

Database

Sat. Nov 21, 2020 3:45 PM - 4:00 PM Room E-2 (Congress center 5F - Conference Room 53)

[AP1-E2-4-02] A Long-Tail Trend of Drug Dispensing Frequency and Expenditure Using ABC Analysis

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Keywords: ABC Analysis, Long-tail Trend, National Medical Expenditure

This study aimed to clarify the use of drugs in clinics based on dispensing frequency and expenditure which greatly influence national medical expenditure. We developed a method to determine drug use based on drug dispensing frequency and expenditure. Data were collected from the electronic receipt records in the University of Miyazaki Hospital from April 1 2017 to March 31 2018. The main item of this cohort was information gathered from the national electronic receipt such as drug type, number of dispensing frequency, and expenditure of claim. Drug selection was based on ABC analysis, one of the most popular methods for inventory management. ABC analysis can visualize the importance of each drug based on cumulative rate of dispensing frequency or expenditure. There are two types of ABC ranking based on cumulative rate of drug dispensing frequency and expenditure. The total frequency was 503,383 times and USD 26,630 thousand from 2,367 kinds of drugs in the cohort. However, the skewness was 8 for the frequency and 17 for the expenditure. In particular, it was possible to extract about 50% of total number of the expenditure from only about 12 drugs with A rank. In conclusion, there was a long-tail trend in drug dispensing as same as many products in internet shopping service. Based on this trend, it would be valuable for these 12 drugs to analyze detailed relationship between them and other treatment such as a process mining.

A Long-Tail Trend of Drug Dispensing Frequency and Expenditure Using ABC Analysis

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Abstract

This study aimed to clarify the use of drugs in clinics based on dispensing frequency and expenditure which greatly influence national medical expenditure. We developed a method to determine drug use based on drug dispensing frequency and expenditure. Data were collected from the electronic receipt records in the University of Miyazaki Hospital from April 1 2017 to March 31 2018. The main item of this cohort was information gathered from the national electronic receipt such as drug type, number of dispensing frequency, and expenditure of claim. Drug selection was based on ABC analysis, one of the most popular methods for inventory management. ABC analysis can visualize the importance of each drug based on cumulative rate of dispensing frequency or expenditure. There are two types of ABC ranking based on cumulative rate of drug dispensing frequency and expenditure. The total frequency was 503,383 times and USD 26,630 thousand from 2,367 kinds of drugs in the cohort. However, the skewness was 8 for the frequency and 17 for the expenditure. In particular, it was possible to extract about 50% of total number of the expenditure from only about 12 drugs with A rank. In conclusion, there was a long-tail trend in drug dispensing as same as many products in internet shopping service. Based on this trend, it would be valuable for these 12 drugs to analyze detailed relationship between them and other treatment such as a process mining.

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Introduction

Recently, various research articles have analyzed large databases [1-2]. Although these studies previously decided the target drug by each study project, they do not discuss the position of the target drug in the context of thousands of drugs used in the healthcare market. In other words, one specific target drug studied may not have a big financial impact on the hospital management, particularly if the target drug has a high price but is rarely used. Therefore, this study suggested a method for drug selection based on the frequency and expenditure of drug dispensing (DS). This study expects that there is a huge difference of DS frequency and expenditure, called a long-tail trend as the study hypothesis.

Materials and Methods

We retrospectively reviewed electronic medical records in the University of Miyazaki Hospital from April 1, 2017, to March 31, 2018. In that period of time, a total DS number was 503,383, with a total DS expenditure of USD 26,630 thousand.

For selection of the target drug, ABC analysis was applied on the cohort. ABC analysis is one of the most popular methods of inventory management, which is explained as follows [3]:

ABC analysis is a technique for prioritizing the management of inventory. Inventories are categorized into three classes – A, B, and C. Most management efforts and oversights are expended on managing A items. C items get the least attention and B items are in-between.

In this study, ABC rank was applied to cumulative rate of dispensing frequency and expenditure. These ranks were allocated as follows: (1) calculate dispensing frequency and expenditure by each drug name registered on the national electronic receipt code in Japan, (2) calculate the cumulative rate by descending sort of results of (1), and (3) decide the liminal value to allocate drugs to ABC rank.

All data processing and analyses were performed using SAS University Edition (developed by SAS Institute Inc., USA).

Results

Table 1 shows the summary statistics for dispensing frequency and expenditure. Approximately 2,367 kinds of drugs were extracted from the cohort.

Table 1- Summary statistics of DS

	Frequency	Expenditure (thousand US dollar except skewness and kurtosis)
Sum	503,383	26,630
Mean	213	11
SD	571	91
Skewness	8	17
Kurtosis	83	363

Figure 1 shows the cumulative rate of the top 100 drugs by dispensing frequency and expenditure. There are two cutoff points for the ABC rank based on a cumulative rate of dispensing frequency and expenditure as follows. The ABC rank for frequency was categorized between 0% and 30% (A), 30% and 40% (B), and 40% and 100%. The ABC rank for the expenditure was defined between 0% and 50% (A), 50% and 70% (B), and 70% and 100% (C).

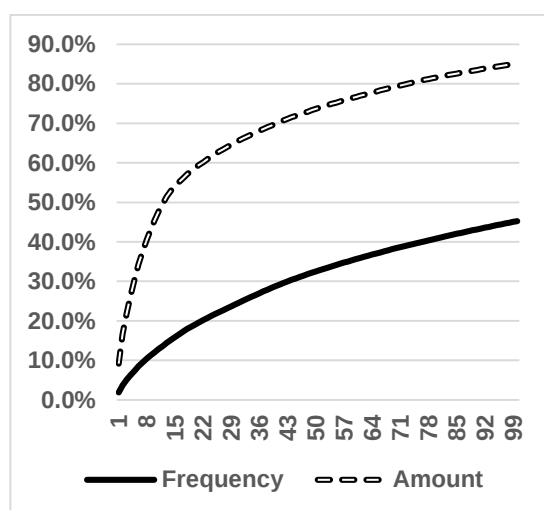


Figure 1- Cumulative rate of dispensing frequency and expenditure

Table 2 shows the number of drug kinds, dispensing frequency, and expenditure by each rank. Despite a few number of drug selection, about 30% frequency and 50% expenditure of dispensing were extracted in A rank.

Table 2- Summary statistics of DS

(a) Rank on frequency

	Number of drugs	Dispense frequency Number	Rate (%)
A	42	149151	29.6
B	34	51707	10.3
C	2291	302525	60.1

(b) Rank on expenditure

	Number of drugs	Dispense expenditure Number (thousand US dollar)	Rate (%)
A	12	13228	49.7
B	28	5391	20.2
C	2327	8011	30.1

Discussion

According to Table 1, skewness is exceptionally large for both frequency and expenditure, suggesting a long-tail trend of DS. As a result, it was possible to extract only 100 drugs, including about 45% dispensing frequency and 85% dispensing expenditure (see Figure 1). This suggests that it is necessary to select a drug that should be the primary target of control. Therefore, ABC analysis was able to select the target.

In particular, only 12 drugs that recorded A rank in the expenditure contained the half of total expenditure of DS. There are multiple drugs for same usage as follows: (1) infliximab and adalimumab for rheumatoid arthritis, (2) bevacizumab and nivolumab for cancer chemotherapy. Other drugs are used for a rare disease such as Fabry disease. Since their price tends to be higher than based on difficulty of treatment, they are particularly important for the dispensing control and management. Furthermore, these drugs may be categorized into the V rank in aspect of VED (vital, essential, and desirable) analysis [4] as the primary drug for treatment.

In future work, we will analyze the relationship between the two drugs and other treatments using process mining [5] within

other hospital's database. For example, there would be cost-effective analyzes by whether single use or combination use.

Acknowledgments

The authors would like to thank Enago (www.enago.jp) for English language review.

Compliance with ethical standards

The authors declare that they have no conflict of interest.

All procedures performed in studies involving human participants were in line with the ethical standards of the Committee of Medical Ethics, University of Miyazaki (Ethics approval number: O-0383) and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Informed consent was obtained through an opt-out method. Authors posted the details of this study on their website and asked participants to opt out of participation until a specified date.

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