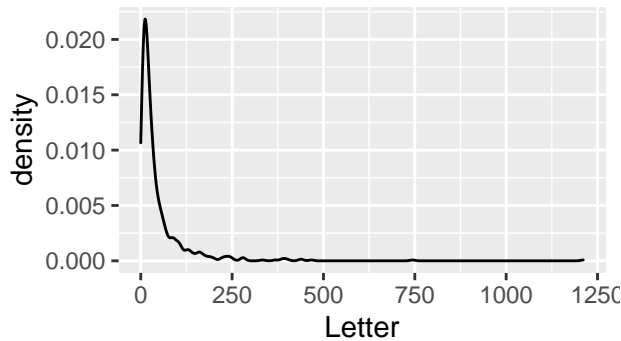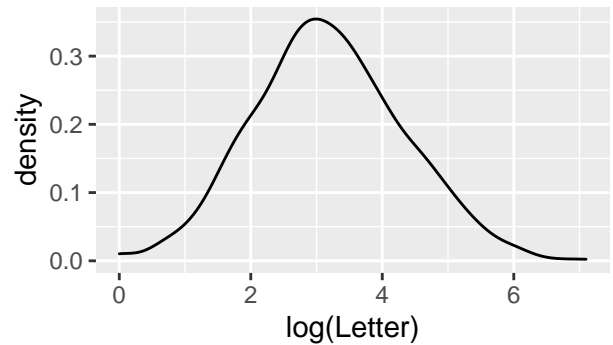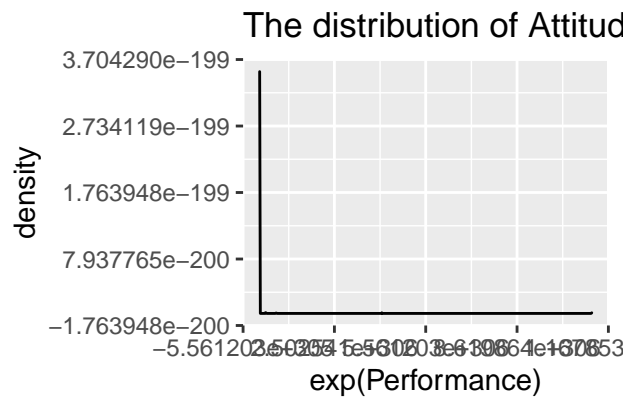
The distribution of Gift

The distribution of Gift after rectify

The distribution of Popular

The distribution of Days

The distribution of Article

The distribution of Article after rect

The distribution of AttitudeSatisfact

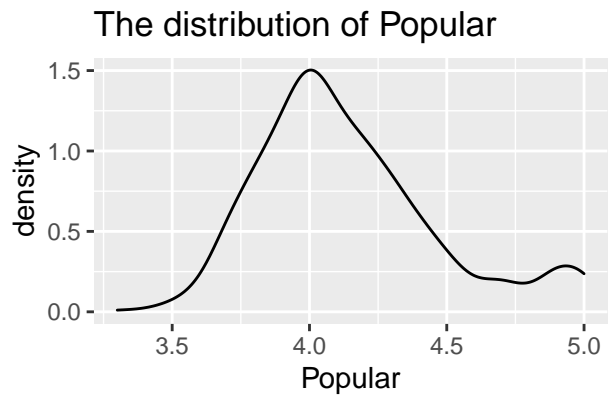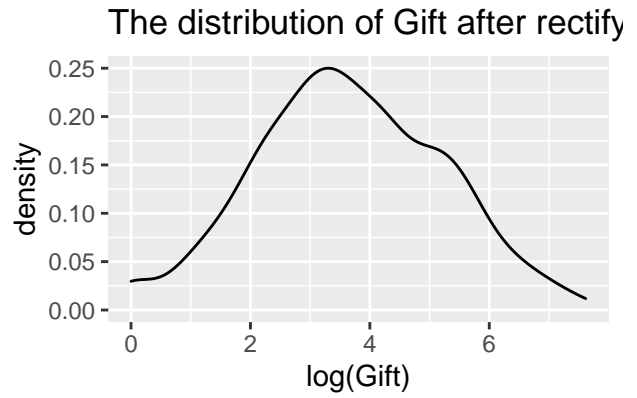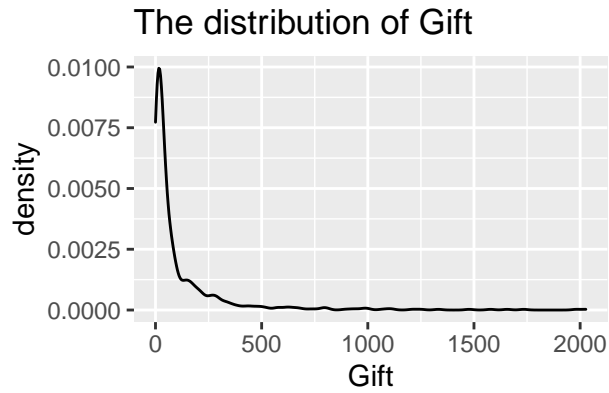The distribution of Attitud

The distribution of Price — The distribution of Priceafter after
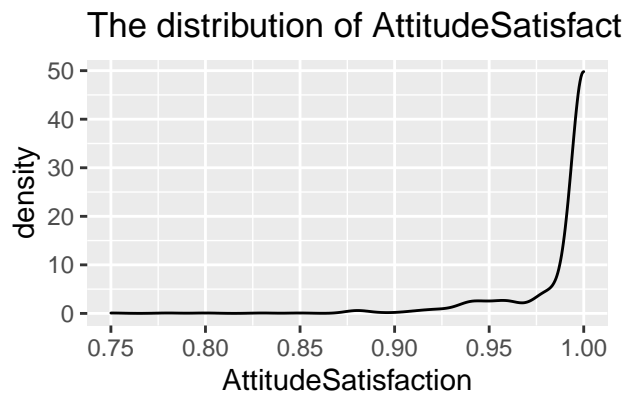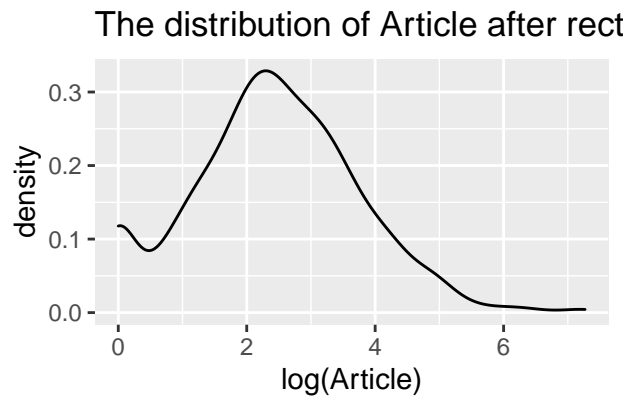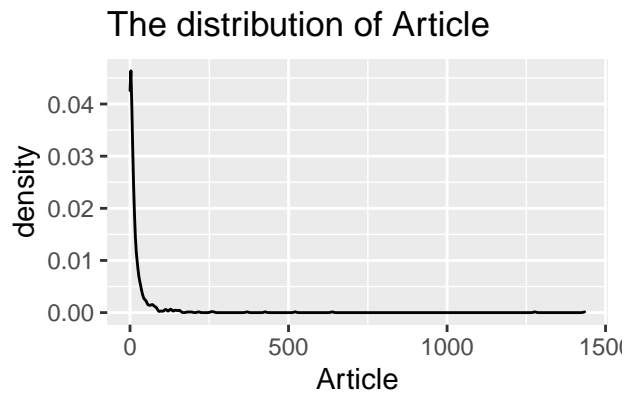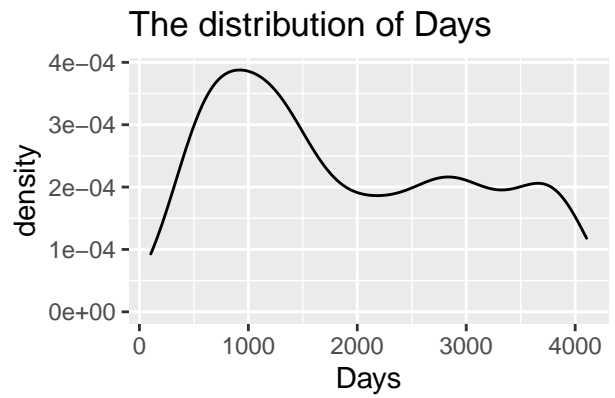
Multiple linear regression model In this part, I use multiple linear regression model to analyze the data. The results are as follows.

```
## 
## Call:
## lm(formula = Performance ~ ., data = data)
## 
## Residuals:
##      Min       1Q   Median       3Q      Max
## -10467.6   -601.7    -94.0    436.2  16477.0
## 
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -1.795e+03  2.582e+03  -0.695 0.487176
## Letter               2.700e+00  1.201e+00   2.247 0.024902 *
## Gift                 7.314e+00  4.118e-01  17.762  < 2e-16 ***
## Popular              1.910e+03  2.394e+02   7.980 5.31e-15 ***
## Article              2.824e+00  7.722e-01   3.656 0.000273 ***
## AttitudeSatisfaction -6.016e+03  2.348e+03  -2.562 0.010596 *
## Price               -2.788e-01  1.337e-01  -2.085 0.037398 *
## Days                 2.994e-01  5.709e-02   5.244 2.03e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 1726 on 771 degrees of freedom
## Multiple R-squared:  0.6624, Adjusted R-squared:  0.6593
## F-statistic: 216.1 on 7 and 771 DF,  p-value: < 2.2e-16
```

Two conclusions can be drawn from the results. First, the P-value of f-statistic is less than 0.05, indicating that the model is significant. Second, the P-value of independent variable coefficient is less than 0.05, indicating that the coefficient of each variable is significant. Among them, the constant term is not significant, which has little influence on our analysis of influencing factors.

Stepwise multiple linear regression model Stepwise regression was further used to test whether there were any variables that could be eliminated. As you can see from the results, there are no variables that go out. This indicates that the overall effect of the model is better.

```
## Start:  AIC=11620.88
## Performance ~ Letter + Gift + Popular + Article + AttitudeSatisfaction +
##     Price + Days
##
##                        Df Sum of Sq         RSS   AIC
## <none>                              2297673660 11621
## - Price                 1   12955199 2310628859 11623
## - Letter                1   15050913 2312724573 11624
## - AttitudeSatisfaction  1   19560948 2317234608 11626
## - Article               1   39843282 2337516942 11632
## - Days                  1   81959816 2379633476 11646
## - Popular               1  189758798 2487432458 11681
## - Gift                  1  940174553 3237848214 11886


##
## Call:
## lm(formula = Performance ~ Letter + Gift + Popular + Article +
##     AttitudeSatisfaction + Price + Days, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -10467.6  -601.7   -94.0   436.2  16477.0
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)          -1.795e+03  2.582e+03  -0.695 0.487176
## Letter                2.700e+00  1.201e+00   2.247 0.024902 *
## Gift                  7.314e+00  4.118e-01  17.762  < 2e-16 ***
## Popular               1.910e+03  2.394e+02   7.980 5.31e-15 ***
## Article               2.824e+00  7.722e-01   3.656 0.000273 ***
## AttitudeSatisfaction -6.016e+03  2.348e+03  -2.562 0.010596 *
## Price                -2.788e-01  1.337e-01  -2.085 0.037398 *
## Days                  2.994e-01  5.709e-02   5.244 2.03e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1726 on 771 degrees of freedom
## Multiple R-squared:  0.6624, Adjusted R-squared:  0.6593
## F-statistic: 216.1 on 7 and 771 DF,  p-value: < 2.2e-16
```

4 Results

From the analysis results, the following conclusions can be drawn:

1. The number of thanks letters has a positive impact on the performance of doctors on online healthcare community.

2. The number of gifts has a positive impact on the performance of doctors on online healthcare community.

3. Popular has a positive effect on the performance of doctors on online healthcare community.

4. The number of published articles has a positive impact on the performance of doctors on online healthcare community.

5. Attitude satisfaction has a negative impact on the performance of doctors on online healthcare community.

6. Service price has a negative impact on the performance of doctors on the online healthcare community.

7. The opening days have a positive influence on the performance of doctors on online healthcare community.

5 Discussion

5.1 Conclusion

Summarize and evaluate the above results:

1. For Letter, Gift and Popular variables, these variables are patient feedback variables.The higher the value of these variables, the better the reputation of the physician, and therefore the higher the performance.

2. For the Article variable, the higher the value of this variable, the higher the willingness of doctors to contribute, so it can also promote the improvement of performance.

3. For the Price variable, the higher this variable is, the higher doctors' fees are, and the lower patients' purchase intention will be.So it has a negative effect on performance.

4. For the Days variable, the higher this variable is, the longer the physician stays open, and therefore the more patients he is exposed to, and the better his performance.

The above conclusions are very easy to understand. For the variable of Attitude satisfaction, the regression result seems not so easy to understand.As far as common sense and previous studies are concerned, the higher the value of this variable indicates that the better the service attitude of doctors is, which will enhance the reputation and performance of doctors.However, this variable has a negative influence in the regression results.I think it's probably the sample that I picked.I chose a small number of samples, and each doctor tended to get a full score on this value.

5.2 Limitation

Due to the limitation of research level, this paper has some limitations in the research process:

1. Limitations of data sources. The number of data samples obtained in this paper is much smaller than the total number of samples, and the limitation of data volume has a certain obstacle effect on the research

2. Limitations of the research model. The reputation evaluation of doctors can be divided into index type and content type. In addition to the quantitative evaluation of patient's thank-you letter, gift and heat, patients can also make a written description of the service content after the telephone consultation, which can be further analyzed in combination with the semantic context in the subsequent research.

3. Limitations of research methods. All the data in this paper are from web page capture data. In the future studies, the subjective indicators of doctors and patients can be further refined according to needs by combining questionnaire survey and other methods, and the mutual influence between these factors can be considered to improve the indicator model.

6 References

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