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Donation frequency of blood donors participating in a prospective cohort study of iron status

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Abstract

BACKGROUND—Blood centers are interested in understanding determinants of frequent blood donation. We hypothesized that participation in uncompensated research could result in higher donation rates.

STUDY DESIGN AND METHODS—Donation rates for 2425 subjects from six US blood centers enrolled in the Retrovirus Epidemiology Donor Study-II Donor Iron Status Evaluation Study were compared to those of nonenrolled donors (n = 202,383). Over 15 months, we compared mean donation rates and adjusted rate ratios (RRs) between enrolled and nonenrolled for three subgroups, first-time, reactivated, and frequent donors, and donation rates before and after the study enrollment period for frequent donors only.

RESULTS—Enrolled donors had higher 15-month mean donation rates than nonenrolled donors (first-time, 1.21 [RR = 1.91]; reactivated, 1.68 [RR = 1.83]; frequent, 3.40 [RR = 1.12]). However, frequent donors donated at approximately the same rate after enrollment as they did before enrollment in the study (3.62 per 15 months [RR = 1.12]).

CONCLUSION—Donors enrolled in the study donated at a higher rate than nonenrolled donors, but frequent donors remained consistent in their donation frequency both before and after enrollment. Although increased donation rates could have been causally related to study enrollment, we cannot rule out an enrollment bias whereby more committed donors were more likely to enroll in the study.

The determinants of frequent donation and factors that lead to high return rates among volunteer blood donors are increasingly important as the eligible donor population continues to be reduced. Deferrals for medications, travel, lifestyle, and emergent diseases and the increasing age of the donor population decrease the pool of available donors. To address concerns about the adequacy of the blood supply, blood centers need to not only recruit new donors but to understand what motivates donors to give again to improve donor retention and increase donation frequency.

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CONFLICT OF INTEREST
The authors have no conflicts of interest or other financial involvement to declare.

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Previous studies have suggested that the total number of first-time donors is decreasing[1] and that only 8% of those new donors continue donating.[2] Other reports suggest that younger and minority donors were less likely to donate again within 12 months,[3] shorter intervals between a first and second donation increased the likelihood of subsequent donations,[4] and first-year donation frequency is a strong predictor of long-term donor return.[2] Variables such as age, ethnicity, blood type, and education have also been shown to influence donor return behavior.[4]

The Retrovirus Epidemiology Donor Study-II (REDS-II) Donor Iron Status Evaluation (RISE) study was a prospective cohort study of hemoglobin (Hb) and iron metabolism in first-time and frequent blood donors. By the midpoint of the 15-month study it became clear that RISE subjects in both cohorts were presenting to donate blood more frequently than predicted. This analysis sought to determine if the reason(s) for higher-than-expected donor return rates involved the donor's participation in a nonremunerated study.

MATERIALS AND METHODS

The REDS-II is a multicenter consortium of six blood centers located across the United States. The six REDS-II blood centers include the American Red Cross, New England Region (Boston, MA); the American Red Cross, Southern Region (Atlanta, GA); the Blood Centers of the Pacific (San Francisco, CA); the BloodCenter of Wisconsin (Milwaukee, WI); the Hoxworth Blood Center (Cincinnati, OH); and the Institute for Transfusion Medicine (Pittsburgh, PA). The REDS-II centers include geographically and demographically diverse populations, representing more than 8% of annual blood collections in the United States.

Shared data on all blood donations were compiled into a centralized research database. REDS-II centers provided monthly donation and deferral records for visits made from January 1, 2006, through December 31, 2009. The database consists of routinely collected information that includes donation procedure, donation type, previous donation date, and other data. Medical history information and donor demographic data, including sex, race or ethnicity, country of birth, and date of birth were also collected from blood center records.

One of the major projects of the REDS-II program was a 24-month longitudinal study of iron status in two cohorts of blood donors. The RISE study enrolled a total of 2425 study subjects with the objective of evaluating the effects of blood donation intensity on iron and Hb status and assessing how these are modified as a function of baseline iron or Hb measures and demographic, reproductive, and behavioral factors. For this analysis, we compared the frequency of donations and other donation-related variables between RISE participants (enrolled subjects) and blood donors from the REDS-II donation database (nonenrolled subjects).

Enrolled subjects

Donors who were 18 years of age or older and who presented for a whole blood or double red blood cell (RBC) donation during the period of time from January 1, 2008, through May 31, 2008, were eligible to participate in RISE. The majority of RISE subjects were recruited at fixed blood donation sites; however, to attain enrollment targets and the needed diversity of subject types, some centers also conducted recruitment at mobile locations.

Within the RISE study, donors were enrolled into either a first-time or reactivated cohort or a frequent repeat cohort. For this analysis, we examined first-time and reactivated donors separately, using the REDS-II donation database as well as the RISE subject questionnaire to categorize subjects. First-time donors were defined as those for whom there was no

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donation history in the REDS-II database (going back 2 years) and who reported on the RISE questionnaire that they had never given blood previously. Frequent repeat donors were defined as males who had donated whole blood or RBC components at least three times or females who had done so at least twice in the previous year. Reactivated donors were those for whom there was no donation record in the REDS-II database, but who reported on the RISE questionnaire that their last date of donation was more than 2 years before the enrollment donation. At the time of enrollment RISE subjects signed a consent form and were asked to commit to donating routinely (two times for first time or reactivated donors and three times for repeat donors) over a period of 2 years, as well as to complete questionnaires at enrollment and during the final study visit.

Subjects were contacted during the interim period as a reminder to return for additional donations while the study was ongoing. Methods for contacting subjects included letters, postcards, e-mails, routine phone calls by blood center telephone recruitment, phone calls by research staff, and face-to-face reminders at blood draw sites. Three of the six centers used identical procedures across all subject groups. Others focused greater efforts on retaining first-time and reactivated donors. Contact methods utilized included reminder letters (two centers), reminder postcards (five centers), e-mails (four centers), routine blood center telerecruitment phone calls (four centers), research staff phone calls (three centers), and face-to-face reminders (one center).

Nonenrolled subjects

A comparison group of nonenrolled donors was selected from the REDS-II database using similar eligibility criteria. Donors in the REDS-II database who were at least 18 years of age and who made a whole blood or double-RBC donation between January 1, 2008, and May 31, 2008, were identified. We utilized the REDS-II database and the self-report information form collected as part of the donation process to categorize these subjects into the same three subgroups as enrolled subjects. First-time donors were defined as those who had no previous donation in the database and answered “yes” to the question “Is this the first time you’ve ever given blood?” Frequent repeat donors were those with a history of either two or three whole blood or RBC donations in the previous year, depending on sex. Reactivated donors were defined as those who had no record of donation within the past 2 years and who answered “no” to the self-report question “Is this the first time you’ve ever given blood?” For this group, unlike the RISE enrolled donors, we did not have access to information pertaining to any donations that might have taken place at non–REDS-II blood centers.

Statistical analysis

Donation frequency was defined by the numbers of whole blood or double-RBC donations made over a 15-month period after the “index donation.” For RISE-enrolled subjects this “index” visit was the study enrollment date. For nonenrolled donors, an “index” visit was defined as the first donation that occurred during the RISE enrollment period (January 1, 2008-May 31, 2008). Each subsequent whole blood and double-RBC donation was counted as one donation. Since less than 2% of RISE donations were other than whole blood or double-RBC donations, any other such procedures were not counted for purposes of this analysis. The mean number of donations made after the index donation was compared between the RISE subject group and nonenrolled donors by Poisson regression in unadjusted and adjusted models. Adjusted models included sex, race or ethnicity, age, education, country of birth, donation location, and center as covariates.

Within the RISE-enrolled cohort, donations made by frequent or repeat donors were also analyzed. A paired t test compared their mean number of donations in the 15 months after the index donation to the mean number of donations in the 15 months before the index

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donation. All data analyses were conducted using statistical software (SAS, Version 9.1.3, 2004, SAS Institute, Inc., Cary, NC).

RESULTS

Between January 1, 2008, and May 31, 2008, a total of 2425 donors were enrolled in the RISE study. With similar enrollment criteria, 202,383 nonenrolled donors were identified in the REDS-II donation database. Demographic characteristics of sex, race or ethnicity, age, education, and country of birth showed equivalent distributions for both the enrolled and the nonenrolled cohorts (Table 1). Donors in each group were primarily white (87%–88%) and born in the United States (approx. 95%) with a college degree or higher (39%–47%). Each group reported roughly similar proportions of male (47%–48%) and female donors (52%–53%).

An approximately equal number of donors from each blood center was enrolled in the RISE study. Within the REDS-II donation database, however, centers C and F are the largest of the six blood centers and contribute over 50% of the donation records each year. Among the nonenrolled subjects, the proportion of donors from each blood center matched expected distribution within the larger REDS-II database (Table 1). Most RISE subjects were recruited at fixed locations (80%) while 67% of the index donations made by the nonenrolled donors were given at mobile drives. Roughly 12% of both enrolled and nonenrolled donors were giving blood for the first time at their initial visit. Among the remaining RISE-enrolled donors, 24% of them were reactivated donors and 63% were frequent repeat donors. The proportion of reactivated and frequent repeat within the nonenrolled donor cohort was approximately the same (33 and 52%, respectively).

Donors enrolled in RISE returned to donate significantly more often than nonenrolled donors (Table 2). This pattern was consistent for all six REDS-II blood centers (data not shown). Results from an unadjusted Poisson regression indicate that RISE-enrolled first-time donors gave 2.09 times more than nonenrolled first-time donors within the 15 months after the initial visit. The rate of donation was similar among reactivated donors (rate ratio [RR] = 2.13), while frequent repeat donors enrolled in RISE gave 1.19 times more often than their nonenrolled counterparts. After adjusting for age, race or ethnicity, sex, and other factors, the Poisson donation rates decreased but remained significantly higher in the enrolled donors, ranging from 1.12 to 1.91 times more frequently than nonenrolled donors (Table 2).

Frequent donors had a higher mean number of donations after the index visit (3.40 for enrolled donors and 2.85 for nonenrolled donors) than other donor groups. Among frequent repeat RISE-enrolled donors, a comparison of donation frequency before and after the initial visit showed significantly more donations were given in the 15 months before enrollment (5563 total; mean, 3.62; including 487 [8.8%] double-RBC donations) than were given in the 15 months after enrollment (5219 total; mean, 3.40; including 595 [11.4%] double-RBC donations). Donation rates for frequent nonenrolled donors also declined from 362,960 donations (including 27,138 [7.5%] double-RBC donations) in the 15 months before the index visit to 299,866 donations (including 25,430 [8.5%] double-RBC donations) in the subsequent 15 months.

To attempt to better understand the effect of double-RBC donations on donation frequency means, we separately calculated means while counting double-RBC visits as two donations. In this model all the relationships between subject groups were quite similar to those we noted while counting double-RBC donations as one donation (first-time enrolled, 1.31 vs. 0.61 for unenrolled; reactivated enrolled, 1.85 vs. 0.84 for unenrolled; and frequent repeat

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enrolled, 3.78 vs. 3.09 for unenrolled). In the “before-versus-after” comparison for the frequent repeat donors, the donation means still declined slightly in the postenrollment period (enrolled, 3.94 before vs. 3.78 during the study; nonenrolled, 3.70 before vs. 3.09 during the study).

DISCUSSION

Previous research has measured how demographic variables, motivating factors, and possible deterrents to donating affect rates of blood donation and return among blood donors. Our study considered the effects of participation in a nonremunerated research study (RISE) in which donors agreed to donate a minimum of one or two additional times over a 12-month time frame.

As the study progressed from initial enrollment of subjects through the final stages, we noticed that enrolled donors seemed to be returning to donate at a rate much higher than expected and higher than that typically seen in blood donors. This informal observation held up in our detailed analysis of the donation database. In each of the donor categories (repeat, reactivated, and first time), the rates of donation for enrolled donors were significantly higher than for those not enrolled in the study, even after controlling for center, sex, race or ethnicity, age, education, country of birth, and donation location. Although study participation may have been causally related to increased donation rates, it is also possible that selection bias played a role in that the most highly motivated donors (in terms of donation frequency) were also the most likely to enroll in our study.

A preindex versus postindex comparison of the frequent donors revealed that both the enrolled and the non-enrolled groups had fewer total donation visits after the index visit than they did before index. Blood centers in the United States generally, and each of the six REDS-II blood centers specifically have been moving toward the conversion of whole blood donors into double-RBC donors to increase component collection overall and improve efficiency of operations. Part, but not all, of the observed decline in number of donations from the preenrollment to the study analysis period was explained by a trend toward more double-RBC donations and fewer whole blood donations in both groups. Regression toward the mean could also explain these data, namely, a group of donors selected because of high donation frequency over one time period tends to have lower (closer to the mean) donation rates over a subsequent time period. It is also possible that motivational factors related to participation in the study, as well as more frequent contact with enrolled donors played a role in lessening the rate of decline in donation visits compared to the nonenrolled subjects.

We also compared donation frequencies across blood centers to understand if any of the observed differences between subject groups could be explained by variation between centers. The amount of contact and methods for contacting enrolled donors did vary quite a bit between the six participating blood centers (see Materials and Methods). In fact our multivariable model found blood center to be a significant predictor of return rate. A cursory examination of the intensity of subject contact and donor return rate did not yield evidence that additional contact attempts resulted in higher donation frequency among enrolled subjects. We did not perform a quantitative analysis of the impact of subject contact methods, but perhaps this could be addressed in future research.

Studies performed by Nguyen and coworkers,[5] Steele and coworkers,[6] and Glynn and coworkers[7] found that the primary factors motivating donors were altruism, medical testing, and the belief that donating blood would bring about a health benefit. It is possible that since our study is about the effects of donating on iron levels, donors were more motivated to return so that their iron levels could be tested. Furthermore, donors motivated by altruism

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may have been even more inspired to participate in the RISE study since in addition to helping patients who needed blood, they would also be contributing to the advancement of knowledge and safety related to the effect of frequent donation.

Schreiber and colleagues[8] and Schlumpf and colleagues[3] both found that convenience was an important motivational factor for first-time and repeat donors. In the study by Schlumpf and colleagues frequent repeat donors reported that fixed sites were more convenient due to the availability of hours for appointments, but first-time donors reported that mobile draws located close to work-places were more convenient. Although our multivariable analysis showed higher return rates at fixed sites than at mobile sites, controlling for this potential confounder did not eliminate differences we saw between enrolled and nonenrolled subjects.

Another significant factor that has been discussed in several articles pertaining to donor motivation is "intent to return."[3,5,9] Donors who report in interviews that they intend to return in the future do return to donate at higher frequencies. In the RISE study, all subjects were asked to commit to donating at least once or twice during the following year as a requirement for participation in the study. Asking for this commitment at the time of enrollment in the study may have impacted our subjects' return rates. None of the blood centers participating in our study ask donors to commit to a minimum number of donations per year, although most encourage donors to set up their next appointment before leaving the center after a donation, and all make telephone calls or send letters or e-mails to remind donors when they are eligible for another donation.

This study has a few limitations. It was not possible to quantify donor motivation, and thus we can only speculate about reasons for donor return since an interview with subjects was not within the scope of this research project. Also, in calculating the rates of return for our study, we did not include attempts at donation in which donors were deferred. Many centers anecdotally reported examples of enrolled subjects who made repeated attempts to donate but were deferred many times for low iron values. The donation frequencies we calculated are based on successful blood cell component visits alone and may not completely capture the full range of donor motivation. As mentioned above, we were unable to compare pre- versus postdonation rates for first-time and reactivated donors. Perhaps a follow-up study could be performed in which donation rates among subjects are analyzed to see if rates continue to remain higher or drop to more typical levels after the end of the study. The retrospective nature of our data did not allow us to perform a quantitative analysis of the impact of subject contact methods on donation frequencies, and future research on this subject should include a more controlled and thorough analysis of that issue. Finally, the specification of enrolled versus nonenrolled subject groups was not exactly comparable. Since there was no access to a donation history interview with nonenrolled donors as there was with the RISE-enrolled subjects, the reactivated donor group was defined slightly differently for enrolled subjects than for nonenrolled donors.

In conclusion, we saw high rates of donation among donors enrolled in a blood center–based research study. It is encouraging that the high donation rates could be maintained even if we suspect that they were caused in part by selection bias and not enrollment per se. Future research using a prospective randomized design could further explore this issue.

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ABBREVIATIONS

RISE	REDS-II Donor Iron Status Evaluation
RR	rate ratio

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Appendix

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TABLE 1

Demographic information for enrolled and nonenrolled donors

Variable	Enrolled donors (n = 2,425)	Nonenrolled donors (n = 202,383)
Blood center		
A	436 (18.0)	33,335 (16.5)
B	390 (16.1)	20,751 (10.2)
C	376 (15.5)	47,205 (23.3)
D	392 (16.2)	14,507 (7.2)
E	415 (17.1)	23,267 (11.5)
F	416 (17.1)	63,318 (31.3)
Donor status		
First-time	303 (12.5)	30,405 (15.0)
Reactivated	585 (24.1)	66,673 (33.0)
Frequent repeat	1,537 (63.4)	105,305 (52.0)
Sex		
Male	1,175 (48.4)	94,421 (46.7)
Female	1,250 (51.6)	107,962 (53.4)
Race or ethnicity		
White	2,111 (87.1)	178,036 (88.0)
Asian	76 (3.1)	4,499 (2.2)
Black	116 (4.8)	9,427 (4.7)
Hispanic	76 (3.1)	6,371 (3.1)
Other	29 (1.2)	3,019 (1.5)
Missing	17 (0.7)	1,031 (0.5)
Age (years)		
<20	133 (5.5)	19,164 (9.5)
20–29	343 (14.1)	31,802 (15.7)
30–39	340 (14.1)	28,631 (14.2)
40–49	497 (20.5)	44,972 (22.2)
50–59	626 (25.8)	47,508 (23.5)
60+	486 (20.0)	30,306 (15.0)
Education		
≤22 years old	246 (10.1)	30,515 (15.1)
≤High school/GED	292 (12.0)	28,805 (14.1)
Some college/associate degree	616 (25.4)	55,421 (27.4)
≥College degree	1,129 (46.6)	79,523 (39.3)
Missing	142 (5.9)	8,119 (4.0)
Country of birth		
US born	2,301 (94.9)	192,728 (95.2)
Foreign born	124 (5.1)	9,655 (4.8)
Donation location		
Fixed	1,936 (79.8)	66,831 (33.0)

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Variable	Enrolled donors (n = 2,425)	Nonenrolled donors (n = 202,383)
Mobile	489 (20.2)	135,489 (67.0)
Missing	0 (0.0)	63 (0.0)

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TABLE 2

Comparison of the mean number of donations between enrolled RISE donors and nonenrolled donors (first-time, reactivated, and repeat) during the 15-month follow-up period

	Mean number of donations			
Cohort	**Enrolled donors**	**Nonenrolled donors**	**RR***	**Adjusted RR†**
First-time donors	1.21	0.58	2.09‡	1.91‡
Reactivated donors	1.68	0.79	2.13‡	1.83‡
Frequent repeat donors	3.40	2.85	1.19‡	1.12‡

* RR is ratio of unadjusted Poisson donation rate of enrolled donors to rate of nonenrolled donors.

† Adjusted RR is Poisson donation rate of enrolled donors to rate of nonenrolled donors, adjusted for center, sex, race or ethnicity, age, education, country of birth, and donation location.

‡ Significant difference ($p < 0.001$).