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***Observational Study***

**Effect and satisfaction of outpatient services by precision valuation reservation registration**

Jin HJ *et al*. Precision valuation reservation and waiting time

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**Abstract**

BACKGROUND

With the improvement of people's living standards, people pay more attention to their health. More patients choose to go to large or well-known hospitals, which leads to the perennial crowding of outpatient clinics in these hospitals in China being an indisputable fact.

AIM

To establish precision valuation reservation registration aimed at shortening waiting time, improving patient experience and promoting the satisfaction of outpatients and medical staff.

METHODS

On the basis of the implementation of a conventional appointment mode, more reasonable interval time modes are set for different doctors by evaluating the actual capacity of each doctor to receive patients, and appointment time modes are made more accurate through intervention. Then, the change in the consultation waiting time of patients was compared. The correlations between the consultation waiting time of patients and the satisfaction of patients or satisfaction of medical staff were analyzed.

RESULTS

After precision valuation reservation registration, the average consultation waiting time of patients was reduced from 18.47 min to 10.11 min (*t* = 8.90, *P* < 0.001). The satisfaction score of patients increased from 91.33 to 96.27 (*t* = -8.62, *P* < 0.001). The satisfaction score of medical staff increased from 90.51 to 96.04 (*t* = -10.50, *P* < 0.001). The consultation waiting time of patients was negatively correlated with their satisfaction scores (γ = -0.89, *P* < 0.001). The consultation waiting time of patients was also negatively correlated with medical staff satisfaction scores (γ = -0.96, *P* < 0.001).

CONCLUSION

Precision valuation reservation registration significantly shortened outpatient waiting times and improve the satisfaction of not only patients but also medical staff. This approach played an important role in improving outpatient services, provided a model that is supported by relevant evidence and could continuously improve the quality of management. Precision valuation reservation registration is worth promoting and applying in the clinic.

**Key Words:** Precision valuation reservation; Shorten waiting time; Effect of outpatient service; Satisfaction; Outpatients; Medical staff

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**Core Tip:** We collected waiting times of patients and satisfaction scores of patients and medical staff. After precision valuation reservation registration, the average consultation waiting time of patients reduced and the satisfaction scores of patients and medical staff increased. The consultation waiting time of patients was negatively correlated with satisfaction scores. This approach played an important role in improving outpatient services, provided a model that is supported by relevant evidence and could continuously improve the quality of management.

**INTRODUCTION**

With the improvement of people's living standards, people pay more attention to their health. More patients choose to go to large or well-known hospitals, which leads to the perennial crowding of outpatient clinics in these hospitals in China being an indisputable fact[1,2]. The long existing phenomenon of "three long and one short"[3], long registration, medical treatment and payment queue waiting time, and the short time of seeing a doctor often cause patients to be anxious. The degree of satisfaction of seeing a doctor is reduced, and it easily causes medical disputes[4-6]. It not only wastes patients’ time but also reduces the efficiency of hospital operation[7]. This problem exists abroad, and the World Health Organization has identified consultation waiting times for medical services as one of the key metrics for health systems[8]. Patient waiting time is the amount of time spent in a medical unit before consultation or treatment[9]. The British government has set a series of standards to require all patients to be seen within 30 min of an appointment[10]. To solve the phenomenon of three long and one short appointments, since 2009, China has called on major hospitals to adopt the mode of appointment diagnosis and treatment[11]. Short waiting times and good order are important signs of modern hospitals[12]. Appointment diagnosis and treatment can not only shorten the waiting time for consultation but also improve the order of outpatient services[13-15]. Therefore, the most effective measure is to carry out appointment diagnosis and treatment. At present, most hospitals adopt the subpperiod registration booking service, and the interval between the outpatient number is mainly 45-60 min[16]. The patient waiting time is still approximately 40 min, and the consultation waiting time remains long. Since 2017 and 2018, the medical clinic of a third-class hospital has been able to make a consultation within half an hour after making an appointment; however, the monthly questionnaires still reflect the problem of long wait times for consultations. To better address this problem, precision valuation reservations have been used and fully documented since August 2018. It provides reliable results for clinical practice, further reduces the wait time for consultation, improves the satisfaction of patients and obviously improves the feeling of seeking medical treatment. It also enhances the satisfaction of medical staff.

**MATERIALS AND METHODS**

***Method***

January 2017-July 2018. Serial number intervals were generally set at intervals of 5 min or 10 min.

August 2018-February 2020. By evaluating the ability of each doctor to receive patients, information technology was used to set more reasonable intervals for different doctors to make the appointment times more accurate.

The specific methods were (1) Calculating the difference between the appointment registration time and the doctor's actual consultation time; (2) Monitoring doctors' real-time workload through information systems; and (3) Conducting a field investigation of outpatient visits by all physicians in the internal medical clinic. Through the above methods, we mastered the outpatient consultation of each doctor. For example, some doctors had assistants and worked quickly, so in this case, the interval was set slightly shorter. Some older and experienced doctors had more patients with complications, so the interval was extended appropriately. Some diseases needed to be assessed by laboratory tests in the morning and diagnosed in the afternoon. Therefore, we set a shorter interval in the morning and a longer interval in the afternoon. After continuous evaluation, improvement and commissioning, each physician in the internal medicine clinic had a precision valuation reservation time tailored for himself. There was no longer a general 5-min or 10-min reservation mode but multiple appointment intervals of 3, 4, 5, 6, 7, 8, 9 or 10 min. The working time was fully utilized, the diagnosis and treatment were more efficient and the wait time for consultation of patients was shortened.

Fifteen questionnaires prepared by the internal medical clinic were distributed to patients daily, and the patient satisfaction score was calculated (except holidays). We used a Likert scale, and each statement had five responses: "Fully agree", "agree", "not necessarily", "disagree" and "very much disagree", which were recorded as 5, 4, 3, 2 and 1, respectively. The sum of scores with "very satisfied" and "satisfied" was divided by the sum of scores of all five scales ("very satisfied", "satisfied", "general", "dissatisfied", and" very dissatisfied"). Then, we multiplied this index by 100 to obtain a satisfaction score of which the highest score was 100.

Monthly questionnaires were distributed to all physicians and outpatient paramedics in the medical clinic, and the satisfaction score was calculated. We used a Likert scale, and each statement had five answers: "Fully agree", "agree", "not necessarily", "disagree" and "very much disagree", which were recorded as 5, 4, 3, 2 and 1, respectively. The sum of scores with "very satisfied" and "satisfied" was divided by the sum of scores of all five scales ("very satisfied", "satisfied", "general", "dissatisfied", and" very dissatisfied"). Then, we multiplied this index by 100 to obtain a satisfaction score of which the highest score was 100.

This research was approved by the Shandong Provincial Hospital Ethics Committee.

***Evaluation methodology***

We evaluated the consultation waiting time of advanced appointment patients, patient satisfaction and medical staff satisfaction from January 2017 to February 2020. Consultation waiting times were specific to the minute. The highest satisfaction score was 100.

***Statistical methods***

Differences in measurement data were compared by independent samples t-tests. The correlations between consultation waiting time of patients and satisfaction of patients or satisfaction of medical staff were analyzed with linear correlation. The correlation coefficient (γ) ranges from -1 to 1. γ > 0 indicates a positive correlation, whereas γ < 0 indicates a negative correlation.

**RESULTS**

The wait times of consultations after precision valuation reservation registration were obviously shortened (*t* = 8.90, *P* < 0.001).Patients’ consultation wait times before and after precision valuation reservation registration are shown in Tables 1 and 2.

Patient satisfaction significantly improved after precision valuation reservation registration (*t* = -8.62, *P* < 0.001). Patient satisfaction before and after precision valuation reservation registration is shown in Tables 3 and 4.

The correlation between patient consultation waiting time and patient satisfaction (Figure 1) was negative (γ = -0.89).

The satisfaction of medical staff was obviously improved (t = -10.50, *P* < 0.001). The satisfaction of medical staff before and after precision valuation reservation registration is shown in Tables 5 and 6.

The correlation between patients’ consultation waiting time and the satisfaction of medical staff (Figure 2) was negative (γ = -0.96).

**DISCUSSION**

Long wait times are the main cause of patient dissatisfaction and reduce patients' satisfaction with hospital services. Even though hospitals provide free medical care, patients are less satisfied with their experience[17-19]. It is important to allow patients not to waste time and complete the matters related to their visit in the shortest possible time. By making full use of hospital information medical resources, the application of information systems can shorten the wait time for outpatient consultations, improve patient satisfaction and enhance the efficiency and quality of medical treatments[20-23]. In this study, the use of precision valuation reservation registration effectively shortened the wait time for patients’ consultation, improved patient satisfaction, and greatly enhanced the patient experience. It also improved the efficiency and satisfaction of medical staff and enhanced the staff's work happiness[24].

***Patients’ registration time decreased to zero***

Patients can make an appointment for a specific time using precision valuation reservation registration. They receive the corresponding information after the appointment is successful, and the reservation information clearly informs them of the specific time and place to sign in and pick up their number. Patients only need to arrive at the corresponding department to check in according to the specific time or sign in on their mobile phone. We need to enhance patient diversion in specialist clinics and avoid the peak of registration in the morning[25]. Precision valuation reservation registration solved the problem of patients’ gathering in the morning at the outpatient clinic and solved the problem of a long registration queue. After using precision valuation reservation registration to make an appointment for a specific time, patients did not need to wait for registration.

***Research showed that precision valuation reservation registration significantly reduced the wait time of patients***

Wait time is an important factor influencing outpatient satisfaction[26-28]. According to reports[29], the average wait time for patients to visit specialist clinics in hospitals is more than one hour. If the appointment time is accurate to the hour, the wait time is still approximately 40 min on average. On the basis that the wait time of our hospital was steadily reduced to 30 min in January 2017-July 2018, we carried out precision valuation reservation registration in August 2018, and patients’ wait time was reduced to 15 min or even within 10 min. The patients’ wait time was further shortened, and the effect was remarkable.

***Patients’ satisfaction was improved***

After precision valuation reservation registration was adopted, patient registration wait times and wait times after triage were almost zero. The patient arrived at the hospital, was checked in and could then hear a radio call. It effectively alleviated patient irritability and anxiety caused by long wait time. The number of medical disputes was reduced to zero, and there existed more thanks. Although the wait time of on-site appointment patients was still long, patients could also learn about the consultation time by the consultation waiting time on the registered ticket. Through our explanation, patients also knew that not making an appointment in advance was the reason for their long wait time for consultation, which reduced the tension, anxiety and dissatisfaction of patients. The satisfaction of the patients and the patients' sense of receiving medical attention were greatly improved.

***The satisfaction of medical staff was improved, and the treatment was in good order***

The patients registered at the designated place according to the appointment time. The incidence of medical disputes caused by the long wait time for consultation was reduced by considering the patient's own situation. It also eased the relationship between medical staff and patients and created a peaceful and efficient treatment[30]. Precision valuation reservation registration basically achieved the effect of the patient’s immediate visit after arriving at the hospital, so the treatment was in good order and the patient was not in a bad mood. It eliminated the time and effort of medical staff to maintain good order and even the abuse and dissatisfaction of patients. Precision valuation reservation registration saved the manpower of maintaining order, gave the medical staff time to provide health guidance to patients, improved the medical staff's satisfaction with their work greatly and enhanced their work happiness at the same time.

***The sustainability of precision valuation reservation registration was ensured***

At present, the reservation rate of our hospital has exceeded the 50% qualified rate set by the State Health and Family Planning Commission. To maintain or improve the reservation rate, we must improve the reservation awareness rate in various ways. Through questionnaires and on-site interviews, some patients were aware of the reservation. However, they did not know all the types of convenient reservations of the hospital completely. For example, some elderly patients said that they knew to make an appointment but did not know how to go online. This means that they did not know that they could make an appointment by telephone. As a result, the reservation was restricted. Therefore, we should increase the publicity of various reservation methods so that patients know the hospital provides suitable reservation services for all kinds of people. In addition to strengthening the publicity of reservations through the media, department staff should also make full use of patients’ wait time to share information about reservations by making a video to explain how to make an appointment and playing the video intermittently. Department staff needs to focus on the patients who need to return and who do not register on the spot successfully to explain the process. We should continuously improve the reservation rate, ensure the sustainability of precision valuation reservation registration and improve the patients’ experience.

The waiting area of the outpatient clinic is where most patients spend the most time during their visit, and its environmental comfort is particularly important for patients' experience[31]. Patients arrive at the hospital according to their appointment time, which effectively alleviates congestion in the waiting room. Patients previously had no place to wait before the hospital carried out reservations. After implementing precision valuation reservation registration, although the number of outpatients has increased year over year, patients have a place to wait, and even the walkway in the waiting room is unblocked now. It has obviously improved the environment, met the requirements of epidemic prevention and control, increased the environmental comfort of medical staff and patients and effectively alleviated the anxiety of medical staff and patients.

**CONCLUSION**

In summary, precision valuation reservation registration can significantly improve the effect of outpatient diagnosis and treatment and has achieved significant results. To consolidate the effect of precision valuation reservation registration, hospitals should increase the publicity and reservation awareness rate of patients. On the other hand, it is necessary to let patients realize and experience the convenience of appointments so that they can publicize to each other and raise their awareness of appointments. They could make an appointment when they return for a visit, and others could also benefit from appointments[32,33]. The study found that some patients, though booked, still arrived early. Therefore, hospitals should make full use of the information function to increase publicity on the spot and let the patients arrive at the hospital according to their appointment time to save patients’ time and reduce the effect of personnel gathering. Therefore, hospitals should continue to strengthen the publicity among patients on the spot, informing them once the appointment is successful that it has been sorted according to the timepoint selected and that there is no need to line up again in advance to the hospital. The hospital has also established strict management rules and regulations, such as a perfect expert outpatient management system, formulated a reasonable outpatient leave and replacement system and strictly enforced it to reduce the rate of doctors' breach of contract and continuously improved the quality of appointments. Doctors should be regularly inspected, supervised and assessed, and summaries should be timely. According to the information system, doctors who arrive early should be encouraged properly, and latecomers should be reminded of the comprehensive objectives of the department and informed through the office platform and other measures. It can effectively shorten the wait time for consultation, reduce disputes between doctors and patients, continuously improve patients' feelings of seeking medical treatment and continuously improve the satisfaction of medical staff and patients. Precision valuation reservation registration is worth popularizing in the clinic.

**ARTICLE HIGHLIGHTS**

***Research background***

Because of the improvement of people's living standards, people pay more attention to their health. More patients choose to go to large or well-known hospitals and it leads to the perennial crowding of outpatient clinics in these hospitals in China.

***Research motivation***

To better address this problem, precision valuation reservations have been adopted. It can provide reliable results for clinical practice.

***Research objectives***

To establish precision valuation reservation registration aimed at shortening waiting time, improving patient experience and promoting the satisfaction of outpatients and medical staff.

***Research methods***

Information technology was used to set more reasonable intervals for different doctors. Questionnaires about the satisfaction were distributed to patients and medical staff to calculate the satisfaction score. Differences in measurement data were compared by independent samples t-tests. The correlations between consultation waiting time of patients and satisfaction of patients or satisfaction of medical staff were analyzed with linear correlation.

***Research results***

The wait times of consultations after precision valuation reservation registration were obviously shortened. Patient satisfaction significantly improved after precision valuation reservation registration. The correlation between patient consultation waiting time and patient satisfaction was negative. The satisfaction of medical staff was obviously improved. The correlation between patients’ consultation waiting time and the satisfaction of medical staff was negative.

***Research conclusions***

Precision valuation reservation registration significantly shortened outpatient waiting times and improve the satisfaction of not only patients but also medical staff.

***Research perspectives***

It is understood that this is the first study to reduce the wait time for outpatient consultations, improve patient satisfaction and enhance the efficiency and quality of medical treatments by setting personalized appointment intervals. This approach played an important role in improving outpatient services, provided a model that is supported by relevant evidence and could continuously improve the quality of management. Precision valuation reservation registration is worth promoting and applying in the clinic.

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**Footnotes**

**Institutional review board statement:** The study was reviewed and approved by Shandong Provincial Hospital Affiliated to Shandong First Medical University Institutional Review Board, SWYX:NO. 2021-067.

**Informed consent statement:** The informed consent was waived.

**Conflict-of-interest statement:** All authors have nothing to disclose.

**Data sharing statement:** Technical appendix, statistical code, and dataset available from the corresponding author at tanghuanmei2021@126.com.

**STROBE statement:** The authors have read the STROBE Statement—checklist of items, and the manuscript was prepared and revised according to the STROBE Statement—checklist of items.

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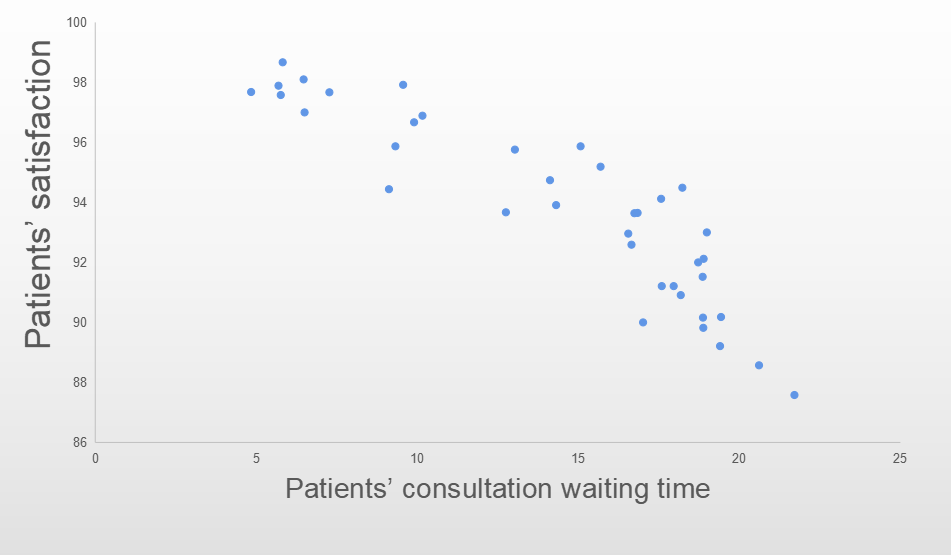
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**Figure Legends**



**Figure 1 Correlation between patients’ consultation wait time and patients’ satisfaction.**



**Figure 2 Correlation between patients’ consultation wait time and satisfaction of medical staff.Table 1 Patients’ consultation wait time before and after precision valuation reservation registration**

|  |  |  |
| --- | --- | --- |
| **Time** | **Number of appointments** | **Consultation wait time (min)** |
| 2017-01  2017-02  2017-03  2017-04  2017-05  2017-06  2017-07  2017-08  2017-09  2017-10  2017-11  2017-12  2018-01  2018-02  2018-03  2018-04  2018-05  2018-06  2018-07  2018-08  2018-09  2018-10  2018-11  2018-12  2019-01  2019-02  2019-03  2019-04  2019-05  2019-06  2019-07  2019-08  2019-09  2019-10  2019-11  2019-12  2020-01  2020-02 | 7025  9361  10713  10095  11248  10393  10471  12385  10289  10386  10405  11385  12695  10108  14299  12538  14062  13194  13436  14600  11078  13634  13110  13508  14213  11075  15211  14502  15226  13783  15864  15485  14240  14946  14338  15285  11144  2815 | 19.43  16.65  18.18  16.55  17.01  17.59  19.4  18.23  16.84  17.57  17.96  20.61  21.71  18.72  18.87  18.88  18.86  18.99  18.89  14.31  14.12  15.69  16.74  15.07  13.03  10.16  7.27  6.47  5.82  5.69  4.84  5.76  6.5  9.12  9.32  9.9  9.56  12.75 |

**Table 2 Comparison of the mean value of wait time before and after precision valuation reservation registration**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time** | **Total appointments** | **Average wait time (min)** | ***t* value** | ***P* value** |
| 2017-01 to 2018-07 | 214488 | 18.47 | 8.90 | < 0.001 |
| 2018-08 to 2020-02 | 254057 | 10.11 |  |  |

**Table 3 Patient satisfaction before and after precision valuation reservation registration**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Time** | **Very satisfied1** | **Satisfied1** | **General1** | **Dissatisfied1** | **Very dissatisfied1** | **Satisfaction score** |
| 2017-01  2017-02  2017-03  2017-04  2017-05  2017-06  2017-07  2017-08  2017-09  2017-10  2017-11  2017-12  2018-01  2018-02  2018-03  2018-04  2018-05  2018-06  2018-07  2018-08  2018-09  2018-10  2018-11  2018-12  2019-01  2019-02  2019-03  2019-04  2019-05  2019-06  2019-07  2019-08  2019-09  2019-10  2019-11  2019-12  2020-01  2020-02 | 130  178  160  137  187  155  151  270  205  178  157  112  127  133  162  149  159  176  172  223  200  295  207  244  241  184  262  282  281  250  289  242  231  178  230  257  201  206 | 127  72  140  114  83  146  160  56  90  62  144  167  162  74  122  107  143  103  132  101  70  62  102  58  75  34  31  27  15  29  48  80  60  77  72  62  34  74 | 21  16  25  14  26  24  29  17  12  11  22  28  36  13  26  23  22  19  22  20  12  10  17  11  12  5  6  5  3  4  7  6  9  14  12  10  5  18 | 5  2  5  5  4  4  2  2  8  4  6  5  3  4  5  4  3  1  2  1  3  3  2  2  1  1  1  1  0  2  1  2  0  1  1  0  0  1 | 2  2  0  0  0  1  3  0  0  0  1  3  2  1  0  2  3  1  2  0  0  0  2  0  1  1  0  0  1  0  0  0  0  0  0  1  0  0 | 90.18  92.59  90.91  92.96  90.00  91.21  89.21  94.49  93.65  94.12  91.21  88.57  87.58  92.00  90.16  89.82  91.52  93.00  92.12  93.91  94.74  95.19  93.64  95.87  95.76  96.89  97.67  98.10  98.67  97.89  97.68  97.58  97.00  94.44  95.87  96.67  97.92  93.67 |

1The column of “Very satisfied”, “Satisfied”, “General”, “Dissatisfied”, “Very dissatisfied” in the table are the number of the patients.

**Table 4 Comparison of the mean value of satisfaction score before and after precision valuation reservation registration**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time** | **Copies** | **Mean value of satisfaction score** | ***t* value** | ***P* value** |
| 2017-01 to 2018-07 | 5775 | 91.31 | -8.62 | < 0.001 |
| 2018-08 to 2020-02 | 5730 | 96.26 |  |  |

**Table 5 Satisfaction of medical staff before and after precision valuation reservation registration**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Time** | **Very satisfied1** | **Satisfied1** | **General1** | **Dissatisfied1** | **Very dissatisfied1** | **Satisfaction score** |
| 2017-01  2017-02  2017-03  2017-04  2017-05  2017-06  2017-07  2017-08  2017-09  2017-10  2017-11  2017-12  2018-01  2018-02  2018-03  2018-04  2018-05  2018-06  2018-07  2018-08  2018-09  2018-10  2018-11  2018-12  2019-01  2019-02  2019-03  2019-04  2019-05  2019-06  2019-07  2019-08  2019-09  2019-10  2019-11  2019-12  2020-01  2020-02 | 60  74  68  77  64  69  71  69  77  68  71  55  53  67  76  79  73  63  64  84  87  87  77  102  108  119  125  120  125  124  128  124  118  110  113  115  122  112 | 55  43  49  42  53  49  43  45  39  47  45  58  59  47  42  40  44  53  52  35  32  32  40  27  22  12  9  14  9  11  8  10  14  20  19  24  17  25 | 14  10  13  10  12  10  10  12  10  12  11  14  15  12  10  9  11  12  11  9  8  8  10  7  5  3  2  3  3  3  2  3  3  6  5  5  5  6 | 1  1  0  0  0  1  1  0  1  0  0  0  1  0  1  1  1  0  1  0  0  0  0  0  0  1  0  0  0  0  0  0  1  0  0  1  0  1 | 0  0  0  0  0  0  2  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0 | 88.46  91.41  90.00  92.25  90.70  91.47  89.76  90.48  91.34  90.55  91.34  88.28  87.50  90.48  91.47  92.25  90.70  90.63  90.63  92.97  93.70  93.70  92.13  94.85  95.59  97.04  98.53  97.81  97.81  97.83  98.55  97.81  97.06  95.59  96.35  95.86  96.53  95.14 |

1The column of “Very satisfied”, “Satisfied”, “General”, “Dissatisfied”, “Very dissatisfied” in the table are the number of the patients.

**Table 6 Comparison of the mean satisfaction score of medical staff before and after precision valuation reservation registration**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time** | **Number of medical staff** | **Mean value of satisfaction score** | ***t* value** | ***P* value** |
| 2017-01 to 2018-07 | 2434 | 90.51 | -10.50 | < 0.001 |
| 2018-08 to 2020-02 | 2581 | 96.04 |  |  |