고정 헌혈 장소로써의 3차 의료기관 헌혈자 분석

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Analysis of Blood Donors in a Tertiary Care Hospital as a Fixed Collection Site

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Background: Blood transfusion is important when treating patients with anemia or bleeding; thus, supply of blood components should be stable prior to transfusion. To recruit donors, blood donation sites should be conveniently located. This study evaluated factors responsible for increased donation rates in hospitals and the characteristics of the donors in hospital blood banks without a fixed blood collection site nearby.

Methods: We retrospectively reviewed 687 blood donations at a blood donation center in Pusan National University Yangsan Hospital (PNUYH) from March 2011 to June 2016. A total of 3,053,695 blood donors listed in the 2014 Korean Red Cross Annual Report were compared to donors in PNUYH. We analyzed the age distribution of donor at blood donation centers from Korean Red Cross according to presence and number of high school and college.

Results: Comparison with total blood donors in Korea revealed that there were more blood donors in their thirties, office workers and business owners at PNUYH ($P < 0.001$). The percentage of younger donors in their twenties differed significantly according to the presence of a college within a 4 km radius of the blood donation center ($P = 0.03$). The presence of a high school did not affect the proportion of teenage donors ($P = 0.833$).

Conclusion: The blood donation rate at our medical institution without fixed blood collection sites nearby increased. A regional hospital may be used as a blood collection site to recruit donors in areas in which there are no fixed blood donation centers. (Korean J Blood Transfus 2017;28:28-35)

Key words: Blood donation, Accessibility, Donation rate

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Introduction

Bleeding or blood transfusion therapy is an important factor in the treatment of patients with anemia; thus, supply of blood components should be stable prior to transfusion. Blood supply through blood banks is stable; however, blood donation at blood centers in hospitals is low in Korea. Additionally, hospital blood banks receive blood donations during special events, but these do not ensure a reliable blood supply and can actually lead to national blood shortages. In addition, hospital blood banks have been operating in many medical institutions designated for donation and self-donation, including blood leukocytes from medical components required.¹⁾

According to the statistical yearbook of the Korean Red Cross, blood reserves for blood transfusions did not meet the required blood reserves in March and October;²⁾ however, the supply of blood products was stable for several years. Nevertheless, a national blood shortage occurred in the first half of 2016 and continued through 2017. For a reliable blood supply, efforts should be made to increase donation rates. To attract potential donors, blood donation sites should be conveniently located.³⁾ Moreover, specific areas should be designated as fixed blood donation sites as this can have a significant effects on the rate of increase in blood donation.

This study analyzed the effects of distance between blood donation center and the residence of donors on donation rate. Our findings will be useful for increasing blood donation at blood centers in hospitals without fixed blood donation sites nearby.

Materials and Methods

1. Study design

We retrospectively reviewed 687 blood donations, including whole blood donations, made at a blood center in Pusan National University Yangsan Hospital (PNUYH) from March 2011 to June 2016. Repeat donors were included. Donor characteristics, including sex, age, address, and profession was recorded. Addresses (residential or workplace) were collected from donor questionnaires. A total 3,053,695 blood donors included in the 2014 Korean Red Cross Annual Report were compared to donors at PNUYH.

Overall, 178,001 blood donors in the 2014 Korean Red Cross Annual Report were evaluated to assess the effects of convenient accessibility on donation rate. To calculate the distance from the high school or college to the blood collection center, information regarding schools was obtained from the website maintained by the Busan Metropolitan City Office of Education. The distances between each school and blood collection center were calculated using Google maps. Citizens in Yangsan province shared the neighborhood with citizens in Busan; therefore, we analyzed the data from blood collection centers in Busan. To analyze the distance between blood donation center and the residence of donors, we defined the 4 km where donors can walk or use public transport. There are no blood collection site within 10 km from our hospital, we also analyzed distance of 10 km. Donors aged 16 to 29 years were considered young donors.

2. Statistical analysis

All analyses were performed using SPSS v.21.0 (IBM Corp., Armonk, NY). Chi-squared tests were used to compare donors at PNUYH with those of total blood donors in Korea. Fisher's exact tests were used for analysis of age differences in blood donors according to the presence or number of high

schools and colleges. A *P* value < 0.05 was considered significant.

Results

1. Donor in a tertiary care hospital

A total of 687 blood donations were performed

Table 1. Comparisons of characteristics of blood donors

		PNUYH (March, 2011 ~ June, 2016)		Total blood donors in Korea (2014)		<i>P</i> values
		Donor (Number)	Donor (%)	Donor (Number)	Donor (%)	
Sex	Male	564	82.1	2,137,369	70.0	0.000
	Female	123	17.9	916,056	30.0	
Age	16 ~ 19	56	8.2	1,074,104	35.2	0.000
	20 ~ 29	268	39.0	1,308,491	42.9	0.000
	30 ~ 39	180	26.2	373,562	12.2	0.000
	40 ~ 49	120	17.5	211,787	6.9	0.000
	50 ~ 59	55	8.0	74,625	2.4	0.000
	Over 60	8	1.2	10,856	0.4	0.002
ABO blood group	A	261	37.8	1,047,531	34.3	0.666
	B	197	26.6	823,503	26.9	0.121
	O	169	24.5	830,964	27.2	0.022
	AB	60	8.7	351,427	11.5	0.023
RhD	Positive	686	99.9	3,039,709	99.6	0.234
	Negative	1	0.1	13,716	0.4	
Occupation	Office worker	201	29.3	549,523	18.0	0.000
	Student	245	35.7	1,681,796	55.1	0.000
	Soldier	64	9.3	423,815	13.9	0.001
	Business owners	59	8.6	49,008	2.1	0.000
	Civil servant	14	2.0	62,402	4.0	0.992
	House worker	14	2.0	34,301	1.1	0.023
	Religious organization	1	0.1	5,563	0.2	0.822
	Other occupational groups	89	13.0	247,287	8.1	0.000
Type of donors	First time donor	514	74.8	434,467	15.3	0.000
	Repeated donor	173	25.2	2,410,071	84.7	

Abbreviation: PNUYH, Pusan National University Yansan Hospital.

in this study. The majority of donors (65.2%) were aged between 20 and 30 years, and female donation rates were 17.9%.

First-time donors accounted for 74.8% (514 donations) of the total donations. There were 67 repeat donors (173 donations), who donated an average of 2.6 times, including the initial blood donation. The age distribution of the repeat donors at the last time of donation were as follows: in their teenage years, 15 cases (8.7%); in their twenties, 67 cases (38.7%); in their thirties, 24 cases (13.9%); in their forties, 42 cases (24.3%); in their fifties, 20 cases (11.6%); and in their sixties, 5 cases (2.9%). The majority of repeat donors in this study were in their twenties. Comparison with total blood donors revealed that characteristics of blood donors in PNUYH were significantly different. There were more donors in their thirties, office workers and business owners at PNUYH than among total blood donors in Korea (Table 1, $P < 0.001$).

We have employed a dedicated blood donation nurse since March 2014 to increase donation. Additionally, we displayed a promotional poster at our institution and a nearby high school to announce the opening of our blood donation center. Blood donations increased to 273 cases in 2015 from 25 cases in 2013 and 11 in 2011.

Details regarding the residence of the donors, distances from blood donation centers, and the distribution according to occupation are presented in Fig. 1. The most frequent donors were high school or college students and residents living within a 4 km radius of the blood donation centers. Office workers and business owners were more common among donors living farther away from the blood donation center. The office workers and business owners were act around the work place; therefore, the home address did not correlate with the distance between blood donation centers and address.

Fig. 1. Distribution of occupations (A) and age (B) of blood donors according to distance from blood collection site. Numbers in bars indicate numbers of donors.

2. Analysis of accessibility of blood donation site to young aged donors

The association between blood donation centers and the presence of high schools or colleges were evaluated using the 2014 Korean Red Cross Annual Report.¹⁾ If any university was within 4 km of the blood donation center, the percentage of young aged donors was significantly higher (Table 2, $P=0.03$). However, the percentage of young donors did not differ according to the number of colleges within 4 km of the blood center. The distribution of high schools did not differ between regions, and the percentage of teenage donors did not differ significantly according to the presence of a high school.

Discussion

Numerous factors influence whether donors give blood. Donor demographics (e.g., gender, age, culture and education), experiences and environment of the collection center, as well as pre-donation anxiety such as concern about pain, motivation, and incentives for donation are known to be factors.⁴⁻⁶⁾ Altruism and social responsibility were the major motivators for both first time and repeat donors. The second most common reason for donating among first-time donors was influence by a friend or relative, or by media/newspapers. Incentives for blood donors tended to have a greater effect on younger donors (≤ 25 years old), especially first-time donors.^{7,8)} Convenient place to donate is important

Table 2. Analysis of characteristics of blood donors at the blood donation center of the Korean Red Cross in Busan according to presence of high school and college

No.	Name of blood donation center	No. of high schools within a 4 km radius of the donation center	No. of colleges within a 4 km radius of the donation center	Donor (N)	Age (%)					
					16~19	20~29	30~39	40~49	50~59	60~69
1	Nampo	14	1	21,880	30.9	40.4	14.1	9.4	4.4	0.9
2	Bugeon	17	2	18,605	29.0	52.1	12.7	4.6	1.3	0.2
3	Seomyun	21	2	29,131	23.7	50.4	14.6	7.6	3.1	0.5
4	Jangjeon	18	3	19,486	32.4	47.2	11.8	6.4	2.0	0.3
5	Haeundae	11	0	11,383	35.2	33.1	15.5	10.5	4.7	1.1
6	Gwangbok	14	0	9,357	18.5	43.9	20.2	12.4	4.5	0.6
7	Dong-eui University	4	4	4,730	27.3	70.5	1.3	0.6	0.3	0.0
8	Hadan	7	1	7,465	27.2	55.9	9.4	4.7	2.4	0.4
9	Dong-eui Institute of Technology	17	2	4,539	51.0	46.3	1.1	1.1	0.4	0.1
10	Daeyeon	14	5	20,533	26.8	56.7	10.3	4.5	1.5	0.3
11	Deokcheon	7	1	19,102	30.8	40.9	14.3	9.7	4.0	0.5
12	Pusan University	19	3	11,790	24.1	64.8	6.7	3.3	0.9	0.1

Note: Data from the Korean Red Cross.

influence factor in younger donors (≤ 25 years old).³⁾ To encourage donors to return, multiple factors must be considered and adjusted for each blood donation environment.⁹⁾ University students who donated blood in high school tended to donate blood more than those who did not donate in high school.¹⁰⁾ This study is first study in the Republic of Korea that is based on actual behavior of blood donors, and analysis was conducted according to accessibility.

Evaluation of the distance distribution of the blood donors around our institution, approximately 40% of donors lived within 4 km of our institution, and could walk or use public transport. Donors living between 4 and 10 km were believed to have easier access to our institutions than other blood collection sites. Donors living between 10 and 20 km of our facility worked at our hospital or were graduates of our university or apprentices. Office workers and university students comprised a dominant group among donors to our blood banks. The results indicated that convenient accessibility to blood banks influence whether both university students and office workers donate their blood. Indeed, evaluation of the donors to the blood donation center of Korean Red Cross in Busan revealed that teenagers and individuals in their twenties were influenced by convenient accessibility. When there was a college within a 1 km radius of a blood donation center, donors in their twenties accounted for more than 40% of all donors. The presence of a college within a radius 4 km from a blood donation center was significantly correlated with recruitment of teenagers and individuals in their twenties, who together accounted for over 70% of total donors. Poon et al.¹¹⁾

conducted a study of 3,744 questionnaires and found that the median distance between blood donation centers and residence locations was 4.77 km. Additionally, they found that 40.8% of donors lived near the blood donation center and 46.8% studied or worked near the blood donation center. Overall, these findings indicate that individuals below 25 years of age are sensitive to convenience.^{3,9)}

To operate a fixed donation site by supplying blood banks requires the selection of areas with floating populations to ensure a certain number of actual donors. Additionally, selected areas must have the resources to support personnel. In the rural area in which our institution is located, there is no obvious floating population when compared with large cities. However, operating a fixed donation site in a small town with a population of 300,000 is costly. Accordingly, there is a need to establish blood donation sites, but it is not possible to establish new secure donation sites. However, establishing medical resources in existing institutions is relatively easy. Our institution provided a secure place and personnel to operate a fixed blood collection site by opening blood banks in 2011 and employing a dedicated nurse in March 2014. It also satisfied the needs of local residents in terms of donating blood. To announce the opening of our blood donation site, we posted a promotional poster in our institution and a nearby high school; however, we have conducted no other active advertisement of our blood donation site. Nevertheless, blood donations increased to 271 cases in 2015 from 25 cases in 2013. This increase is likely a result of individuals being influenced by their friends or relatives, rather than mass media.^{6,12)} Moreover, the convenient accessibility to our blood

bank is an important factor influencing recruitment of blood donors.

It is important to note that our findings are based on the analysis of a single institution, and are therefore difficult to generalize. Accordingly, further studies including surveys about behaviors of blood donors are necessary. Additionally, it might be helpful to use a regional hospital as a fixed blood collection site to recruit donors from areas in which there are no fixed blood donation centers.

요 약

배경: 수혈은 빈혈이나, 출혈이 있는 환자의 치료에 중요하므로, 수혈을 위해서는 혈액제제가 안정적으로 공급되어야 한다. 헌혈자를 모집하기 위해서는 헌혈 장소가 편리한 곳에 위치하는 것이 필요하다. 본 연구에서는 근처에 고정 헌혈 장소가 없는 의료기관 혈액은행에서의 헌혈률이 증가하는 이유와 헌혈자들의 특성을 분석하였다.

방법: 2011년 3월부터 2016년 6월까지 양산부산대학교병원 헌혈실을 방문한 687명의 헌혈자들을 후향적으로 조사였다. 헌혈자 기본 특성을 비교하기 위해 2014년도 대한적십자 연보의 총 3,053,695명의 헌혈자들의 정보를 분석하였다. 고등학교와 대학교의 존재여부 또는 개수에 따른 헌혈자 연령 분포를 비교하기 위해 대한적십자사 헌혈 센터의 헌혈자들을 분석하였다.

결과: 전체 국내 헌혈자 대비 30대의 헌혈자, 회사원, 자영업자의 비율이 높았다($P < 0.001$). 헌혈장소 반경 4 km 이내에 대학이 존재하면 헌혈자 중 20대 헌혈자가 차지하는 비율이 통계적으로 유의하게 달랐다($P = 0.03$). 고등학교의 존재여부는 10대 헌혈자 비율에 영향을 주지 않았다($P = 0.833$).

결론: 주위에 고정 헌혈 장소가 없는 본 기관에서의 헌혈률이 증가하였다. 주위에 고정 헌혈 장소가 없는 경우, 의료기관을 헌혈 장소로 이용하는 것이 헌혈자를 모집하는 한 방법이 될 수 있겠다.

References

1. Choi GR, Kim HO, Kim S, Jang CH, Choi YS, Kim JN. Analysis survey on changes in hospital blood donation center and satisfaction level with the Korean Red Cross. Korean J Blood Transfus 2015;26:142-51
2. Korea Red Cross. 2014 blood services statistics. https://www.bloodinfo.net/promotion_yearstats.do [Online] (last visited on 10 March 2017).
3. Schreiber GB, Schlumpf KS, Glynn SA, Wright DJ, Tu Y, King MR, et al. Convenience, the bane of our existence, and other barriers to donating. Transfusion 2006;46:545-53
4. Kim JH, Song HJ. Factors affecting regular blood donation behavior. Korean J Blood Transfus 2006;17:20-31
5. Bednall TC, Bove LL, Cheetham A, Murray AL. A systematic review and meta-analysis of antecedents of blood donation behavior and intentions. Soc Sci Med 2013;96:86-94
6. Sojka BN, Sojka P. The blood donation experience: self-reported motives and obstacles for donating blood. Vox Sang 2008;94:56-63
7. Glynn SA, Williams AE, Nass CC, Bethel J, Kessler D, Scott EP, et al. Attitudes toward blood donation incentives in the United States: implications for donor recruitment. Transfusion 2003;43:7-16
8. Kasraian L, Maghsudlu M. Blood donors' attitudes towards incentives: influence on motivation to donate. Blood Transfus 2012;10:

- 186-90
9. Ringwald J, Zimmermann R, Eckstein R. Keys to open the door for blood donors to return. *Transfus Med Rev* 2010;24:295-304
10. Kam S, Kim SA, Kang YS, Park KS, Son JH, Yeh MH, et al. Factors affecting blood donation in university students. *Korean J Blood Transfus* 1997;8:113-24
11. Poon CM, Lee SS, Lee CK. Variation of motivation between weekday and weekend donors and their association with distance from blood donation centres. *Transfus Med* 2013;23:152-9
12. Misje AH, Bosnes V, Gåsdal O, Heier HE. Motivation, recruitment and retention of voluntary non-remunerated blood donors: a survey-based questionnaire study. *Vox Sang* 2005;89:236-44