

Analysis on the Effectiveness of the "Three-Exemption" Policy Aimed at Promoting Unpaid Blood Donation in Zhejiang Compared with Anhui and Fujian

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ABSTRACT

An effective and sustainable volunteer team is needed to create a more available blood supply system. In order to promote the sustainable development of blood donation in Zhejiang Province, China, a "three-exemption" policy was proposed in 2014: blood donors who received the National Award for unpaid blood donation may visit government-invested and funded parks, scenic spots and other places for free, visit non-profit medical institutions for free outpatient fees, and be exempted from urban public transportation fees. As the policy has been in place for 7 years, this study evaluated the effectiveness of the policy by comparing the increasing rate of blood donation in Hangzhou (capital city of Zhejiang) before and after the policy using the intermittent time series analysis. The blood donation in Anhui, a Province near Zhejiang was also compared as a negative control. Blood donation data from 2012 to 2018 were obtained from the donation centers official websites. The increasing rate of blood donation volume since 2012 in Hangzhou is 34.37 unit/month, and after 2014, the increasing rate additionally increases 71.69 ($p=0.1442$), which indicates a statistically non-significant change after the policy. While as a negative control, in Anhui, the increasing rate of blood donation volume since 2012 is -163.3 unit/month, and the increasing rate additionally increases 167.2 ($p=5.63e-07$) after 2014. The result shows that the three-exemption policy had a certain level of impact on encouraging volunteers to donate blood, but the effect was not substantial. One possible reason for the ineffectiveness of the policy might be a lack of public awareness of the policy. This policy mainly waived unnecessary life expenses, such as fares and scenic entrance fees, and required a certain number of blood donation, registration procedures, and blood donation certificates. Perhaps, reducing life-related expenses such as oil, water and electricity, could better attract people to participate in blood donation. This current study on the three-exemption policy provides a new direction for promoting people's blood donation. Incentive policies may require greater publicity and incentives. In order to better ensure the operation of the blood donation system, other policies, especially incentive policies, should be further explored.

Keywords: Blood donation, interrupted time series, policy, three-exemption policy

1. INTRODUCTION

During the COVID-19 Pandemic, the demand for transfusion had rapidly increased. Seventy-nine countries collect over 90% of their blood supply from voluntary unpaid blood donors, but the current pandemic has had an impact on blood supply due to reduced blood donation and reduced availability of appropriate blood collection facilities. [1]

As blood transfusion is most commonly used to support cardiovascular surgery, transplantation, massive trauma, malignant tumors, hematological malignancies, pregnancy-related complications, and severe anemia in children,[2][3] it is vital to maintain a steady demanding-supply relationship in blood. The reason why people are trying to prevent paid blood donation is that the blood qualification rate of unpaid blood donation was extremely significantly higher than that of paid blood donation ($P<0.001$), and the positive rate of the four indicators of ALT, HBsAg, HCV-Ab, and syphilis was

significantly lower than that of paid blood donation.[4] The most reliable blood resource is donors who regularly donate. To create a more available blood supply system, we need to keep a volunteer team to push blood donation. Aiming to promote the sustainable development of blood donation in Zhejiang Province, China has implemented many incentive policies. Among them, the three-exemption policy proposed by Zhejiang Province in 2014 has become a highlight. The second paragraph of Article 25 of the "implementation measures" stipulates that "blood donors who have won the National Award for unpaid blood donation can visit parks, scenic spots and other places invested and sponsored by the government free of charge, go to non-profit medical institutions for treatment, free of the outpatient consultation fee, and free of urban public transport." This article is referred as the "three-exemption policy".[5]

As the policy has been put into effect for eight years, its availability can be tested by comparing the increasing rate of donation to Anhui, a province with a similar population but has not implied this policy yet. [6][7] The growing rate, total donation amount and donation amount right after the policy was implied are compared in this research.

This research is based on the public health policy of blood donation and blood transfusion. It compares the impact of the implementation of the policy on the amount of blood donation. On the one hand, it evaluates the effectiveness of the policy, and on the other hand, it can lay the foundation for future blood donation research. At the same time, this article sorts out the blood donation volume in Hangzhou, Zhejiang and Hefei, Anhui, which is helpful for further research on the current situation of blood donation.

2. METHODS

The data comes from the websites of the Zhejiang donation center and Anhui donation center. All the data is collected by hand. In data processing, R is used as an analysis tool. Donations from Anhui and Zhejiang provinces come from official websites. The data of blood donation on the official website of the Zhejiang blood center only includes the data of Hangzhou, and other prefecture-level blood centers have their official websites. Some cities have yet to publish data on their websites. Because of the difficulty of blood storage, the supply of blood rarely meets the demand, so we use blood usage to place blood donation. Through the comparison of consumption and donation in Anhui Province, it is proved that consumption and donation are consistent. Because the data of blood donation in Fuzhou City cannot be obtained, blood donation is replaced by blood donation.

The data of Zhejiang Province (Huzhou City, Ningbo City, Hangzhou City) are weekly, while the data of

Fuzhou City and Anhui Province are monthly. During the analysis, to avoid the impact of the decline of blood donation during the Spring Festival, the data were summarized in years. The amount of all kinds of blood products were converted into units (U): whole blood 200 ml was 1 u, suspended red blood cells 200 ml was 1 u, plasma 100 ml was 1 u, and apheresis platelets were 1 apheresis treatment amount (platelet content $\geq 2.5\%$) $\times 10^{11}$ / bag) is 10 U. In 2014, Zhejiang Province popularized the "three-exemption" policy. This paper uses interrupted time series to analyze the changes in blood donation before and after the implementation of the three-exemption policy and takes Fuzhou City and Anhui Province as the control. This paper analyzes the changes in blood donation before and after the implementation of the three-exemption policies by using intermittent time series and summarizes the data into this formula:

$$Y = \beta_0 + \beta_1t + \beta_2D + \beta_3p + e.$$

When analyzing the data, the linear programming method is used. Taking the blood donation as the independent variable, time (year) as the dependent variable and the slope (β_1) represents the average annual growth of blood donation. The larger the value of S, the faster the growth of blood donation is. In order to show the effect of the three-exemption policies, another variable (β_2) is applied. It is 0 before the implementation of the three-exemption policies and 1 after the implementation of the policy. In order to avoid the impact of the time before the implementation of the policy on the data and the reduction of blood donation during the Spring Festival, the data are accurately processed every year. This minimizes the impact of irrelevant variables and shows that the three-exemption policy has no significant impact.

3. RESULTS

The s_1 value (slope in data of Hangzhou) changes from 34.37 units/month to 71.69 units/month the year around 2014, which indicates that three-exemption policies may have some positive influences on blood donation. Charts of data in Hangzhou before 2014(Figure 1) and after 2014 (Figure 2) are shown below.

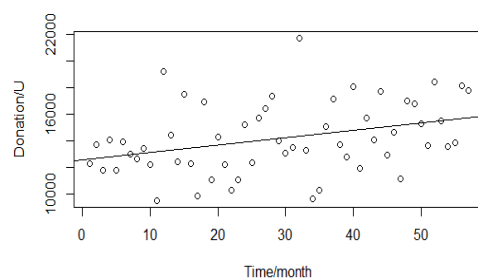


Figure 1 The Donation Amount Change with time before 2014 (Three-exemptions Policy) in Hangzhou

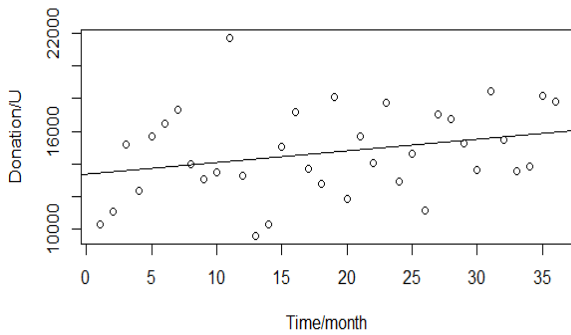


Figure 2 The Donation Amount Change with time after 2014 (Three-exemptions Policy) in Hangzhou

Though, the p-value of three-exemption police is not large enough to show statistical significance ($p=0.1442$), which indicates a statistically non-significant change after the policy was implied. The value of s_2 (slope in Anhui) is that it has been divided into two parts since the year when Hangzhou implied the three-exemption policy. In 2014, the slope had a similar change, but Anhui had not applied three-exemption policies. Figure 3 (before 2014) and 4 (after 2014) show the data in Anhui province. As a negative control, in Anhui, the increasing rate of blood donation volume since 2012 is -163.3 unit/month, and the increasing rate additionally increases 167.2 ($p=5.63e-07$) after 2014.

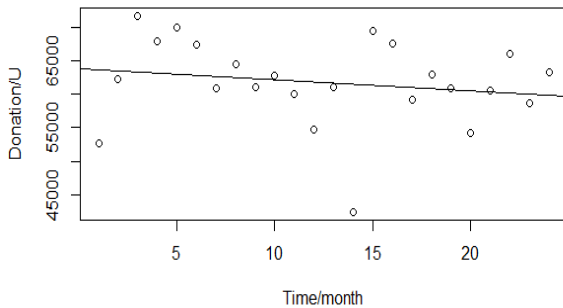


Figure 3 The Donation Amount Change with time before 2014 (Three-exemptions Policy) in Anhui

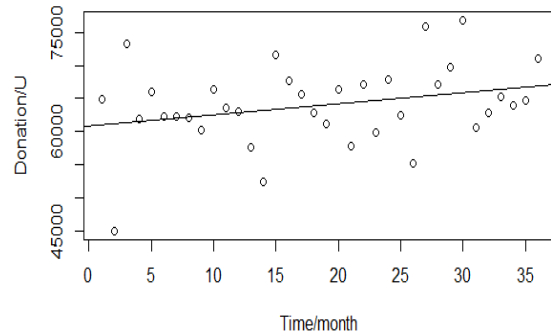


Figure 4 The Donation Amount Change with time after 2014 (Three-exemptions Policy) in Anhui

Though, the increasing rate of slope in Anhui is bigger than that in Hangzhou. This fact indicates that three-exemption policies have little effect on the donation willingness or the total donation amount of people. It can be seen from the figure that the implementation of the three-exemption policy has no significant impact on the amount of blood donation because there is no obvious data fault in the figure which implies an instant change. At the same time, it did not accelerate the growth rate of blood donation, and the image did not show bending or broken lines which indicates afterward influences of the three-exemption policy. The type of data in Fuzhou is similar to that of Anhui, both showing relatively stable growth. However, why the growth rate of blood donations in these two regions changed in 2014 is still a question.

Generally speaking, the slope is positive, indicating that blood donation increases year by year. The linear model can better match the data points, indicating that the growth rate of blood donation is stable.

4. DISCUSSIONS

It can be seen from the data of the two places that the amount of blood donation has increased year by year since 2012, showing a relatively stable upward trend. Whether it is Hangzhou, Zhejiang (the three-exemption policies have been implemented since 2014), or Anhui (the three-exemption policies have not been implemented), the amount of blood donation is increasing. The reasons for this increase may be diverse. The first thing we can consider is population differences. The population density of Anhui [8] and Hangzhou [9] (the total population of a region divided by area) is similar, and the population concentration of Hangzhou (the uneven degree of population distribution) is high, but there is no significant difference in the growth rate of blood donation between them.

The second relevant factor that can be considered is the age distribution of the population. There are more elderly people in Anhui than in Hangzhou. According to the Law of the People's Republic of China on Blood Donation[10], people over 65 are not allowed to donate blood, which may have an impact on the results, but the growth of blood donation in Anhui is not significantly lower than that in Hangzhou, which proves that the three-exemption policy has not promoted people's blood donation in Hangzhou. The spread of the three-exemption policy may be another problem. Perhaps people do not know the relevant policies well or misunderstand them, which can also lead to the ineffectiveness of the three-exemption policy.

The third possible factor affecting the amount of blood donation is the level of economic development. The blood donation rate per thousand people in developed countries is higher than that in developing countries. Zhejiang's per capita GDP is higher than that of Anhui, [11] and the total amount of blood donations in Zhejiang is indeed higher, but this did not bring about a significant difference in the growth rate of blood donations. This shows that the level of economic development does not have a significant impact on the effectiveness of the data processing of the three-exemption policy. The three-exemption policy may be due to Zhejiang's higher economic level and the insignificant effect of average income. Since everyone has little demand for economic support, the incentives of the three-exemption policy are not high.

After the implementation of the three-exemption policy, the growth rate of blood donation has slightly increased to a certain extent. However, the improvement brought about by the three-exemption policies is not significant. This may be because the three-exemption policy mainly exempts non-essential expenses such as fares and scenic spots etc., and requires a certain number of blood donation registration procedures and blood donation certificates. This allows us to reflect on policy.

The inconvenience makes people less concerned about whether they get fee reductions. Therefore, their donation rate is not so strongly influenced. Perhaps the reduction or exemption of living expenses such as oil, water, and electricity will better attract people to participate in blood donation. For example, the public transportation fee reduction included in the three-exemption policy is not high, and if you want to ride for free, you need to bring and show the relevant blood donation certificate, which is very inconvenient. This makes people do not really want to use this exemption service. The three-exemption policies may also lack publicity. There are few reports on the three links policy on the Internet. Perhaps Hangzhou people do not fully understand or even hear of the three-exemption policy, thus, the three-exemption policy has not been effectively promoted and implied.

In general, the increase in blood donation rate is relatively constant, which is a good phenomenon because it shows that the amount of blood donation is increasing year by year. The steady increase in blood donation can make the medical system more stable and make surgery and rescue more secure.

5. CONCLUSIONS

The three-exemption policy has some positive effects on blood donation but there is no significant increase. However, the implementation of the three-exemption policy is an attempt to use incentive policies to promote unpaid blood donation. This research on the three-exemption policy provides a new idea for promoting people's blood donation.

We need rewarding policies which are more effective and more in line with the actual people's lives, and more comprehensive promotion and publicity methods to make the blood donation rate improved. China's blood donation rate per thousand people is still lower than the standard of developed countries. In order to better ensure the operation of the medical system, we should further explore how to run a better-organized blood system.

The study of the three-exemption policies has provided new ideas for promoting the blood donation of the whole people and raising the awareness of regular donation. It may be necessary to implement incentive policies more effectively. The blood rate per thousand people in China, compared with the blood using rate, is not big enough, though. Paid-donation is dismissed because of the disadvantages and risks, but improvements of unpaid-donation are urgently required. However, with increasing incentives to encourage unpaid blood donation, we must be careful not to make blood donation a paid behavior. We need to keep on the

yardstick between rewarding blood donation and buying blood. Regarding the grasp of such a scale, direct cash rewards should be avoided, and fee reductions, honorary rewards or gifts may be better choices. Some blood donation centers will send congratulatory text messages and present gifts to regular blood donors during holidays. This is also a practice of retaining blood donors and forming a regular blood donation team. Still, further researches focused on the reason for the increasing donation rate will benefit in deepening people's understanding of factors influencing the donation rate. The discovery of more influencing factors in the blood donation rate can lead to more accurate policies. Additionally, the maintenance of the increase of the blood donation rate is important, too. The growth in blood donation provides the medical system with a more stable blood supply.

To better guarantee the daily operation of the medical system, further exploration of public health, public policy, sociology, and psychology to develop a more effective

policy to improve the donation amount and donation willingness of people is needed. There may be other reasons for the increase in blood donations in Anhui Province, but they have not been fully discussed in this study. Future research can focus on the increase in blood volume in Anhui in order to find more suitable and effective policies. At the same time, the significant drop in blood donation during the Spring Festival and the small peak of blood donation in September are worthy of further discussion.

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Zhejiang Donation Center Website: zjb.org.cn

Anhui Donation Center Website:

<http://www.ahbts.cn/index.php?r=post/show&id=67>
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Data processing: R Core Team(2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

REFERENCES

- [1] World Health Organization. (2020) .Guidance on maintaining a safe and adequate blood supply during the coronavirus disease 2019(COVID-19) pandemic and on the collection of COVID-19 convalescent plasma: interim guidance, 10July 2020. World Health Organization. <https://apps.who.int/iris/handle/10665/333182>.
- [2]<https://www.who.int/zh/news-room/fact-sheets/detail/blood-safety-and-availability>
Published at 10th, June, 2020; access at 21st, Sept, 2021 Unable to found the author of this page.
- [3] Dzik, Walter H . Innocent lives lost and saved: the importance of blood transfusion for children in sub-Saharan Africa[J]. *Bmc Medicine*, 2015, 13(1):22.
- [4] Shi Juan, Li Yongmei. Analysis of blood quality between free blood donation and paid blood donation[J]. *Practical Preventive Medicine*, 2005, 12(4): 972-973.
- [5] Bao Chunmao, Luo Jiagen, Ning Yumei, et al. Thoughts on the implementation of the "three-exemption policy" for unpaid blood donation in Zhejiang Province[C]// Chinese Blood Transfusion Association Blood Transfusion Conference. Chinese Blood Transfusion Association, 2014.
- [6] Li Fangqi. Counting the population of Anhui—— Interpretation of the main data of the sixth national census of Anhui Province[J]. *Anhui Shengqing Shengli*, 2011, 000(003):13-14.
- [7] Research Group of Zhejiang Provincial Bureau of Statistics. Comparative Study of Zhejiang's Population Development and Coastal Provinces[J]. *Zhejiang Economics*, 2013(13)
- [8] Li Xiaoqiang. Research on the evolution of population spatial distribution in Anhui Province[D]. Anhui University of Finance and Economics, 2018.
- [9] Feng Jian. A model study on the spatial distribution and evolution of population density in Hangzhou[J]. *Geographical Research*, 2002, 5.
- [10] Wang Li. Free blood donation system to protect people's health-Introduction to the "Blood Donation Law of the People's Republic of China" [J]. *China National People's Congress*, 1998(4): 10-11.
- [11] Zhuo Yongliang. Look at the development of Anhui from another perspective [J]. *Zhejiang Economy*, 2009(12): 62-62.