Discussion on the Medication Rule of Children's Cough in Ancient Medical Books Based on Data Mining

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Abstract: Objective: To explore the medication rule of children's cough in ancient medical books by using the traditional Chinese Medicine Inheritance calculation platform. **Methods:** By collecting the prescriptions for the treatment of children's cough in the Great Dictionary of traditional Chinese medicine prescriptions, the prescription information was entered into the traditional Chinese Medicine Inheritance calculation platform (V3.0), the frequency, four properties, five flavors and meridian tropism of the entered prescriptions were counted, and the common drug pairs, core combinations and new prescription combinations were obtained by using the methods of association principles and cluster analysis. **Results:** A total of 106 prescriptions and 203 traditional Chinese medicines were selected, and the cumulative use frequency was 1061 times. Among them, there are 12 traditional Chinese medicines used more than 20 times, and the top three are Platycodon grandiflorum, Bitter almond and Pinellia ternary. The top three traditional Chinese medicine efficacy categories are expectorant drugs, antitussive and antiasthmatic drugs, antipyretic drugs and drugs for relieving exterior syndrome. The four properties are mainly warm and cold, the five flavors are mainly spicy, bitter and sweet. It's Channel tropism mostly goes to lung, spleen and stomach meridians. Five common couplet medicines, twenty-three core combinations of traditional Chinese medicine and three new traditional Chinese medicine prescription were obtained. **Conclusions:** Ancient doctors used cold and warm drugs to treat children's cough. Most of the drugs are pungent, bitter and sweet. Drugs mainly belong to lung meridian, followed by spleen meridian and stomach meridian, the main treatment methods are to expel wind and clear heat, eliminate dampness and dissipate phlegm, dispersing lung and relieve asthma, and appropriately add drugs for reducing Qi and moistening intestines.

Keywords: Traditional Chinese Medicine Inheritance Calculation Platform; Cough in children; Dictionary of traditional Chinese medicine prescriptions; Medication rule

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Author Introduction: Fulin Yuan (1996.05), Female, From Jinsha, Guizhou, Bachelor Degree, Research area: Prevention and treatment of children's diseases with traditional Chinese medicine.

1. Introduction

Cough is a common symptom of children lung disease. The grain of skin and the texture of the subcutaneous flesh of children is loose. Lung is often insufficient and other physiological characteristics, resulting in frequent cough. In recent years, under the influence of environmental pollution, climate change and other factors, the incidence of wheezing diseases in children has increased year by year, which is also positively correlated with the incidence of cough in children [1]. Traditional Chinese doctor believes that children's cough is the result of external and internal injury. The disease is located in the lung, often involving the spleen and heart. The pathogenesis is that the lung is affected by exogenous pathogen. The function of lung clearing and carrying downward is weakened and the adverse rising of pulmonary qi. At present, western doctor mainly uses antibiotics drugs, antitussive and antiasthmatic drugs and expectorants drugs. Although they have quick effects, they are easy to relapse and have great side effects. Traditional Chinese doctor has unique advantages in the clinical treatment of children's cough. "Dictionary of Traditional Chinese Medicine Prescriptions" [2] recorded the prescriptions of various generations of doctors since the Qin and Han Dynasties, which is the crystalli-

zation of the doctors of past dynasties. Due to the large number and variety of prescriptions, this study collected and screened the prescriptions used to treat children's cough in the Dictionary of Traditional Chinese Medicine Prescriptions. The prescription composition is completely entered into the software of traditional Chinese Medicine Inheritance calculation platform (V3.0) for data analysis. Excavate the four properties, five tastes and meridian tropism for the treatment of children's cough, obtain the combination of drug pairs and basic prescriptions, and excavate the prescription of new drugs on this basis, so as to provide new ideas for the treatment of this disease with traditional Chinese medicine.

2. Data and Methods

2.1 Inclusion Criteria

It is clearly recorded in the Dictionary of Traditional Chinese Medicine Prescriptions (Volume 1,2nd edition) that the indications or functions include prescriptions of "pediatric cough", "pediatric phlegm" or "pediatric asthma". The prescription is complete, including decoction, pill and Chinese patent medicine preparation.

2.2 Exclusion Criteria

Prescriptions with exactly the same drug composition but different dosage forms, and prescriptions with drug taste less than 2 herbs.

3. Research Methods

3.1 Analysis Software

Traditional Chinese Medicine Inheritance calculation platform (V3.0) software [3] is provided by the Institute of traditional Chinese medicine, Chinese Academy of traditional Chinese medicine. It is upgraded from the auxiliary platform of traditional Chinese Medicine Inheritance (v2.5). It is mainly used for traditional Chinese medicine data analysis.

3.2 Data Standardization Processing

All the included traditional Chinese medicines are based on the Pharmacopoeia of the People's Republic of China [4]. The white stiff silkworm is unified as stiff silkworm, cinnabar is unified as cinnabar, white Poria cocos and red Poria cocos are unified as Poria cocos,and the Qing Pinellia ternary, French Pinellia ternary and prepared Pinellia ternary are unified as Pinellia ternary. Fried almonds and almonds are unified as Bitter almonds.

3.3 Data Entry

Download the data template in the traditional Chinese medicine inheritance calculation platform (V3.0), and completely input the prescription composition into the excel template according to the template requirements. The data are entered by one person and checked by the other to ensure the authenticity, accuracy and correctness of the data.

4. Data Analysis

Select "data management→data upload" to import the data in Excel into the software. Data mining was conducted for 106 prescriptions included in this study to analyze the frequency of traditional Chinese medicine prescriptions, efficacy, property and flavor, channel tropism, core drug pairs and new prescription mining.

5. Results

5.1 Drug Frequency

Select "Data analysis→Prescription analysis→Drug frequency" and import the data into Excel. The results showed that a total of 106 prescriptions meeting the standards were included, a total of 203 traditional Chinese medicines, with a cumulative use frequency of 1061 times, and 12 traditional Chinese medicines with a use frequency more than 20 times, with a cumulative use frequency of 309 times. The top three were Platycodon grandiflorum, Bitter almond and Pinellia ternary (Table 1).

5.2 Property and Flavor, Channel Tropism

Selecting "statistical analysis→four properties and five flavors statistics and meridian tropism statistics", it is concluded that ancient doctors used warm and cold drugs to treat children's cough. Most of the drugs were pungent, followed by bitter and sweet. It mainly belongs to lung meridian, followed by spleen meridian and stomach meridian (Figure 1, Figure 2 and Figure 3).

Table 1. Traditional Chinese medicine with medication frequency≥20 times

Serial number	Medicine	Frequency	Serial number	Medicine	Frequency
1	Platycodon grandiflorum	33	7	Mint	24
2	Bitter almond	33	8	Ginseng	23
3	Pinellia ternary	31	9	Ephedra	22
4	Baikal Skullcap	28	10	Ginger	21
5	Licorice	28	11	Dried orange peel	21
6	Poria cocos	25	12	Cortex Mori	20

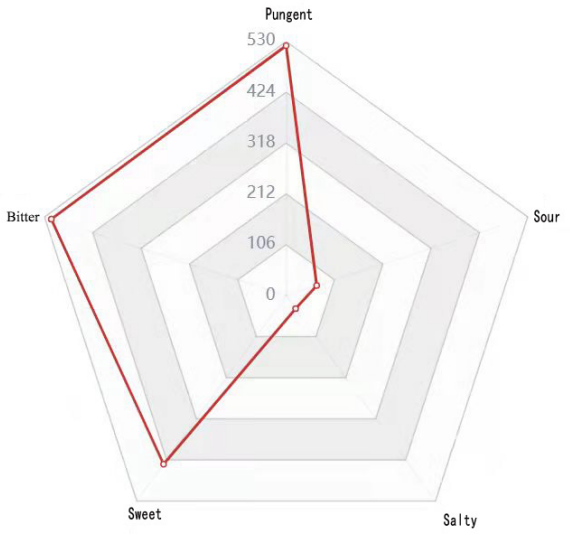

Figure 1. (Four properties distribution diagram)

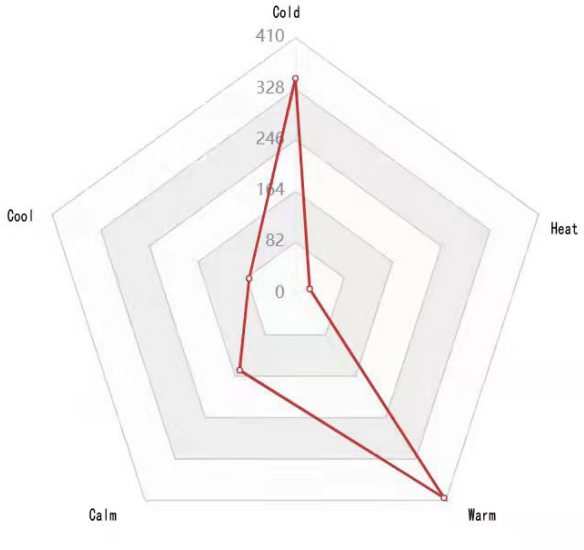

Figure 2. (Five tastes distribution diagram)

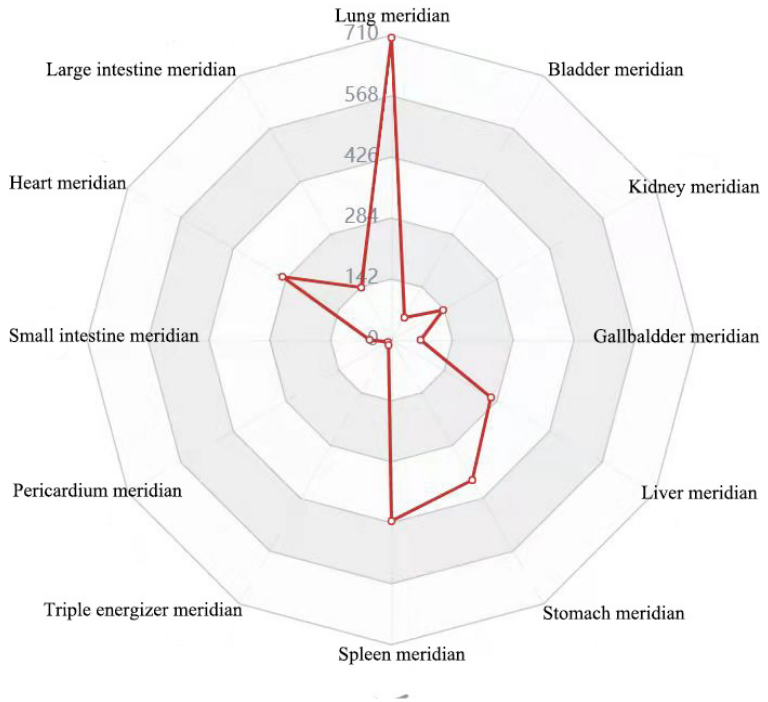

Figure 3. (Meridian tropism diagram)

5.3 Drug Efficacy

Select "statistical analysis→efficacy statistics", the results show that the included traditional Chinese medicine involves 21 different efficacy categories, of which the top three are expectorant drugs, antitussive and antiasthmatic drugs, antipyretic drugs and drugs for treating exterior syndromes (Figure 4).

5.4 Analysis of Cough Prescription Rule in Children Based on Association Principle

Select "Prescription analysis→Association Rule" and set the number of support to 10 and the confidence to 0.7. Support refers to the frequency of drug combination in the selected prescription, and confidence represents the probability of the occurrence of the next drug when the previous drug appears [3]. Under this parameter, 23 groups of high-frequency drug combinations with support ≥10 were obtained (Table 2). Select "Rule analysis" to obtain 5 association rules with confidence degree≥0.7 (Table 3). Select "Network Topology" to obtain a visual network display of association rules (Figure 5).

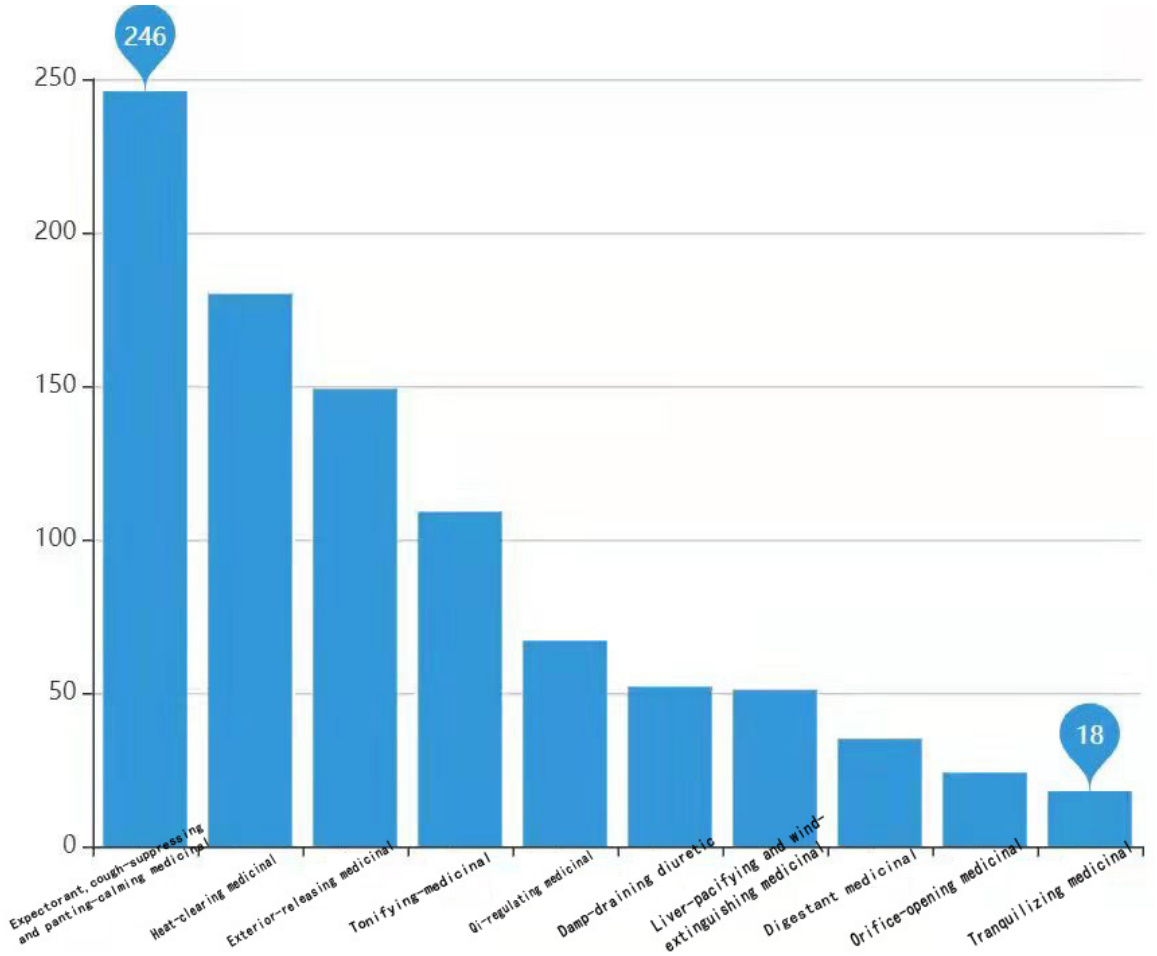

Figure 4. Frequency distribution of drug efficacy (top 10)

Table 2. Core combination based on association principle (support≥10)

Serial number	Drug combination	Frequency	Serial number	Drug combination	Frequency
1	Bitter almond, Baikal Skullcap	16	13	Bitter almond, Fructus Perillae	10
2	Bitter almond, Platycodon grandiflorum	14	14	Poria cocos, Cinnabaris	10
3	Bitter almond, Ephedra	14	15	Pinellia ternary, Poria cocos	10
4	Platycodon grandiflorum, Dried orange peel	14	16	Platycodon grandiflorum, Poria cocos	10
5	Pinellia ternary, Ginger	13	17	Ginseng, Ginger	10
6	Bitter almond, Cortex Mori	14	18	Platycodon grandiflorum, Fructus Aurantii	10
7	Platycodon grandiflorum, Baikal Skullcap	13	19	Bile arisaema, Cinnabaris	10
8	Mint, Cinnabaris	12	20	Bitter almond, Mint	10
9	Platycodon grandiflorum, Angelica decursiva	11	21	Pinellia ternary, Ginseng	10
10	Platycodon grandiflorum, Mint	11	22	Dried orange peel, Fructus Aurantii	10
11	Baikal Skullcap, Gypsum Fibrosum	10	23	Platycodon grandiflorum, Pinellia ternary	10
12	Baikal Skullcap, Ephedra	10			

Table 3. Analysis of common drug pair rules

Serial number	rule	confidence level
1	Fructus Perillae→Bitter almond	0.91
2	Gypsum Fibrosum→Baikal Skullcap	0.71
3	Fructus Aurantii→Platycodon grandiflorum	0.71
4	Fructus Aurantii→Dried orange peel	0.71
5	Cinnabaris→Mint	0.71

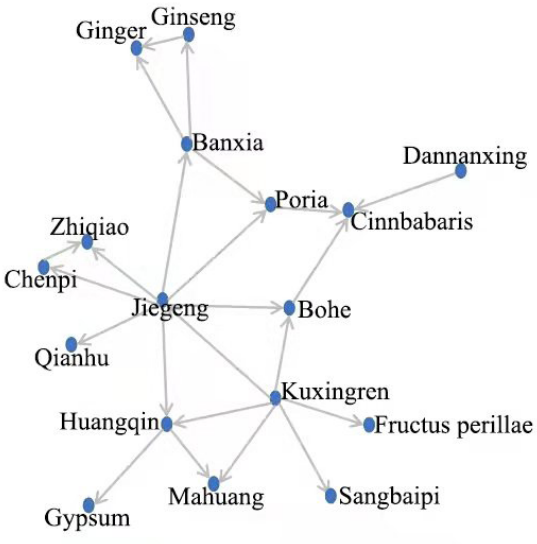

Figure 5. Visual network display diagram of association rule analysis

5.5 New Prescription Analysis Based on K-means Clustering

Select "prescription analysis→cluster analysis", set the number of clusters to "3", select "extraction combination", and extract three groups of new prescription combinations (Table 4) and visual network display diagram (Figure 6).

Table 4. new prescription combination based on cluster analysis

Serial number	new prescription combination
1	Mint-Bitter almond-Platycodon grandiflorum-Pinellia ternary-Baikal Skullcap
2	Dried orange peel-Pinellia ternary-Radices saussureae-Platycodon grandiflorum-Bitter almond
3	Licorice-Aster-Bitter almond-Ephedra-Baikal Skullcap

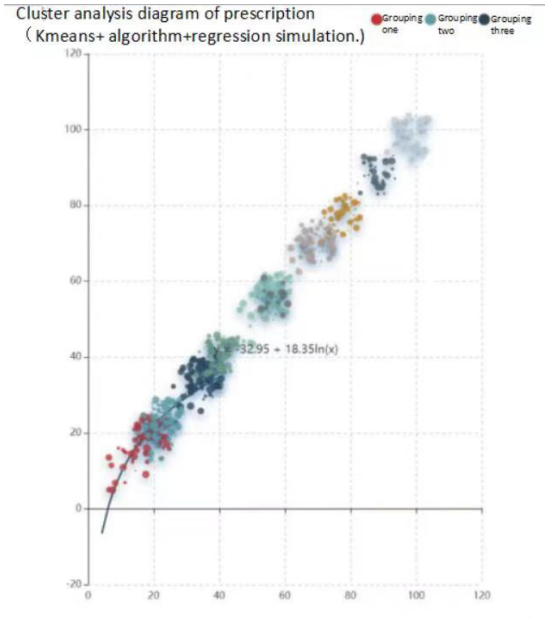

Figure 6. new prescription combination visual network display diagram

6. Discussion

The results showed that the ancient doctors used expectorant drugs, antitussive and antiasthmatic drugs in the treatment of children's cough, and Platycodon grandiflorum and Bitter almond are the most frequently used drugs. According to the Chinese Pharmacopoeia [4], Platycodon grandiflorum has bitter taste, acrid flavor and mild-natured. It belongs to the lung meridian. It has the functions of dispersing the lung, promoting the pharynx, eliminating phlegm and expelling pus. It is mainly used for cough and phlegm, chest tightness, pharyngalgia and hoarse sound, abscess of lung and vomiting pus. Bitter almond, bitter in flavor, little warm, has slightly poisonous, belongs to the lung and large intestine meridian, has the functions of lower adverse-rising energy, relieve a cough and preventing asthma, relaxing bowel, and is used for cough and asthma, fullness sensation in chest and excessive phlegm, dryness of the intestine and constipation. "Almond-Platycodon grandiflorum" is a common couplet medicines for relieving cough, dispelling phlegm and adjusting activities of qi [5]. Modern pharmacological studies show that Platycodon grandiflorum saponin, the active ingredient of Platycodon grandiflorum, has the effects of relieving cough and expectorant, anti-inflammatory and enhancing immunity. It has remarkable curative effect in the treatment of bronchitis, pharyngitis, bronchial asthma and other respiratory diseases [6]. Amygdalin in bitter almond will produce hydrocyanic acid in vivo, and an appropriate amount of hydrocyanic acid can relax bronchial smooth muscle, so as to alleviate cough [7]. Pulmonary dysfunction leads to adverse rising of pulmonary qi and coughing. Platycodon grandiflorum promotes lung qi and almond to descending qi and relieve asthma. When the two drugs are used together, one rises and one falls. The rise and fall are related to each other. If the activities of qi is smooth, the cough will be relieved.

From property and flavor and channel tropism, warm and cold drugs are often used for children's cough. The drugs are mostly acrid flavor and bitter, mainly belonging to the lung and spleen meridian. Children often have insufficient lungs and spleen, lung controlling respiration and fur, and the qi governs the breathing. Striae of the skin and muscles being loose of children. Weakened defensive qi, disturbance of diffusion and down bearing. When lung qi adverse rising of pulmonary qi cough occurs: The spleen is the foundation of the posteriority, and it governing transportation and transformation. Striae and interstitial space of children is loose, if coupled with improper feeding by parents. This will damage the transport and transformation function of spleen and stomach and easy to accumulate dampness into phlegm, then store it up in the lungs. It will affect lung governing diffusion, purification and descending and make cough more intense. If it is repeated for such a long time, the cough will be difficult to treat. According to "Essential Readings for Medical Professionals •Phlegm-fluid retention": "Spleen is the source of phlegm, the lung being the utensil for storing phlegm". It can be seen that the symptoms of children's cough are in the lung and the root is in the spleen. Those who have retention of phlegm and fluid should be treated with warm medicine. Therefore, warm medicine is commonly used for children's cough. And children have been known as "Pure Yang body Constitution". "Disease is easy transformed from sthenia fire", refining fluid into phlegm, causing endogenous cough with phlegm-heat syndrome. Therefore, warm medicine should be appropriately accompanied by cold medicine. Spicy can disperse and promoting the circulation of qi, and enhance the function of lung governing diffusion, purification and descending. Bitterness can dry dampness and clear heat. It can clear the fire of lung and stomach. It can stop coughing when it is used together with bitter, warm and cold traditional Chinese medicine.

Through the analysis of association principle, it is concluded that the drug combinations with high confidence are "Fructus Perillae→Bitter almond", "Gypsum Fibrosum→Baikal Skullcap", "Fructus Aurantii→Platycodon grandiflorum", etc.

These drugs have the effects of clearing heat, opening the inhibited lung-energy, relieving a cough, lower adverse-rising energy, resolving phlegm and relieving asthma. Among them, Fructus Perillae and Bitter almond also have the functions of relaxing bowel, "The lung and the large intestine being interior-exteriorly related". The large intestine peristalsis and defecation function are normal, which is conducive to the normal exertion of the function of lung governing diffusion, purification and descending. If the six hollow organs keep its dredging function and activities of qi is smooth, the cough will heal.

Based on cluster analysis, three new prescriptions for children's cough were obtained. According to the composition characteristics of the new prescription, the main treatment methods are dispersing wind to ease heat, drying damp and eliminating phlegm, freeing lung and relieving asthma, and appropriately add drugs for lower adverse-rising energy and moistening intestines. New prescription can be used for exogenous cough. New prescription can be used for phlegm dampness cough, and new prescription can be used for phlegm heat cough.

With the help of traditional Chinese Medicine Inheritance calculation platform, this study digs the ancient prescriptions for the treatment of children's cough. It is concluded that the treatment of children's cough is mainly based on to reduce phlegm, relieve a cough and relieving asthma, heat-clearing drugs, while, freeing the lung and relieving a cough and taking into account the spleen and stomach. Although the new prescription has certain reference value for the treatment of children's cough, it still needs to be tested by later clinical research.

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