

# Correct Understanding and Filling Data Can Improve the DRG's RW of Inpatients with Malignant Tumor Effectively

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**Abstract:** *Objective* To investigate the correlation between average cost, average length of stay, diagnosis, surgery or operation and relative weight (RW) of inpatients with malignant tumors and find defects of the data related to DRG. *Methods* From January 1, 2021 to June 30, 2021, inpatients in the oncology department of a hospital were selected. The data of relative weight, average cost, average length of stay, major diagnosis, other diagnosis, surgery or operation were collected. The stability of RW in different months and the correlation of relative weight, average cost and average length of stay were compared so as the correlation between the primary diagnosis, other diagnosis, surgery or operation and DRG and RW. *Results* There was no significant difference in RW from January to June,  $P>0.05$ . The relative weight, average cost and average length of stay was in the same trend. Errors in major diagnosis, other diagnosis and related surgery or operation led to different DRG groups. And RW increased by 5.83% after adjustment. *Conclusion* DRG can be used as a method to measure the work efficiency of oncology department. Different diagnosis and the order of surgery or operation can affect the correct group of DRG. Persistent training and dynamic quality control based on continuous improvement are of great important for the accuracy of DRG data.

**Keywords:** DRGS, Inpatients with Malignant Tumor, RW, Analysis and Consideration

## 1. Introduction

The so-called Diagnosis Related Groups (DRG) is a system that divides patients into several diagnosis groups for management based on factors such as age, Diagnosis of disease, comorbidities, complications, treatment methods, severity and outcome of disease, and resource consumption [1]. Originated in the United States in the 1980s, DRG is recognized as advanced and scientific payment method globally. At the macro level, there is a consensus that DRG payment can effectively control the unreasonable growth of medical expenses and improve the quality and efficiency of medical services [2]. However, from the micro aspect, how to ensure the authority of DRG group and the objectivity of Relative Weight (RW) and Case Mix index (CMI), and how to make the first page data of medical records "truly authentic" need further research [3]. In 2019, The Medical Insurance

Administration of china issued "The Notice on printing and Distributing the List of National pilot cities paying fees by Disease Diagnosis related Groups", and Wuxi city was one of the 30 pilot cities [4]. In order to play the more important role of DRG in clinical diagnosis and treatment, this study analyzed the correlation between average cost, average length of stay, diagnosis, operation or operation and relative body weight (RW) of hospitalized patients with malignant tumors from January to June 2022, searched for problems in the first page of medical records, and put forward suggestions for continuous improvement.

## 2. Materials and Instruments

### 2.1. Patients and Specimens

The inpatients were from the Oncology Department of the hospital from January 1, 2021 to June 30, 2021. The data were

obtained from the Municipal Medical Insurance Bureau. A total of 1651 patients were enrolled, including 1042 males and 609 females, with an average age of 65 years, an average hospitalization cost of 10,650 yuan, and an average length of stay of 5.05 days.

## 2.2. Statistical Analysis

All statistical analyses were performed by EXCEI2013 and SPSS25.0 to calculate diagnostic composition, average length of stay and average cost of each DRG group. ONE-WAY ANOVA was used to analyze the relative weight and average

length of stay in different months and  $P < 0.05$  was considered statistically significant.

## 3. Results

### 3.1. Overall Situation of Enrolled DRG Patients

Among 1651 patients, the total number of DRG groups was 66, of which 11 groups accounted for 95.82%, and the other 55 groups 4.18%. As shown in Table 1.

Table 1. Main grouping of DRG in 1651 patients.

| DRG name (Code)  | RW   | Average cost (ten thousand yuan) | Average length of stay | number | Ratio (%) |
|--|------|----------------------------------|------------------------|--------|-----------|
| Acute leukemia chemotherapy and/or other treatments (RB19)   | 0.88 | 1.089                            | 4.73                   | 514    | 31.13     |
| Chemical and/or targeted, biologic treatment of malignant proliferative disorders without complications or comorbidities (RE15)    | 0.72 | 1.016                            | 4.3                    | 465    | 28.16     |
| Radiotherapy for malignant proliferative diseases (RC19)   | 1.97 | 1.673                            | 8.9                    | 90     | 5.45      |
| Malignant hyperplastic disorders associated with chemical and/or targeted, biologic therapies (RU19)                               | 0.77 | 0.806                            | 5.01                   | 83     | 5.03      |
| Maintenance treatment of malignant hyperplastic disorders without complications or complications (RW25)                            | 0.7  | 0.763                            | 4.12                   | 75     | 4.54      |
| Maintenance treatment of malignant hyperplastic disorders with complications or comorbidities (RW23)                               | 0.77 | 0.855                            | 5.29                   | 68     | 4.12      |
| Follow-up examination after treatment of malignant hyperplastic disease (RW19)   | 0.61 | 0.699                            | 4.52                   | 65     | 3.94      |
| Surgery unrelated to the primary diagnosis (RQY)   | 1.5  | 1.596                            | 6.7                    | 64     | 3.88      |
| Chemical and/or targeted, biologic treatment of malignant hyperplastic disorders with severe complications or comorbidities (RE11) | 0.99 | 1.134                            | 3.86                   | 56     | 3.39      |
| other  |      |                                  |                        | 69     | 4.18      |
| summation  |      |                                  |                        | 1651   | 100       |

Acute leukemia chemotherapy and/or other treatment (RB19) group had the most cases (514 cases, 31.13%); The second group was chemical and/or targeted and biological therapy for malignant proliferative diseases, without complications or complications (RE15), 465 cases (28.16%). The CMI of Radiotherapy for malignant proliferative diseases was the highest in all groups (RC19 group), 90 cases (5.45%).

Relatively, there were fewer patients with serious complications, and chemical and/or targeted and biological therapies with serious complications or comorbidities (RE11) accounted for 3.39% of malignant hyperplastic diseases. The proportion of Maintenance treatment of malignant hyperplastic disorders with severe complications or comorbidities (RW21) was 1.15%, lower than that with complications or comorbidities (RW23, 4.12%) or without

(RW25, 4.54%).

### 3.2. Monthly RW Value, Average Cost and Average Length of Stay Were Relatively Stable

There were no significant differences in RW value, average cost and average length of stay between January and June ( $P > 0.05$ ), indicating the relative stability of DRG grouping. RW in May is lower than that in other months, which may be related to the failure of the hospital accelerator and the replacement of the positioning CT, which leads to the failure of positioning and radiotherapy for a long time. The radiotherapy with high RW value is relatively decreased, but it does not affect the overall situation. As shown in Table 2.

Table 2. Comparison of monthly RW, Average Cost and Average Length of stay from January to June 2021.

|                                  | January     | February    | March       | April       | May          | June           | F     | P     |
|----------------------------------|-------------|-------------|-------------|-------------|--------------|----------------|-------|-------|
| CMI                              | 0.92±0.35   | 0.92±0.33   | 0.93±0.35   | 0.90±0.33   | 0.88±0.32    | 0.91±0.34      | 0.823 | 0.533 |
| Average cost (ten thousand yuan) | 1.044±0.440 | 1.120±0.498 | 1.117±0.509 | 1.048±0.483 | 1.0564±0.504 | 10202.32±0.499 | 1.891 | 0.093 |
| Average Length of stay (day)     | 5.26±2.66   | 4.97±2.85   | 5.13±2.38   | 5.05±2.66   | 5.01±2.67    | 4.91±2.71      | 0.586 | 0.711 |

### 3.3. RW Value, Average Cost and Average Length of Stay Were Correlated to Some Extent

According to the trend chart, the DRG group with high RW

had higher average cost and longer average hospital stay, which was consistent with the grouping principle of DRG group. Chemical and/or targeted and biological therapy for malignant hyperplastic disorders with severe complications or

comorbidities (RE11) had a mean hospital stay of 3.86 days, which was lower than that of patients without that, but its cost was higher than that of the latter, which may be associated

with severe complications leading to short rescue time or family members' abandonment. As shown in figure 1.

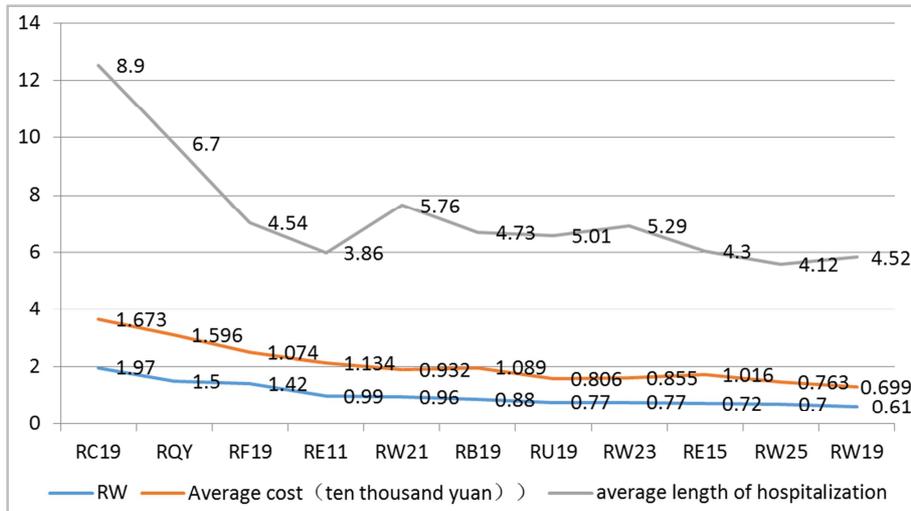


Figure 1. Trends of CMI, cost per capita and average length of stay in different DRG groups.

**3.4. Main Diagnosis, Operation or Operation, and the Presence or Absence of Complications Had Great Influence on the RW Value of the Disease Group**

In 514 cases of Acute leukemia chemotherapy and/or other treatments group, the main diagnosis was maintenance chemotherapy or preoperative (post-operative) chemotherapy, and the operations or procedures was filled with intravenous chemotherapy drugs. Among them, 7 cases were combined with targeted therapy for malignant tumor, 11 cases with immunotherapy, and 496 cases with primary tumors.

The main diagnosis of 465 cases with Chemical and/or targeted, biologic treatment of malignant proliferative disorders group without complications or comorbidities, Targeted therapy of malignant tumors was 189, immunotherapy 265, the operations or procedures correspond to them. The other 11 cases were mainly diagnosed as Malignant tumor maintenance chemotherapy, postoperative chemotherapy, of which 9 cases was combined with other diagnoses such as Targeted therapy or postoperative targeted therapy for malignant tumors, and of 2 primary tumor, without filling operations or procedures. Of all 465 cases, 280 cases were treated with chemotherapy and 27 cases with other therapy.

The main diagnosis of 83 cases with Malignant hyperplastic

disorders associated with chemical and/or targeted, biologic therapies group, targeted therapy was 21, endocrine therapy 7, and maintenance chemotherapy or preoperative (post-operative) chemotherapy 55. The operations or procedures were not filled.

The main diagnosis of 90 cases with Radiotherapy for malignant proliferative diseases group was all Radiotherapy for malignant tumor or preoperative (postoperative) radiotherapy. 21 of which had another diagnosis such as Malignant tumor maintenance chemotherapy, preoperative (post-operative) chemotherapy, 69 primary tumor. Operations or procedures were filled with Intensity Modulated Radiation Therapy or radiotherapy.

The main diagnosis of 64 patients with Surgery unrelated to the primary diagnosis group, Radiotherapy for malignant tumor, preoperative (postoperative) radiotherapy was 43, Malignant tumor maintenance chemotherapy 21, the operations or procedures was filled with linear accelerator radiotherapy and Intravenous infusion port implantation respectively.

Another, the main diagnosis of 3 patients with Malignant hyperplastic disorders associated with radiation therapy group was Radiotherapy for malignant tumors. The operations or procedures were unfilled. As shown in table 3.

Table 3. Analysis of case groups with high PROPORTION of DRG.

| DRG name (n)  | RW   | Main Diagnostic name   | n   | Other diagnostic 1   | n         | operation or procedure 1       | operation or procedure 2                          |
|---|------|--|-----|--|-----------|--------------------------------|---|
| Acute leukemia chemotherapy and/or other treatments, RB19 (514) | 0.88 | Malignant tumor maintenance chemotherapy, preoperative (post-operative) chemotherapy | 514 | argeted therapy of malignant tumors  | 7         | Intravenous chemotherapy drugs | Molecular targeted therapy<br>Tumor immunotherapy |
| Chemical and/or targeted, biologic treatment of malignant       | 0.72 | Targeted therapy of malignant tumors   | 189 | Immunotherapy of malignant tumors<br>Primary tumors                                  | 11<br>496 | Molecular targeted therapy     | Intravenous chemotherapy drugs                    |
|   |      |  |     | Malignant tumor maintenance chemotherapy, preoperative (post-operative) chemotherapy | 138       |                                |   |

| DRG name (n)   | RW   | Main Diagnostic name  | n   | Other diagnostic 1   | n   | operation or procedure 1  | operation or procedure 2               |
|--|------|---|-----|--|-----|---|--|
| proliferative disorders without complications or comorbidities, RE15 (465)                                 |      | Immunotherapy of malignant tumors   | 265 | Primary tumors   | 51  |   | /                                      |
|  |      |   |     | Targeted therapy or postoperative targeted therapy for malignant tumors              | 27  |   | Molecular targeted therapy             |
|  |      |   |     | Malignant tumor maintenance chemotherapy, preoperative (post-operative) chemotherapy | 133 | Tumor immunotherapy   | Intravenous chemotherapy drugs         |
|  |      |   |     | Primary tumors   | 105 |   | /                                      |
| Malignant hyperplastic disorders associated with chemical and/or targeted, biologic therapies, RU19 (n=83) | 0.77 | Malignant tumor maintenance chemotherapy, postoperative chemotherapy        | 11  | Targeted therapy or postoperative targeted therapy for malignant tumors              | 9   | Molecular targeted therapy                                      | Intravenous chemotherapy drugs         |
|  |      |   |     | Primary tumors   | 2   | /   | /                                      |
|  |      |   |     | Targeted therapy of malignant and malignant tumors                                   | 21  | /   | /                                      |
| Radiotherapy for malignant proliferative diseases, RC19 (n=90)   | 1.97 | Radiotherapy for malignant tumor, preoperative (postoperative) radiotherapy | 90  | Malignant tumor maintenance chemotherapy, preoperative (post-operative) chemotherapy | 21  | Intensity modulated conformal radiotherapy or radiation therapy | /                                      |
|  |      |   |     | Primary tumors   | 69  |   | /                                      |
| Surgery unrelated to the primary diagnosis, RQY (n=64)   | 1.5  | Radiotherapy for malignant tumor, preoperative (postoperative) radiotherapy | 43  |  |     | Linear accelerator radiotherapy                                 | /                                      |
|  |      |   |     | Malignant tumor maintenance chemotherapy, etc  | 21  |   | Intravenous infusion port implantation |
| Malignant hyperplastic disorders associated with radiation therapy, RV19 (n=3)                             | 1.68 | Radiotherapy for malignant tumors   | 3   |  |     |   | /                                      |

### 3.5. Comparison of Disease Groups After Adjustment

Table 4 was adjusted as follows: Malignant tumor maintenance chemotherapy, preoperative (post-operative) chemotherapy was adjusted as the main diagnosis, operation of procedure were changed accordingly; If operation or

procedure is unfilled, it should be added according to the diagnosis. Linear accelerator radiotherapy was modulated to conformal radiotherapy. Average RW= (number of DRG cases \* corresponding RW)/total number of cases. The average weight after adjustment was increased by 5.83% compared with before. As shown in table 4.

Table 4. Comparison of mean RW of 1219 patients with malignant tumor before and after adjustment.

|          | RB19 |      | RE15 |      | RU19 |      | RC19 |      | RQY |     | RV19 |      | Average RW |
|----------|------|------|------|------|------|------|------|------|-----|-----|------|------|------------|
|          | n    | RW   | n    | RW   | n    | RW   | n    | RW   | n   | RW  | n    | RW   |            |
| unadjust | 514  | 0.88 | 465  | 0.72 | 83   | 0.77 | 90   | 1.97 | 64  | 1.5 | 3    | 1.68 | 0.926      |
| adjust   | 796  | 0.88 | 204  | 0.72 | 62   | 0.77 | 136  | 1.97 | 21  | 1.5 | 0    | 1.69 | 0.980      |

## 4. Discussion

DRG is an important tool for measuring the quality, efficiency of medical services and medical insurance payment. It can be used for payment management, budget management and quality management, and is a set of "medical management tools" [5]. The treatment of malignant tumor involves medical and surgical oncology, and covers surgery, chemotherapy, radiotherapy, immunity and other methods. Therefore, it is of important reference significance to explore the application of DRG in tumor patients.

DRG RW refers to the weight given to each DRG according to its resource consumption. The higher the average cost, the greater

the RW of the DRG group, which also reflects the treatment difficulty and technical level of each DRG group to a certain extent [6]. From January to June in 2021, there was no significant difference in RW values, indicating that RW values would not fluctuate significantly under the premise of no obvious technological innovation or new technology development. A total of 346 patients (28.6% of the related group) were treated with combination therapy including radiotherapy, chemotherapy, immunotherapy or targeted therapy. The key factor influencing the RW was the main diagnosis, while the other diagnoses had little impact, but which did not affect the decision of doctors to carry out combination therapy.

DRG data comes from the first page of medical records [7]. Doctors must fully grasp the DRG filling rules to ensure

accuracy and timeliness [8]. As opposed to the same treatment, different diagnosis even the order may lead to different codes, and which results in different RW or CMI values [9]. Maintenance chemotherapy as the primary diagnosis accompanied by operation or procedure filled in "intravenous chemotherapy drugs" can be assigned to Acute leukemia chemotherapy and/or other treatments (RB19, RW0.88); If not specified, it is classified as Malignant hyperplastic disorders associated with chemical and/or targeted, biologic therapies (RU19, RW0.77); Combined targeted or immunotherapy, but not as the primary diagnosis, is classified as Chemical and/or targeted, biologic treatment of malignant proliferative disorders without complications or comorbidities (RE15, RW0.72).

Comprehensive therapy, including chemotherapy, immunization and targeting, is an important feature of the treatment of malignant tumors and also an inevitable direction of development [10]. The main diagnosis should be related to the most expensive, energetic treatment, and consistent with the operation or procedure. In table 3, 11 cases of "Chemical and/or targeted, biologic treatment of malignant proliferative disorders without complications or comorbidities" group, were firstly diagnosed as "Malignant tumor maintenance chemotherapy, postoperative chemotherapy", but the operation or procedure was misfilled with "Molecular targeted therapy" or unfilled. Errors in surgical procedures resulted in incorrect grouping, which should be caused by the doctor's careless. At the same time, coders should play a guiding and correcting role.

Radiotherapy is also the main treatment for malignant tumor [11], the operation or procedure was filled in radiotherapy or Intensity Modulated Radio Therapy, which are classified as Radiotherapy for malignant proliferative diseases (RC19, RW1.97). If filled in linear accelerator radiotherapy, so Surgery unrelated to the primary diagnosis (RQY, RW1.5); If unfilled, so Malignant hyperplastic disorders associated with radiation therapy (RV19, RW1.68). Linac radiotherapy is a general concept, including conformal radiotherapy, conformal Intensity Modulated Radio Therapy and general radiotherapy. In table 3, 3 cases of "Malignant hyperplastic disorders associated with radiation therapy" that operation or procedure was unfilled, actually received radiation therapy by reviewing of medical records, which should also be defined as "incorrect filling".

The complication and its treatment also have a certain impact on RW of malignant tumor. The rate of patients with serious complications is low. In the real world, medical staffs pay too much attention to chemotherapy, radiotherapy or immunotherapy of tumors. For complications such as bone marrow suppression after chemotherapy or basic diseases associated with tumor patients, such as severe malnutrition, moderate and severe anemia, obstructive jaundice, etc., which must be treated actually but not reflected in the first page of medical records, which also affects the objectivity of DRG.

Authority is based on the reality of data, which comes from the homogeneity of concept understanding, while the homogeneity comes from standardized training and effective quality control [7, 12, 13]. As shown in Table 4, the average RW increased by 5.83% when Chemotherapy was adjusted as the main diagnosis and the order of operation changed

accordingly. The same diagnosis and operation are divided into different groups, which due to the misunderstanding of the concept of DRG. And the facts may lead to disconnection between real data and final results, and even question the rationality of the policy. From this point of view, persistent training and dynamic quality control based on continuous improvement are extremely important!

In essence, the fundamental goal of medical staff is to take good care of patients' diseases and improve their quality of life with their own expertise [14]. Under the current situation of unbalanced medical resources, tertiary hospitals should focus on patients with complex and difficult malignant tumors, while primary hospitals should deal with common cases or those without complications, which means that each should play its own role. Doctors in tertiary hospitals should divert simple and common cases with low RW value to primary hospitals, and deal with complicated and difficult patients with high RW value with limited quality medical resources of tertiary hospitals [15]. However, in the real world, inpatient clinics with intravenous chemotherapy drugs cannot be reimbursed, and expenses of intravenous chemotherapy drugs for outpatient cannot be reimbursed. Primary hospitals refuse to treat chemotherapy patients for fear of medical disputes or self-protection. In addition, due to workload based performance assessment and other factors, other departments of the hospital, such as general surgery, thoracic surgery, respiratory medicine department, are also treating non-surgical tumor patients. Which require multiple efforts to make tertiary hospitals dare not or unwilling to treat patients with low CMI or Low RW, and primary hospitals have the ability and motivation to treat patients that meet their processing capacity. Only in this way can DRG be implemented to optimize the allocation of medical resources, standardize doctors' diagnosis and treatment behaviors, and reduce the economic burden of patients.

## 5. Conclusion

DRG can be used as a method to measure the work efficiency of oncology department. Different diagnosis and the order of surgery or operation can affect the correct group of DRG. Persistent training and dynamic quality control based on continuous improvement are of great important for the accuracy of DRG data.

## Disclosure of Conflict of Interest

All the authors do not have any possible conflicts of interest.

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