# The Impact of Temporary Deferrals on Future Blood Donation Behavior Across the Donor Life Cycle

Clement, Michel; Shehu, Edlira; Chandler, Torsten

*Document Version*
Final published version

*Published in:*
Transfusion

*DOI:*
10.1111/trf.16387

*Publication date:*
2021

Received: 4 November 2020 | Revised: 18 March 2021 | Accepted: 18 March 2021

DOI: 10.1111/trf.16387

BLOOD DONORS AND BLOOD COLLECTION

TRANSFUSION

# The impact of temporary deferrals on future blood donation behavior across the donor life cycle

**Michel Clement**[1] | **Edlira Shehu**[2] | **Torsten Chandler**[3]

[1]Institute for Marketing, University of Hamburg, Hamburg, Germany

[2]Department of Marketing, Copenhagen Business School, Frederiksberg, Denmark

[3]Hamburg Center for Health Economics, University of Hamburg, Hamburg, Germany

**Correspondence**
Michel Clement, Marketing and Media, University of Hamburg, Institute for Marketing, Moorweidenstr. 18, 20148 Hamburg, Germany.
Email: michel.clement@uni-hamburg.de

**Funding information**
European Commission, Grant/Award Number: Marie Skłodowska-Curie grant agreement 721402

## Abstract

**Background:** Donor retention is essential for blood banks because acquiring new donors is more expensive than retaining existing ones. Previous studies show that the temporary deferral of donors negatively impacts future donation likelihood. In this study, we analyze the impact of temporary deferrals on future donation behavior while correcting for potential endogeneity, depending on the level of donor experience and number of previous deferrals.

**Study Design and Method:** We use data from more than 123,000 whole blood donors of the Austrian Red Cross over a period of 5.5 years. We estimate logit models to analyze how a deferral affects future donation behavior while controlling for potential selection biases because donors are not deferred randomly. We control for gender, blood type, years since first donation, and number of previous donations and deferrals. We analyze the direct deferral effect, its interaction with donor experience, and the number of previous deferrals.

**Results:** Our results confirm that temporary deferrals hurt future donation behavior. This effect varies with donor experience and the number of previous deferrals. The effect is weaker with a higher number of previous donations and is stronger with a higher number of previous deferrals. The results suggest that donors learn to cope with deferrals the more they donate. However, the negative effect of deferrals amplifies over time, and each additional deferral decreases donation likelihood.

**Conclusion:** Blood banks that seek to overcome the negative effect of deferrals should be aware that this effect varies with donor experience and with the number of previous deferrals. Our results suggest that blood banks should focus on early-stage donors who are deferred because the negative deferral effect is stronger for more experienced donors. At the same time, blood banks should be careful with donor groups who have experienced deferrals in the past because every additional deferral demotivates future donation behavior. Overall, researchers should be careful to correct for endogeneity because our results suggest that ignoring these effects could lead to substantial underestimation of the negative deferral effect.

KEYWORDS
donors

## 1 | INTRODUCTION

A deferral occurs when donors do not meet the eligibility criteria for donating blood when visiting their blood collection site. Deferral periods, which may be permanent or temporary, are implemented to protect both the donor's health (e.g., deferral due to low hemoglobin) or that of the recipient (e.g., deferral due to travel to "high-risk" areas).

In this study, we analyze the impact of temporary deferrals on future donation behavior, depending on donor experience and past temporary deferrals. The negative impact of deferral on subsequent donor behavior is quantitatively and qualitatively well established.[1–9]

However, we still know very little of the factors that moderate the impact of temporary deferrals. Specifically, donor experience and the number of previous deferrals are less well understood with very limited research in this area. To contextualize our findings, we reviewed the literature and included studies that reported the impact of donor deferral on whole blood donors using the following search terms: (((“Deferral” OR “Deferred” OR “Defer”)) AND (“Donor” OR “Donation”)) and searching the following sources: Google Scholar, PubMed, and relevant clinical journals related to transfusion medicine: Vox Sanguinis, Transfusion, ISBT Science Series, and Transfusion Medicine. Furthermore, we reviewed the reference list from a recent narrative review by Davison et al (2019) and the bibliographies of any included articles.[1] Studies that directly compared the outcomes of deferred to eligible donors or investigated the impact of the type of deferral on donor return were considered. In addition, qualitative studies that reported the emotional response of the donor to being deferred were included. We excluded studies not published in English. The included quantitative and qualitative studies are listed in Tables 1 and 2, respectively.

Overall, past research shows a negative effect of deferrals on future donation behavior, that is, deferred donors are less likely to return than their nondeferred counterparts. First-time donors, especially, are more sensitive to deferral than repeat donors[2–7] (Table 1). For example, Custer et al (2007) found in a sample of 7577 U.S. donors that the return rate for deferred versus nondeferred was 81% versus 86% ($p < .0001$) for repeat donors and 25% versus 47% ($p < .0001$) for first time donors.[2] Spekman et al. (2019) looked at the impact of deferral by donor experience, where experienced donors (not deferred 96% vs. deferred 92%) were found to be more likely to return following deferral than first-time and reactivated donors (69% and 61%, respectively) compared with the nondeferred group (82% and 76%, respectively).[7] However, studies that analyze how deferral effects may vary depending on a donor's previous donation and deferral history are lacking.

Our research differs in that we look at donor experience and previous deferrals on a continuous scale, allowing us to evaluate on the margin how each additional year of donor experience can impact the likelihood of return (threshold perspective). Moreover, we highlight the importance of a methodological issue as most of the studies do not account for a potential endogeneity of temporary deferrals. Deferrals are not random but relate to a donor's health conditions. Consequently, a donor being deferred may have a lower probability to donate blood in general, that is, donors with and without deferrals may show systematically different profiles that affect their future donation behavior, and these differences may bias the estimated deferral effect on future donation likelihood. Our research addresses this gap and analyzes donor experience and past deferrals as moderating factors of temporary deferrals, while controlling for potential endogeneity of temporary deferrals.

Fundamentally, we argue that deferrals at the early stage of a donor's life cycle reduce redonation likelihood. However, the more experienced a donor is, the less negative the influence of deferral is on donation behavior. In contrast, the negative influence of a deferral is intensified as the donor experiences more deferrals.

Theories grounded in psychology and behavioral economics suggest that the impact of a deferral on subsequent donor return differs between first time, novice, and experienced donors (Table 3). For example, elements of the theory of planned behavior (TPB)[17] and its extensions[18, 19, 30] help to explain how deferral effects may differ across the donor lifecycle. These extensions comprise elements including habit forming,[19] belongingness,[26] goal setting,[25] and social identity theory,[21, 22] which indicate that the negative effect of temporary deferrals may diminish with each year of donor experience. Moreover, we propose that the impact of deferral may “carry over” from previous deferrals (long-term effect), even once the initial deferral impact has passed (hysteresis effect).[27–29]

Although we do not test these theories explicitly, in Table 3, we provide illustrative examples of how they may relate to the behavior of deferred blood donors across the donor lifecycle.

**TABLE 1** Quantitative studies reporting the impact of deferral on donors

| Author (year) | Journal | Study type/ method of estimation | Sample (country) | Reported outcomes | Summary of findings | Return rate for deferred donors (vs. not deferred) |
|---|---|---|---|---|---|---|
| Bednall et al (2013)[10] | Social Science & Medicine | Meta-analysis | n = 473,384 (multiple) | Weighted average of effect size | −0.372 (CI; −0.633 to −0.035) likelihood of subsequent donation following deferral. Conversely, experienced donors were less likely to be deterred from subsequent donations by temporary deferrals (B = 0.149, $p = .014$) (Moderator analysis) | ↓ |
| Bruhin et al (2019)[5] | Transfusion Medicine and Hemotherapy | Quasi-experiment using regression discontinuity design (RDD) | n = 80,060 (Switzerland) | Probability of return; donation attempts | Female donors are 13.53 percentage points ($p < .001$) less likely to make at least 1 donation attempt within the next 18 months after any repeated LHD. Male donors are 5.32 percentage points ($p = .139$) less likely to make at least 1 donation attempt over the next 18 months. | ↓ |
| Custer et al (2007)[2] | Transfusion | Cox proportional hazard model | n = 7577 (US) | Return rate; time to return | Return rate for deferred vs. not deferred: repeat donors: 81% vs. 86% ($p < .0001$) and first-time donors: 25% vs. 47% ($p < .0001$) | ↓ |
| Custer et al (2011)[11] | Transfusion | Time-to-event analysis | n = 505,623 (US) | Time to return | The type of temporary deferral influenced donor return. Time in days when 25% had returned [95% CI] was lower for deferrals for the categories low hematocrit (53 [52–54]), blood pressure/pulse (75 [72–77]), feeling unwell/colds/ temperature (73 [71–77]) and could not wait/second thoughts (78 [74–83]) than for eligible donors (92 [92–93]). | NR |
| Gemelli et al (2017)[6] | Transfusion | Multivariate Cox proportional hazard ratios (HRs) | n = 81,762 (Australia) | Hazard ratio | Probability of donor return for existing (repeat) donors HR = 0.689 (CI, 0.667–0.711) and new donors HR = 0.664 (CI, 0.593–0.742) compared with eligible donors. | ↓ |
| Germain et al (2007)[12] | Transfusion | Mail survey/weight-adjusted ORs | n = 921 (Canada) | Odds ratio | Having a previous deferral was associated with a higher probability of lapsing for repeat donors 1.52 (CI: 1.10–2.11). | ↓ |
| Halperin et al (1998)[3] | Transfusion | Retrospective study using matched control (chi-square analysis) | n = 2793 (US) | Return rate; volume of whole blood | Deferred vs. matched control: 62% vs 80% ($p < .001$). In addition, nondeferred donors donated 81% more whole blood units. | ↓ |

(Continues)

TABLE 1 (Continued)

| Author (year) | Journal | Study type/ method of estimation | Sample (country) | Reported outcomes | Summary of findings | Return rate for deferred donors (vs. not deferred) |
|---|---|---|---|---|---|---|
| Hillgrove et al (2011)[4] | Transfusion | Multivariable logistic regression model | n = 69,686 (Australia) | Return rate; time to return; frequency of donation | Deferred vs. Not deferred; 58.5% vs. 87.4% ($p < .001$). Those in the deferred group were significantly less likely to return in all 3 years of follow-up: Year 1 (odds ratio [OR], 0.13; 95% confidence interval [CI], 0.11–0.15]; $p < .001$); Year 2 (OR, 0.30; 95% CI, 0.27–0.34; $p < .001$); and Year 3 (OR, 0.31; 95% CI, 0.27–0.35; $p < .001$). | ↓ |
| Leipnitz et al (2018)[13] | International Journal of Research in Marketing | Randomized field trial /logistic regression analysis | n = 53,257 (Germany) | Odds ratio | Each additional previous deferral resulted in lower likelihood of donor attending blood drive (OR = 0.95; $p < .01$). | ↓ |
| Piliavin et al (1987)[14] | Transfusion | Cohort study | n = 1247 (US) | Return rate | Return rate for deferred vs. not deferred: first time donors 2.8% vs. 27.3% (not significant). | $\downarrow^{ns}$ |
| Spekman et al (2019)[7] | Transfusion | Retrospective study with Cox proportional hazard model. | n = 343,825 (Netherlands) | Return rate; odds ratio | Experienced donors (not deferred 96% vs. deferred 92%). First-time and reactivated donors were less likely to return after deferral (69 and 61%, respectively) compared to their not deferred counterparts (82 and 76%, respectively). | ↓ |
| Wevers et al (2014)[15] | Blood Transfusion | Multivariate logistic regression analysis. | n = 4901 (The Netherlands) | Odds ratio | Probability of return following deferral lower for men 0.73 (CI: 0.61–0.88) and women 0.78 (CI: 0.64–0.95). Adjusted OR model. | ↓ |
| Zou et al (2006)[16] | Transfusion | Retrospective analysis with logistic regression | n = 47,814,370 (US) | Return rate | Return rates varied by deferral type and donor characteristics. Compared to donors temporarily deferred for general donor safety reasons, those temporarily deferred for blood-borne pathogen risk had the lowest return rates (OR, 0.347; 95% CI, 0.303–0.398). | NR |

Abbreviations: ↓, negative effect of deferral on return rate; $\downarrow^{ns}$, negative effect of deferral on return rate (not significant); CI, 95% confidence interval; NR, not reported.

According to the TPB, donation intention is determined by attitude, subjective norm, and perceived behavioral control (closely related to self-efficacy). All these three elements vary along the donor lifecycle and lead to heterogeneous deferral effects, as described in Table 3.

Additionally, we conjecture that habit formation, which has been found to be an important predictor of blood donation behavior,[23, 24] could explain differences in the impact of deferral as donor experience increases. Related to habit forming, we propose that donors may set goals as they become more experienced or their donation goals become more established (i.e., I will donate every 3 months, or I will donate five times this year). Reaching these goals can also be incentivized by marketing actions,

**TABLE 2** Qualitative studies reporting the impact of deferral on donors

| Author (year) | Journal | Method | Sample (country) | Findings |
|---|---|---|---|---|
| Hillgrove et al (2012)[8] | BMC Public Health | Semistructured interviews | n = 23 (Australia) | "Most participants described negative emotional responses resulting from their deferral. Some strong negative emotions resulted from denial of the opportunity to help and the disruption to the donors' self-perceptions as capable, competent, and healthy individuals". |
| Gemelli et al (2018)[9] | ISBT Science Series | Mixed methods approach | n = 397 (Australia) | "Staff reported that donors frequently had negative emotional responses to being deferred–particularly anger, frustration and rejection." |

for example, honoring donors who reached a certain threshold. Furthermore, we propose that deferrals may threaten a sense of belongingness to a donor community resulting in a sense of social rejection that may be experienced when a donation is unsuccessful.[26] Moreover, social identity theory suggests that group membership is a source of identity and self-esteem may be derived through membership to a group such as a donor community.[21, 22] In the context of deferral, donors may feel their identity as part of a donor group is threatened by a deferral through which they may well choose to reassert their social identity by continuing to donate at the next opportunity. Lastly, we expect that the influence of a negative deferral is stronger if donors have been deferred in the past. Furthermore, the negative effect from a deferral can be accumulated over time, lowering donors' motivation to redonate, which may be explained by hysteresis and carry-over effects.

Overall, the theoretical mechanisms in Table 3 suggest that the negative deferral effect is stronger in the early stages of the donor lifecycle. A donor's past experience moderates this effect in opposed directions: With increasing donor experience, and number of donations, this negative effect is reduced. However, the negative effect is intensified with an increasing number of past deferrals. We test these effects empirically using observational data from the Austrian Red Cross. Our results complement existing research, providing valuable insights for managers of blood donation services which may help them to develop strategies for minimizing potential negative consequences.

## 2 | MATERIALS AND METHODS

We use observational data from more than 123,000 whole blood donors of the Austrian Red Cross, who donated at least once over a period of more than 5 years (January 2010 to June 2016). We utilize panel data on donation behavior, communication activities, and demographic information (Table 4 provides an overview of the descriptive statistics).

The Austrian Red Cross invites registered donors to donate, via telephone calls, letters, short text messages, and postcards. For each donor, the data contain information on when they donated, on the marketing activities from the Austrian Red Cross, as well as demographic data. Individuals are not always eligible to donate blood; males can only donate up to six times yearly and female donors up to four times yearly. This implies that male donors need to pause for 8 weeks following a donation and female donors for 12 weeks. We only consider weeks where each individual is eligible to donate. The final sample consists of 3,241,772 observations.

Our dependent variable is binary, indicating whether a donation took place or not. In our sample, donors donate in 19% of the weeks they are eligible. Our focal independent variable is whether an individual was deferred after the last donation. We aim to analyze how the deferral effect varies with donor experience. Donor experience is measured by the number of donations previous to week t.

We control for communication activities from the Austrian Red Cross. The Austrian Red Cross communicates with the donors primarily via text messages (43%) followed by calls (9%), mailings (2%), and post cards (1%); 65% of our sample is male, and we control for blood groups in our model. Lastly, we control for the number of years since the first donation.

We apply logistic regression analysis with the binary donation variable as the dependent variable. The variables outlined above serve as independent variables. The dependent variable is valued 1 if a donor appeared to donate blood in week t and 0 otherwise. Our main independent variables of interest are the deferral variable and its interaction with the number of previous donations, which measures donor experience, and the number of previous deferrals.

## 3 | MODEL

We estimate a logistic regression with the donation (yes/no) as the dependent variable and the independent variables presented in Table 4. We model donation likelihood as a logistic equation:

**TABLE 3** Impact of deferral across the donor lifecycle: Theoretical framework

| | Expected impact of deferral by donor stage | | |
|---|---|---|---|
| **Theory stream** | **First time donors** | **Novice donors (2–4 donations)** | **Experienced donors (5+ donations)** |
| Attitudes[17–20] | Feelings and beliefs about giving blood vulnerable to negative deferral experience. | Feelings and beliefs less vulnerable to deferral with initial experience and knowledge. | Experienced and knowledgeable of donation procedure. Robust attitude toward donation less vulnerable to negative deferral experience. |
| Subjective norms[17–20] | Motivation to overcome deferral drawn from blood donor group, family, and friends not yet developed. | Expectation and approval from family and friends starting to develop. Donor groups beginning to form. However, deferral still demotivating. | Established expectations and approval from family, friends, and donor groups. Deferral may not meet with expectations but can still be overcome. |
| Self-efficacy[17–20] | Not yet developed confidence as a "capable donor" able to overcome deferral. | Confidence and capability to donate starting to develop. However, deferral at odds with "capable donor" image. | Donor feels confident and capable both in their ability to donate and in overcoming deferral with their next donation. |
| Blood donor identity (role identity)[19] | Blood donor identity not yet developed to overcome negative deferral experience. | Blood donor identity in early stages and could overcome deferral but still fragile to negative experience. | Blood donor identity is well developed. Donor may try to maintain role identity after deferral through a successful subsequent visit. |
| Social identity[21, 22] | Donor has not yet developed an identity as a member of a donor group. | Social identity as a member of a donor group beginning to form. Deferral may be disheartening. | Strong social identity as a donor developed. Deferral may threaten identity but could also provide motivation to continue donating. |
| Habit formation[19, 23, 24] | Habits not yet developed and habit forming potentially fragile to deferral. | Limited experience with 1–4 donations. Early-stage habits disrupted by deferral. | Established donation habits. Deferral may be disruptive but can be overcome. |
| Goal setting[25] | Donors' personal goals not yet developed. | Donors may develop donation goals, for example, 3–4 successful visits per year. Effects of not meeting goals may be motivating or demotivating.[25] | Donors may have well established donation goals that may not be met with deferral. Could be motivating or demotivating when targets are missed.[25] |
| Belongingness[26] | Sense of belongingness to donor group/community not yet established. Belongingness fragile to deferral. | Belongingness to donor group in early stages. Deferral/rejection may result in antisocial reaction or nonreturn.[26] | Belongingness to donor group well established. Deferral may result in antisocial reaction or nonreturn. However, donors may overcome social rejection and continue donating.[26] |
| Role of past deferrals[27–29] | Accumulation of past deferral experience not relevant. | Limited possibility for accumulation of past deferral experience. | Negative impact of deferral may "carry over" from previous deferrals (long-term effects), even once initial deferral impact has passed (so-called hysteresis and carryover effects).[27–29] |

$$P\_donation_{it} = \begin{cases} 1 \text{ if } P\_donation^{*}_{it} > 0 \\ 0 \quad \text{otherwise} \end{cases}, \tag{1}$$

where $P\_donation^{*}_{it}$ is a latent variable, depending on the deferral dummy, donor experience measured by past donations, past deferrals, interaction terms, and control variables $X_{it}$. Because donors are not deferred randomly, the deferral variable may be subject to selection bias. We correct for this selection bias by defining a second probit equation with the deferral dummy as the dependent variable and three instrumental variables (one for the potentially endogenous deferral variable, and its interaction terms with past donations and past deferrals, respectively). We estimate both equations simultaneously with correlated error terms.[31]

**TABLE 4** Descriptive statistics

| Variable | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| Donation (d) | 0.19 | 0.39 | 0.00 | 1.00 |
| Deferral (d) | 0.31 | 0.46 | 0.00 | 1.00 |
| Number of previous donations | 3.49 | 4.09 | 0.00 | 80.00 |
| Text messages | 0.43 | 0.50 | 0.00 | 1.00 |
| Mailing | 0.02 | 0.13 | 0.00 | 1.00 |
| Call | 0.09 | 0.29 | 0.00 | 1.00 |
| Post card | 0.01 | 0.08 | 0.00 | 1.00 |
| Gender | 0.65 | 0.48 | 0.00 | 1.00 |
| Blood group O | 0.24 | 0.43 | 0.00 | 1.00 |
| Blood group A | 0.42 | 0.49 | 0.00 | 1.00 |
| Blood group B | 0.13 | 0.34 | 0.00 | 1.00 |
| Blood group AB | 0.06 | 0.24 | 0.00 | 1.00 |

*Note:* N = 3,241,772.
Abbreviations: d, dummy coded variable; SD, standard deviation.

$$P\_donation_{it}^{*} = \beta_{1i} Deferral + \gamma_1 Past\ donations + \gamma_2 Past\ deferrals + \delta_1 Deferral \times Past\ donations + \delta_2 Deferral \times Past\ deferrals + \kappa X_{it} + u_{it}, \quad (2)$$

$$P\_deferral_{it}^{*} = \alpha_1 Deferrals\_zip_{it} + \alpha_2 Donations\_zip_{it} + \alpha_3 Deferrals\_gender_{it} + \kappa X_{it} + \epsilon_{it}. \quad (3)$$

As instrumental variables, we use the number of deferrals from donors of the same zip code in a specific week, the number of donations from donors of the same zip code area in a specific week, and the number of deferrals for a specific gender in a specific week. Durbin–Wu–Hausman test shows that the deferral dummy, indeed, suffers from endogeneity ($\chi^2 = 46{,}700$, $p < .001$). All three instruments are jointly significant in the main equation (F(33238064) = 300,000; $p < .001$). The Sargan test statistic implies that the test of overidentifying restrictions can reject its null hypothesis ($\chi^2 = 24{,}000$; $p < .001$). A Cragg-Donald weak identification test shows that the null hypothesis of weak identified instruments can be rejected (F = 584.984, $p <. 01$), undermining the validity of our instruments.

# 4 | RESULTS

## 4.1 | Main results

Table 5 shows the estimated results. Temporary deferrals hurt the motivation to donate (b = −1.38, se = .00; $p < .01$). However, this effect varies with donation experience and number of previous deferrals. Specifically, we see from the interaction effects that a higher number of past donations attenuates the negative effect (b = .01, se = .00; $p < .01$), whereas a higher number of previous deferrals intensifies the negative effect (b = −.03, se = .00; $p < .01$).

We calculate the marginal effect of temporary deferrals depending on donor experience and number of past donations (Figure 1). We see that a deferral is especially problematic for new donors with a low number of blood donations. For more experienced donors, the negative deferral effect is much smaller. However, we find that past deferrals intensify the negative deferral effect. In other words, donors' likelihood to donate again decreases with every additional deferral.

## 4.2 | Additional results

As expected, and in line with previous research, we see positive effects as the total number of past donations increase (e.g., Veldhuizen et al, 2009). We see that phone calls and post cards increase redonation likelihood (see Table 5), whereas text messages and mailings received in the week preceding the donation were less helpful due to smaller target groups. We also see that male donors donate on average more often, and that donors with blood groups O, A, and AB have higher donation likelihood compared with the baseline. Lastly, we see that donation likelihood increases with a longer donor lifetime (i.e., number of years since first donation) and decreases with recency of last donation.

TABLE 5 Results

| Donation likelihood | b | SE | t | 2.5% | 97.5% |
|---|---|---|---|---|---|
| Deferral | −1.38 | 0.00 | −843.33 | −1.38 | −1.38 |
| Previous donations | 0.01 | 0.00 | 36.92 | 0.01 | 0.01 |
| Deferral × Previous donations | 0.01 | 0.00 | 38.03 | 0.01 | 0.01 |
| Previous deferrals | 0.04 | 0.00 | 32.23 | 0.04 | 0.04 |
| Deferral × Previous deferral | −0.03 | 0.00 | −18.32 | −0.03 | −0.02 |
| Text messages | −0.08 | 0.00 | −54.36 | −0.09 | −0.08 |
| Mailing | −0.05 | 0.01 | −9.81 | −0.06 | −0.04 |
| Calls | 0.09 | 0.00 | 35.58 | 0.09 | 0.10 |
| Cards | 0.04 | 0.01 | 4.64 | 0.02 | 0.05 |
| Gender | −0.11 | 0.00 | −71.51 | −0.11 | −0.11 |
| Blood group O | 0.16 | 0.00 | 66.37 | 0.16 | 0.17 |
| Blood group A | 0.11 | 0.00 | 48.00 | 0.10 | 0.11 |
| Blood group B | 0.08 | 0.00 | 30.61 | 0.08 | 0.09 |
| Blood group AB | 0.12 | 0.00 | 34.07 | 0.11 | 0.13 |
| Years since first donation | 0.00 | 0.00 | 19.48 | 0.00 | 0.00 |
| Recency | −0.09 | 0.00 | −340.36 | −0.09 | −0.09 |
| Constant | −0.03 | 0.00 | −11.66 | −0.03 | −0.02 |
| **Deferrals** | **b** | **SE** | **t** | **2.5%** | **97.5%** |
| Deferrals zip code | 0.00 | 0.00 | 200.43 | 0.00 | 0.00 |
| Deferrals gender | 0.00 | 0.00 | −62.25 | 0.00 | 0.00 |
| Donations zip code | 0.00 | 0.00 | −338.00 | 0.00 | 0.00 |
| Text messages | −0.09 | 0.00 | −56.28 | −0.09 | −0.08 |
| Mailing | −0.09 | 0.01 | −15.66 | −0.10 | −0.08 |
| Calls | 0.11 | 0.00 | 44.65 | 0.11 | 0.12 |
| Cards | −0.10 | 0.01 | −10.91 | −0.11 | −0.08 |
| Gender | −0.22 | 0.00 | −144.93 | −0.22 | −0.22 |
| Blood group O | 0.25 | 0.00 | 102.47 | 0.25 | 0.26 |
| Blood group A | 0.17 | 0.00 | 74.29 | 0.16 | 0.17 |
| Blood group B | 0.12 | 0.00 | 42.96 | 0.12 | 0.13 |
| Blood group AB | 0.18 | 0.00 | 51.72 | 0.18 | 0.19 |
| Constant | −0.37 | 0.00 | −143.76 | −0.37 | −0.36 |
| N | 3241772.00 | | | | |
| Log-likelihood | −3172584.00 | | | | |

Abbreviations: CI, confidence interval; SE, standard error; t, t statistic.

## 5 | DISCUSSION

Donor availability is the most vulnerable link in the transfusion (e.g., blood, blood components, plasma-derived medicines) and transplantation (e.g., stem cells) chains. Individuals willing to donate blood invest time, effort, and pain (needle injection) to help others in need. Ethics and regulations require blood donation services to minimize health risks for both blood donors and blood recipients, which may lead to the necessity to temporarily defer an individual from donating blood.

In this study, we focus on the impact of temporary deferrals on future donation behavior, accounting for donor experience, which we contextualize within a detailed literature review and a theoretical framework. We contribute to the literature that looks at the impact of deferral on donors and how to manage them. Particularly, our results corroborate with previous findings on the negative effects of deferral, which were found to be especially detrimental for new donors. Notable for those concerned with managing blood donations, we find that the impact of deferral is reduced with an increasing

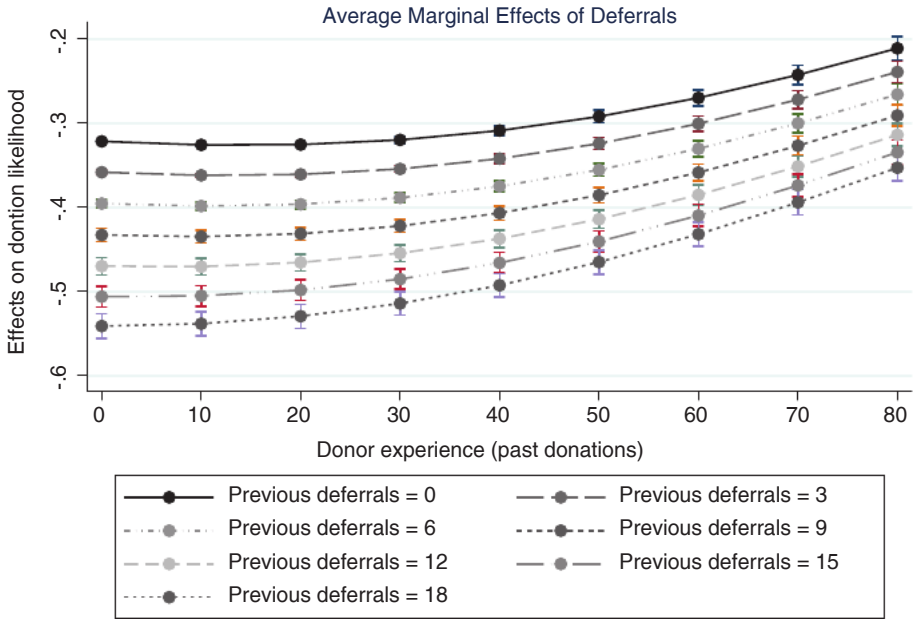


**FIGURE 1** Marginal effects of deferrals depending on donor experience and past deferrals [Color figure can be viewed at wileyonlinelibrary.com]

number of donations. Habit formation, belongingness, goal setting, and donor identity may provide a reasonable explanation for why deferral may be less demotivating to redonate for experienced donors.

We also find that the negative effect of temporary deferrals accumulates over time. One potential explanation is that a residual effect following deferral remains that is carried over to future deferrals (hysteresis & carry over effects).[27–29] Hysteresis and carry-over effects could explain how the negative effect of deferral is accumulated over a series of negative experiences, which is supported by our results.

Based on our findings, we suggest that blood donation services should focus their attention on early career donors and develop strategies to retain them following deferral. Strategies may include donor counseling and support, additional reminders, clear information regarding the deferral procedure, or even creating donor appeals with positive effects to compensate for the negative deferral effect targeted to early-stage donors.

At the same time, blood donation strategies should also monitor the total number of past deferrals and devote special attention to donor groups who have experienced multiple temporary deferrals. Thus, we suggest deferral management strategies targeted toward the needs of different donor groups. Furthermore, blood banks could choose to automate their donor databases to alert them when deferred donors need additional attention, as their number of deferrals increase.

Our results also show the importance of correcting for endogeneity bias when assessing the deferral effect on future donations. Donors are not deferred randomly, and these systematic differences require consideration. An estimation of the deferral effect without accounting for endogeneity correction leads to substantial underestimation of the deferral effect (−.09 in the model without endogeneity correction vs. −1.4 in the model with endogeneity correction). As an avenue for further research, we recommend exploring the motivations by which experienced donors cope with deferral, which once identified, could be nurtured in donors early in their career. A more thorough understanding of the psychological processes that drive this behavior would be especially valuable. Furthermore, our data do not allow us to study the reasons of deferral, but it would be very interesting to further analyze the impact of different deferral types.

In conclusion, donor experience attenuates the negative deferral effects. Blood banks should thus be careful with temporary deferrals of novice and early career donors and monitor the number of previous deferrals to overcome the negative effect on donation likelihood.

## ACKNOWLEDGMENT

We thank the Austrian Red Cross for providing the data. Torsten Chandler received funding from the European Union's Horizon 2020 Research and Innovation Programme under the Marie Skłodowska-Curie grant agreement No. 721402. Open Access funding enabled and organized by Projekt DEAL.

Open access funding enabled and organized by Projekt DEAL.

## CONFLICT OF INTEREST

All authors have no conflict of interest.

## ORCID

*Michel Clement* https://orcid.org/0000-0001-6769-6709
*Edlira Shehu* https://orcid.org/0000-0002-1807-0731
*Torsten Chandler* https://orcid.org/0000-0001-7729-6952


## REFERENCES


1. Davison TE, Masser BM, Gemelli CN. Deferred and deterred: A review of literature on the impact of deferrals on blood donors. ISBT Sci Ser. 2019;15:3–10.
2. Custer B, Chinn A, Hirschler NV, Busch MP, Murphy EL. The consequences of temporary deferral on future whole blood donation. Transfusion. 2007;47:1514–23.
3. Halperin D, Baetens J, Newman B. The effect of short-term, temporary deferral on future blood donation. Transfusion. 1998;38:181–3.
4. Hillgrove T, Moore V, Doherty K, Ryan P. The impact of temporary deferral due to low hemoglobin: Future return, time to return, and frequency of subsequent donation. Transfusion. 2011;51:539–47.
5. Bruhin A, Goette L, Haenni S, Jiang L, Markovic A, Roethlisberger A, et al. The sting of rejection: Deferring blood donors due to low hemoglobin values reduces future returns. Transfus Med Hemother. 2020;47(2):119–28.
6. Gemelli CN, Hayman J, Waller D. Frequent whole blood donors: Understanding this population and predictors of lapse. Transfusion. 2017;57:108–14.
7. Spekman MLC, van Tilburg TG, Merz E-M. Do deferred donors continue their donations? A large-scale register study on whole blood donor return in The Netherlands. Transfusion. 2019;59:3657–65.
8. Hillgrove TL, Doherty KV, Moore VM. Understanding non-return after a temporary deferral from giving blood: A qualitative study. BMC Public Health. 2012;12:1063.
9. Gemelli CN, Thijsen A, Van Dyke N, Masser BM, Davison TE. Emotions experienced when receiving a temporary deferral: Perspectives from staff and donors. ISBT Sci Ser. 2018;13:394–404.
10. 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 (1982). 2013;96:86–94.
11. Custer B, Schlumpf KS, Wright D, Simon TL, Wilkinson S, Ness PM, et al. Donor return after temporary deferral. Transfusion. 2011;51:1188–96.
12. Germain M, Glynn SA, Schreiber GB, Gélinas S, King M, Jones M, et al. Determinants of return behavior: A comparison of current and lapsed donors. Transfusion. 2007;47:1862–70.
13. Leipnitz S, de Vries M, Clement M, Mazar N. Providing health checks as incentives to retain blood donors — Evidence from two field experiments. Int J Res Mark. 2018;35(4):628–40.
14. Piliavin JA. Temporary deferral and donor return. Transfusion. 1987;27:199–200.
15. Wevers A, Wigboldus DHJ, de Kort WLAM, van Baaren R, Veldhuizen IJT. Characteristics of donors who do or do not return to give blood and barriers to their return. Blood Transfus. 2014;12(Suppl 1):s37–43.
16. Zou S, Musavi F, Notari EP, Rios JA, Trouern-Trend J, Fang CT. Donor deferral and resulting donor loss at the American red Cross blood services, 2001 through 2006. Transfusion. 2008;48:2531–9.
17. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. 1991;50:179–211.
18. Ferguson E, France CR, Abraham C, Ditto B, Sheeran P. Improving blood donor recruitment and retention: Integrating theoretical advances from social and behavioral science research agendas. Transfusion. 2007;47:1999–2010.
19. Ferguson E, Atsma F, de Kort W, Veldhuizen I. Exploring the pattern of blood donor beliefs in first-time, novice, and experienced donors: Differentiating reluctant altruism, pure altruism, impure altruism, and warm glow. Transfusion. 2012;52:343–55.
20. Ferguson E. Predictors of future behaviour: a review of the psychological literature on blood donation. Br J Health Psychol. 1996;1:287–308.
21. Tajfel H. In: Tajfel H, editor. Differentiation between social groups: studies in the social psychology of intergroup relations. London, New York: Academic Press; 1978.
22. Tajfel H. Social identity and intergroup relations. Cambridge: Cambridge University Press; 2010.
23. Ferguson E, Farrell K, Lawrence C. Blood donation is an act of benevolence rather than altruism. Health Psychol. 2008;27:327–36.
24. Ferguson E, Bibby PA. Predicting future blood donor returns: past behavior, intentions, and observer effects. Health Psychol. 2002;21:513–8.
25. Soman D, Cheema A. When goals are counterproductive: The effects of violation of a behavioral goal on subsequent performance. J Consum Res. 2004;31:52–62.
26. Gerber J, Wheeler L. On being rejected: A meta-analysis of experimental research on rejection. Perspect Psychol Sci. 2009;4:468–88.
27. Simon H. Hysteresis in marketing – A new phenomenon? Sloan Manage Rev. 1997;38:39–49.
28. Ewing J. On the production of transient electric currents in iron and steel conductors by twisting them when magnetised or by magnetising them when twisted. Proc R Soc Lond. 1881;33:21–3.
29. Cleophas TJ. Carryover effects in clinical research. Human experimentation. Dordrecht, The Netherlands: Springer; 1999.
30. Masser BM, White KM, Hyde MK, Terry DJ, Robinson NG. Predicting blood donation intentions and behavior among Australian blood donors: Testing an extended theory of planned behavior model. Transfusion. 2009;49:320–9.
31. Wooldridge JM. Introductory econometrics: A modern approach. 3rd ed. Mason, Ohio: Thomson South-Western; 2006.



**How to cite this article:** Clement M, Shehu E, Chandler T. The impact of temporary deferrals on future blood donation behavior across the donor life cycle. *Transfusion*. 2021;61:1799–1808. https://doi.org/10.1111/trf.16387