

ORIGINAL ARTICLE

A critical contribution in a time of crisis: Examining motivations and deterrents to COVID-19 convalescent plasma donation and future donation intentions among prospective Canadian donors

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Abstract

Objectives: To understand motivations and deterrents to donate COVID-19 convalescent plasma for a clinical trial and determine whether they predict intention to donate source plasma.

Background: During the COVID-19 pandemic, Canadian Blood Services was involved in three nationally coordinated convalescent plasma clinical trials, requiring the recruitment of several thousand prospective convalescent plasma donors. Understanding the motivations and deterrents of donors in the unique context of a clinical trial and ongoing pandemic can inform recruitment for source plasma donation beyond a clinical trial.

Methods and Materials: We invited 2785 Canadians who had registered interest in donating COVID-19 convalescent plasma to participate in an online survey containing a 42-item scale on motivators of and deterrents to donation. Between April 26th and May 19th, 2021, 979 responded (35.1%). We included a final sample of 820 participants with sufficient data across all scales. Exploratory and confirmatory factor analysis determined the factor structure of the scale. Regression analysis assessed the extent to which the factors predicted intention to donate.

Results: Four factors were identified: 'helping relationally', 'deterrents to donation', 'social facilitators', and 'access to the donation centre', each with good internal consistency ($\alpha = 0.78-95$). Higher scores on the helping relationally scale were associated with higher odds of intention to donate, whereas higher scores on the deterrents scale were associated with lower odds of intention to donate.

Conclusion: Participants were motivated by an interest in helping people who are ill and contributing to research committed to finding treatments in a time of crisis. Outside the crisis context, blood service operators seeking to recruit source plasma donors should emphasise its lifesaving potential and the impact of donation on the community.

KEYWORDS

blood donation, convalescent plasma, COVID-19, donation intentions, donation motivation, factor analysis, plasma donation

1 | INTRODUCTION

From 2020 to 2021, hundreds of clinical trials took place internationally to determine whether convalescent plasma from donors recovered from COVID-19 was an effective therapy for people hospitalised with COVID-19.^{1,2} During the COVID-19 pandemic, Canadian Blood Services was involved in three nationally coordinated convalescent plasma trials approved by Health Canada. The primary trial was a Randomised, Open-Label Trial of CONvalescent Plasma for Hospitalised Adults with Acute COVID-19 Respiratory Illness (CONCOR-1),³ a collaboration between Canadian Blood Services, Héma-Québec (the blood collection agency in Quebec), 10 research teams and 72 hospital sites in Canada, the United States, and Brazil. To source sufficient COVID-19 convalescent plasma for the clinical trial, Canadian Blood Services created, advertised, and managed a registry of prospective donors recovered from COVID-19 in Canada. Prospective donors were recruited through pamphlets and posters at clinics, social media outreach, paid recruitment (e.g., radio advertisements, social media content etc.), earned media, internal communications, and recruitment by the clinical trial investigators. Several thousand prospective donors signed up to the registry, creating a unique opportunity to expand our knowledge about the characteristics, motivations, and deterrents of prospective plasma donors within a pandemic context.

At the same time, there is increasing demand for plasma-derived therapies to treat bleeding disorders, burns, and immune deficiencies in Canada, with a resultant increase in the need for plasma donors to contribute 'source' plasma. Unlike plasma collected for transfusion (such as convalescent plasma), source plasma is pooled from multiple donors then manufactured into therapies called 'plasma protein products', through a process called fractionation. The international publicity about convalescent plasma as a potential treatment for COVID-19 raised the profile of plasma as a potential lifesaving treatment.⁴ While the CONCOR-1 clinical trial found that convalescent plasma is not an effective treatment for COVID-19,³ understanding convalescent plasma donor motivations can inform how we approach recruitment of source plasma donors during the current COVID-19 pandemic, and beyond. Thus, our research objective was to understand motivations and deterrents to donate COVID-19 convalescent plasma for a clinical trial and determine whether they predict intention to donate source plasma.

Our research objective requires attention to how the motivations and deterrents to donation differ across contexts. The context for donation—in this case a pandemic and a clinical trial—may influence who is motivated or deterred from donating plasma, potentially mobilising new populations of donors or generating insights about deterrents for particular social groups. Particularly, the context of donating blood for research can affect donor motivations and deterrents,⁵ thus, we approached the survey design and analysis with a sociological lens to account for the influence of context.

The sociology of donation situates donors within wider social structures, and relatedly, interrogates concepts that have been central to analysing motivations of donors. There is a growing scholarship challenging the concept of altruism, arguing that donation is rarely simply a gift, but often an opportunity for reciprocity, personal gain, or mutual exchange,⁶ embedded in the context of a community.^{7,8} For example, researchers have found that appeals towards enhancing the status of an organisation, giving back to community, performing a civic duty, having blood donation tied to meaningful aspects of their social network,^{7,8} or meeting the increasing need for plasma-derived treatments for recipients with a range of illnesses⁹ can be more effective in recruiting donors than appeals to altruism. The pandemic, for many, was a significant life event that could impact donor motivation,¹⁰ and differentially impacted our ability to interact socially with others (depending on one's work, caregiving responsibilities, housing, etc.), which could intern motivate or deter certain demographics. Social science research on blood donation in the context of the COVID-19 pandemic is thus required to examine how national emergencies can encourage donation as a symbol of national solidarity, while noting that the longevity of a pandemic can pose unique challenges to blood collection agencies.¹¹

During the first wave of the COVID-19 pandemic in 2020, researchers in Australia and the United Kingdom (UK) distributed a survey measuring the motivations and deterrents of COVID-19 convalescent plasma donors. Masser and colleagues¹² found that awareness of COVID-19 convalescent plasma among the UK sample was low, that a stronger sense of altruism through adversity and moral civic duty were positively related to intention to donate, and that generic fears about infection were negatively related. Our study builds on the scales developed by Masser and colleagues¹² by applying them to the Canadian context, following the third wave of COVID-19 and completion of the CONCOR trial. Consequently, we sought to understand predictors of intention to donate plasma going forward, rather than for donating convalescent plasma, specifically. Our analysis extends Masser and colleagues¹² concept of 'altruism from adversity', suggesting that beliefs centred around gratitude and reciprocity are developed in the context of social relationships, based in relations of reciprocity,¹³ and is done to benefit others and oneself or one's family. This notion of *mutual* benefit¹⁴ may be particularly salient in the context of the COVID-19 pandemic given the prevalence and threat of infection within communities worldwide, and the likelihood that people known to an individual, including family members, friends, colleagues, and neighbours, might fall ill and need convalescent plasma.^{13,15,16} We also sought to understand whether social facilitators such as donating to get out of the house and see people, and encouragement from friends and family, were relevant predictors of plasma donation in the context of a pandemic. Finally, we reframe



their concept of ‘logistics’ to suggest that travel and convenience are socially mediated features of donation as they speak to a donor’s work and caregiving responsibilities and their access to donation.^{17,18}

Thus, this study aimed to: (1) determine and confirm the factor structure and internal consistency of the motivators and deterrents to becoming a COVID-19 convalescent plasma donor scale in a sample of Canadians registered to donate convalescent plasma; and (2) determine to what extent the factors predicted intention to become a regular plasma donor in the future. We see donation as existing within wider social structures such as family, education, and work, and the act of donation as involving a complex web of social actors—the donor, the recipient, practitioners.⁶ Thus, our analysis considers motivations and deterrents as existing socially, where decisions are made in relation to other people and communities.

2 | MATERIALS AND METHODS

We conducted a cross-sectional survey of a convenience sample of prospective COVID-19 convalescent plasma donors who had voluntarily registered their interest to donate with Canadian Blood Services. The University of Toronto (Ref#: 40052) and Canadian Blood Services (Ref #: 2020.056) research ethics boards approved this study.

Between 10 April 2020 and 2 February 2021, 4291 people provided their contact information to Canadian Blood Services’ COVID-19 convalescent plasma registry via email to express interest in donating plasma to the CONCOR-1 clinical trial; 2785 registrants consented to be contacted for research purposes. Individuals were eligible to enrol if they were previously confirmed positive for COVID-19 by a laboratory test; were younger than 67 years old (at the time of the study, people over 67 were not eligible to donate apheresis products for their first donation); had fully recovered from the virus; and were symptom free for at least 28 days.

We sent a personalised email to the 2785 consenting prospective donors on 26 April 2021 through the Research Electronic Data Capture (REDCap) platform,^{19,20} a gold standard, secure data management web application for building and managing online surveys and databases hosted at the University of Toronto. REDCap automatically emailed non-responders a reminder at 2 and 4 days after original contact.²¹ The survey closed on 19 May 2021. Prior to proceeding with the survey, participants read the study information letter (see Appendix S1) and acknowledged their consent. The survey recruitment period occurred after the convalescent plasma clinical trials in Canada had ended recruitment, when globally, results of trials indicated that outcomes for those treated with convalescent plasma did not significantly differ from controls treated with the standard of care.²

3 | MEASURES

Six individuals piloted the survey to ensure that the questions were clear. Each took an average of 20 minutes to complete the questionnaire. We asked participants to provide details about their

demographic characteristics including sex, age, sexual orientation, race, education level, and income level as well as their COVID-19 infection details. For the latter, participants were asked if they tested positive for COVID-19 (yes, no, unsure). If they replied ‘no’ or ‘unsure,’ they were asked if they had a close contact with someone who had tested positive for COVID-19. Individuals who reported a close contact with a confirmed positive COVID-19 infection were considered positive for the purposes of the analysis.

Revised motivators and deterrents of donating convalescent plasma scale: We adapted the scale originating in Australia,²² and developed by Masser et al., into a 56-item scale.¹² The original scale was found to have a 12-factor structure, with good internal consistency.¹² To account for differences in national and pandemic context, and to address the primary outcome (i.e., intention to donate plasma in the future), we prioritised the scales measuring motivators and facilitators, and deterrents and barriers to donating convalescent plasma and removed the section ‘Reflections on COVID-19 infection’. To better understand how donation is a social act involving friends, family and other social networks, and how donation is embedded in wider social structures,⁶ we added five items addressing how other social facilitators in a pandemic might influence motivation to donate plasma. Our additional items sought to measure how participants are situated in a social life, focusing on their relationship to work and the time they have for donation,⁹ their proximity and ease of access to the donation centre,^{17,18} their relationship with friends and family who donate and the ‘social capital’ involved in donation,^{7,8} knowledge and familiarity with the donation process,^{23,24} and interest in supporting research through donation.^{5,25} In its final form, the scale contained 42 items measured on a 7-point Likert scale, ranging from strongly disagree¹ to strongly agree.⁷

Intention to donate: Participants were asked, using a 7-point Likert scale (1—strongly disagree to 7—strongly agree), about their intention to donate and frequency of intended donation (once a week to never) for blood products, and separately, plasma, in the future. Participants were also asked if they had successfully completed a convalescent plasma donation.

Open-ended questions: Participants were asked to share what they know about convalescent plasma, how they found out about the clinical trial, and, if relevant, why they were unable to successfully complete a convalescent plasma donation.

4 | STATISTICAL ANALYSES

We summarised the sample using descriptive statistics, including mean and standard deviations for age, and frequency counts and percentages for nominal variables. This part of the analysis was undertaken using SAS (version 9). We analysed the three open-ended questions using inductive coding, refined the preliminary codes into defined categories, then calculated the category frequencies.

The first objective was undertaken using factor analysis. As the dimensionality of the scale had never been determined in its revised form, we conducted an Exploratory Factor Analysis (EFA) in Mplus

(version 7).²⁶ EFA was undertaken in a random split-half of the sample to validate the factor structure identified using Confirmatory Factor Analysis (CFA) in the hold out portion of the sample. A robust maximum likelihood estimator was used and a GEOMIN rotation, an oblique rotator that allows for correlations between factors.²⁶ This appeared to be a reasonable approach given the medium to large-sized correlations found among factors in the Masser et al. study.¹² Parallel analysis and Velicer's MAP test were used to extract the optimal number of factors.²⁷ We assessed model fit using a variety of fit indices including: Root Mean Square of Approximation (RMSEA, <0.06 recommended), Comparative Fit Index (CFI, >0.95 recommended), Tucker-Lewis Index (TLI, >0.95 recommended), and Standardised Root Mean Square residual (SRMR, >0.08 recommended).²⁸ The model Chi Square statistic is reported for completeness but not used to judge model fit due to its sensitivity to sample size.²⁸ Items were candidates for removal if they had a low-loading value (i.e., <0.3) or were cross-loaded (loading on multiple factors with a loading value >0.3). After the optimal number of factors was selected and adequate model fit was observed, the final solution was determined with consideration of theoretical meaningfulness and adequate factor separation. In the hold out portion of the sample, we undertook CFA to confirm the factor structure implied by the EFA. We assessed model fit using the model fit indices described above. Modification indices were requested to identify places where model fit could be improved. Changes to the model were made only if theoretically justified. Missing item level data was accounted for using robust full information maximum likelihood (MLR) for model estimation based on the assumption of Missing At Random (MAR). Most items had 2% missing or less; the maximum missing was 6.5%. Little's MCAR test was significant ($p = 0.012$), supporting the MAR assumption and the use of full information maximum likelihood for handling missing data.

Once we determined and confirmed the factor structure of the scale, we assessed internal consistency for each subscale and the overall scale using Cronbach's alpha coefficient. Composite reliability was additionally assessed based on the standardised factor loadings from the CFA.²⁹ Finally, we presented item and scale level descriptive statistics which included means and variances, and subscale, means, and standard deviation in the overall sample. Individual mean imputation was used to calculate composite scores.

To address the second study objective we used multiple regression, selecting two outcomes: (1) intent to donate plasma as a regular donor going forward, and (2) intent to donate blood products as a regular donor going forward. Predictor variables included the composite scores for the four subscales. We ran the models unadjusted and adjusted for the following covariates: age (<36, 36–55, >55 years), gender (women, men), education level (≤high school, college, university, other), rural, and history of donation in the past year. Model diagnostics revealed that the distribution of the intention to donate variables was not compatible with Ordinary Least Squares regression due to a heavy right skew. Therefore, logistic regression was undertaken using a binary version of the outcome, categorising those scoring above the neutral point of the scale⁴ as intending to donate and those scoring neutral or below as not intending to donate. To address missing data in the

outcome and the predictor variables, Multiple Imputation (MI) was undertaken using the variables described above, plus additional demographic variables that were hypothesized to be related to missingness (i.e., income, sexual orientation, and race). Twenty datasets were imputed. Analyses were undertaken using SAS (version 9.4).

4.1 | Sample size calculations

We calculated minimum sample size to achieve the primary objective of completing an EFA and a separate CFA. The sample size for EFA is best estimated using the average loading on a factor, known as the degree of factor saturation.³⁰ To mirror the Masser et al. study,¹² the analysis required a medium to high factor saturation across subscales (range 0.44–0.88). This suggested a sample size of 150 would suffice.³⁰

For CFA, samples sizes between 150 and 315 participants are adequate assuming the data is normally distributed and the level of missingness is low.²⁶ Using the most conservative estimates, a minimum sample size of 150 participants for the EFA and a separate sample of 300 participants for the CFA, resulted in a combined total sample size of at least 450.

5 | RESULTS

We emailed the survey to a total of 2785 individuals who had expressed interest in donating their convalescent plasma to a clinical trial. In total, 979 participants answered at least one question from the survey (response rate of 35.1%). We removed participants from the final analysis if they did not test positive for COVID-19 (20/979, 2.0%), and therefore would be ineligible for convalescent plasma donation, or had completely missing data on the scale (119/979, 12.2%). This resulted in a final sample of 820.

Table 1 presents the demographic characteristics of the sample. Slightly more participants identified as female (56.8%) than male (43.1%), most were heterosexual (82.9%), and there was a roughly equal spread across all age groups between 26 to 66 years (range 22%–23%), while ages <25 and 67+ represented 10.9% of the participants. Most participants who reported a self-identified race/ethnic group were White (79.2%). Over half of respondents reported having a university degree (55.6%), and another 21.9% had a college degree. For those who reported their family income, 31.3% stated they earn >\$150 000 and 11.5% earned <\$60 000.

Approximately a third (283/820, 34.6%) were current blood donors, indicating that they had donated blood products in the past year; 62.9% of these donations occurred within the previous 3 months of completing the survey. In the past year, most donated whole blood (90.1%), while a few participants donated plasma (12.4%) or platelets (5.7%). Of the participants who were unsure or had not donated blood products in the past year ($n = 537$), 23.1% ($n = 124$) said they tried to donate blood products but were considered ineligible. 95.7% of survey participants had not donated plasma in the past year, indicating that most participants were new or infrequent plasma donors.

TABLE 1 Demographic characteristics of the sample

Demographic characteristic	n (%)
Age (n = 804)	
<25	78 (9.7)
26–35	181 (22.5)
36–45	175 (21.7)
46–55	185 (23.0)
56–66	175 (21.7)
67+	10 (1.2)
Gender (n = 819)	
Male	353 (43.1)
Female	465 (56.8)
Another identity	1 (0.1)
Sexual orientation (n = 797)	
Asexual	60 (7.3)
Bisexual	24 (2.9)
Gay or lesbian	20 (2.4)
Heterosexual/straight	679 (82.9)
Another identity (e.g., pansexual, queer, demisexual)	14 (1.7)
Race/ethnic group (n = 804)	
Asian-East	17 (2.1)
Asian-South	42 (5.5)
Asian-South East	21 (2.6)
Black	8 (0.9)
Latin American	12 (1.5)
First Nations/Metis	11 (1.3)
Middle Eastern	11 (1.3)
White	648 (79.2)
Mixed heritage	22 (2.7)
Another identity	12 (1.5)
Education (n = 812)	
High school degree or less	168 (20.5)
College degree	175 (21.9)
University degree	455 (55.6)
Other	14 (1.7)
Family income (n = 639)	
\$0–29 999	26 (3.3)
\$30 000–59 999	65 (8.2)
\$60 000–89 999	102 (12.9)
\$90 000–119 999	108 (13.6)
\$120 000–149 999	90 (11.4)
\$150 000 or more	248 (31.3)

Most participants (23.1%) found out about the convalescent plasma clinical trial from traditional media (e.g., the news, radio), followed by internet searches (17.4%), being contacted by Canadian Blood Services (16.4%), word of mouth (16.2%), social media (7.4%), their own research motivated by an interest to help (7.0%), and

referral from a healthcare provider (4.6%). When asked, 20.9% of respondents said they did not know much, or anything, about convalescent plasma. Those that discussed convalescent plasma described what it is, what it does, or how it works (40.8%), its potential for use in the treatment of COVID (14.3%), a general sense of its helpfulness (10.4%), its use in research (8.2%), or donation procedures (4.9%).

In total, 231 participants successfully donated convalescent plasma (28%), while 307 attempted to donate but were unsuccessful (37%). When asked, half of those who attempted but were unable to donate said they were ineligible (primarily due to current or past pregnancy, travel history, or insufficient weight 50.1%). The remainder cited the end of the trial (26.0%), a lack of follow up (10.5%), logistical barriers (5.5%), or experiencing adverse events while donating (5.2%).

5.1 | Exploratory factor analysis

We conducted an EFA in a random split half of the sample ($n = 410$). Parallel analysis and Velicer's MAP test indicated a model with four factors (Table 2). The first factor, 'helping relationally', explained 31.8% of the total variance and contained 10 items with factors loadings ranging from 0.86 to 0.25. The second factor, accounting for 11.9% of the total variance, we called 'donation deterrents', contained 16 items with factor loadings ranging from 0.97 to 0.24. The third factor, 'social facilitators', explained 4.9% of the variance and contained 11 items with factor loadings ranging from 0.82 to 0.17. The fourth and final factor, 'access to the donation centre', explained 3.6% of the variance and had five items with factor loadings ranging from 0.78 to 0.34. Model fit for the 4-factor model was adequate, with the RMSEA = 0.058, and SRMR = 0.04, but the CFI/TLI were below recommended cutoffs (CFI = 0.88, TLI = 0.85). There were several items with loadings below 0.3 or that were loaded on multiple factors. Four items were candidates for removal due to low loadings (Item Number: 8, 37, 42, 21). Another five items had problematic cross-loadings (Item Number: 6, 31, 5, 30, 19). To resolve the cross-loadings, we tried a simpler factor structure with 3 factors and a more complex one with five factors, and while both options resolved some cross-loadings, the 3-factor model introduced additional low-loading items and the 5-factor model generated item groupings without discernable themes. It was decided that the four-factor structure was the best model with the low-loading and cross-loaded items removed. The EFA was re-run on the final 33-item scale and the four-factor model was indicated again by parallel analysis and model fit indices were slightly better. Table 2 presents the item loadings and item level statistics for the initial and revised models of the scale.

5.2 | Confirmatory factor analysis

We ran CFA in the hold out portion of the sample ($n = 410$) using the four-factor model of 33 items identified using EFA (Table 3). Initial model fit was borderline, with RMSEA = 0.063, CFI = 0.851, TLI = 0.839 and SRMR = 0.080. The modification indices showed

TABLE 2 Exploratory factor analysis

Item number	N	Item	Survey section	Mean	Variance	Factors							
						Initial model			Revised model				
						Helping relationally	Donation deterrents	Social facilitators	Access to the donation centre	Helping relationally	Donation deterrents	Social facilitators	Access to the donation centre
2	815	Through donating convalescent plasma, I could help others.	MF	6.47	1.25	0.858	-0.039	-0.104	-0.001	0.886	-0.024	-0.1	0.029
7	815	I like to help others, and donating convalescent plasma is just one way I could help.	MF	6.14	1.49	0.822	-0.103	0.001	0.111	0.806	-0.076	0.033	0.054
1	816	I was in a unique position to help by donating convalescent plasma where other people could not.	MF	6.20	1.72	0.734	0.023	0.067	0.01	0.737	-0.011	-0.073	0.009
10	817	Donating convalescent plasma could help research into COVID-19 treatments.	MF	6.23	1.38	0.72	-0.099	-0.035	-0.084	0.739	-0.099	-0.021	-0.054
4	816	Donating convalescent plasma would make me feel proud.	MF	5.71	2.11	0.658	0.018	0.208	-0.084	0.647	0.052	0.19	-0.161
11	812	Donating convalescent plasma could potentially help my family and friends if they became ill.	MF	5.67	2.26	0.571	0.013	0.195	-0.064	0.582	0.004	0.202	-0.07
12	814	Donating convalescent plasma was the morally right thing to do.	MF	5.63	2.09	0.51	-0.101	0.252	-0.017	0.531	-0.067	0.271	-0.001
6	813	Donating convalescent plasma is a story I could tell others about.	MF	4.63	2.95	0.446	0.042	0.382	0.064	-	-	-	-
8	818	There are very few people who could help through donating convalescent plasma.	MF	4.48	2.98	0.258	0.038	0.138	0.07	-	-	-	-
37	768	I was confident that I could complete convalescent plasma donation successfully.	AB	6.18	1.68	0.249	0.18	0.058	0.085	-	-	-	-
29	785	I worried that donating convalescent plasma would mean I lost valuable antibodies that I still needed.	DB	1.53	1.50	0.094	0.972	-0.049	0.066	0.088	0.957	-0.059	-0.04
35	784	I worried I would become ill again if I donated convalescent plasma.	DB	1.40	1.12	-0.025	0.939	0.002	-0.091	-0.027	0.923	0.001	-0.061
34	786	If I donated convalescent plasma again, it would set my recovery back.	DB	1.43	1.14	-0.04	0.905	-0.002	-0.067	-0.042	0.895	-0.003	-0.047

TABLE 2 (Continued)

Item number	N	Item	Survey section	Mean	Variance	Factors							
						Initial model			Revised model				
						Helping relationally	Donation deterrents	Social facilitators	Access to the donation centre	Helping relationally	Donation deterrents	Social facilitators	Access to the donation centre
27	781	I would have felt like a guinea pig if I donated convalescent plasma.	DB	1.39	1.10	-0.037	0.861	-0.001	-0.025	-0.056	0.861	-0.006	-0.006
36	782	I worried that I might inadvertently infect others with COVID-19 through donating.	DB	1.38	1.11	-0.003	0.82	0.068	0.007	-0.009	0.815	0.069	0.013
28	784	My friends and family would not have wanted me to donate convalescent plasma.	DB	1.46	1.35	-0.004	0.816	-0.006	0.023	-0.015	0.792	-0.004	0.013
33	780	I needed more time to recover from COVID-19 before I could donate.	DB	1.50	1.41	-0.074	0.792	-0.052	0.041	-0.085	0.787	-0.052	0.035
22	785	I was worried about getting re-infected if I donated convalescent plasma.	DB	1.53	1.63	0.033	0.784	-0.011	0.034	0.026	0.787	-0.015	0.03
40	766	Donating convalescent plasma took too much of a toll on my body.	AB	1.70	1.50	0.062	0.644	0.06	0.087	0.087	0.641	0.047	0.175
31	784	Logistically, it was just too difficult for me to donate convalescent plasma because of caregiving responsibilities.	DB	1.45	1.30	0.058	0.63	0.005	0.308	-	-	-	-
23	781	I did not really feel well enough to donate convalescent plasma.	DB	1.61	1.62	-0.131	0.618	0.054	-0.081	-0.144	0.648	0.051	-0.006
32	783	Others who were fitter than me could donate convalescent plasma.	DB	1.77	2.07	0.016	0.605	0.062	0.101	0.005	0.61	0.049	0.095
26	784	I did not think that convalescent plasma would be an effective therapy for COVID-19.	DB	1.77	1.74	-0.095	0.57	-0.057	0.118	-0.119	0.585	-0.065	0.062
25	784	I did not want to be around other people in the donor centre.	DB	1.75	1.96	-0.115	0.532	0.102	0.127	-0.124	0.551	0.098	0.101
38	768	I have been asked to donate convalescent plasma too often.	AB	1.84	1.90	0.021	0.403	0.136	0.079	0.039	0.394	0.123	0.177
42	769	I would have liked to know if I had anti-bodies before I made the donation.	AB	3.96	5.14	0.138	0.243	0.08	0.075	-	-	-	-

(Continues)

TABLE 2 (Continued)

Item number	N	Item	Survey section	Mean	Variance	Factors							
						Initial model			Revised model				
						Helping relationally	Donation deterrents	Social facilitators	Access to the donation centre	Helping relationally	Donation deterrents	Social facilitators	Access to the donation centre
15	811	Donating convalescent plasma could help me get back some sense of control over my life.	SM	2.98	3.03	-0.119	-0.086	0.819	0.025	-0.108	-0.05	0.823	0.028
16	813	Donating convalescent plasma would be a way to repay being saved.	MF	3.31	3.54	0.054	0.027	0.732	-0.028	0.064	0.015	0.737	-0.059
13	816	I have felt a little 'down' since recovery and donating convalescent plasma was something I could do to pull myself back up.	MF	3.17	3.28	-0.037	0.02	0.726	0.003	-0.025	0.016	0.722	0.004
17	801	Donating convalescent plasma was a way for me to get out of the house and see other people.	SM	2.47	2.71	-0.044	0.1	0.543	0.042	-0.048	0.133	0.505	0.02
14	815	Donating convalescent plasma was part of my civic duty.	MF	4.35	3.46	0.231	-0.139	0.538	0.098	0.25	-0.097	0.552	0.086
5	815	Donating convalescent plasma would make others feel more positively about me.	MF	4.11	2.55	0.322	0.112	0.506	0.036	-	-	-	-
9	817	I would have felt guilty if I did not sign up to donate convalescent plasma.	MF	3.56	3.38	0.232	0.045	0.488	-0.023	0.252	0.094	0.476	-0.002
20	800	Friends/family/people around me were encouraging me to donate.	SM	2.80	3.16	-0.051	0.068	0.482	-0.014	-0.043	0.097	0.445	-0.022
3	814	If convalescent plasma were available when I had COVID-19, then it could have helped me.	MF	3.83	3.44	0.111	0.065	0.315	-0.091	0.114	0.064	0.317	-0.072
18	802	I was not working or in school, so I had time to donate convalescent plasma.	SM	2.47	3.64	-0.186	0.085	0.301	-0.006	-0.172	0.105	0.286	-0.003
21	799	I'm a regular donor already so it made sense for me to donate convalescent plasma	SM	3.22	4.92	0.064	0.081	0.165	0.032	-	-	-	-

TABLE 2 (Continued)

Item number	Item	Survey section	Mean	Variance	Factors							
					Initial model				Revised model			
					Helping relationally	Donation deterrents	Social facilitators	Access to the donation centre	Helping relationally	Donation deterrents	Social facilitators	Access to the donation centre
41	769 It was difficult for me to get to a centre to donate convalescent plasma.	AB	1.99	2.43	-0.012	0.049	-0.012	0.779	-0.012	0.011	-0.003	0.96
24	783 I did not want to travel to the donor centre to donate convalescent plasma.	DB	1.83	2.23	-0.139	0.249	-0.007	0.664	-0.201	0.301	-0.007	0.516
30	782 Logistically, it was just too difficult for me to donate convalescent plasma because of transportation challenges	DB	1.60	1.80	0.035	0.413	0.021	0.632	-	-	-	-
39	770 It was not easy for me to donate convalescent plasma given my other commitments.	AB	2.29	2.80	0.058	0.279	0.025	0.411	0.029	0.266	0.012	0.468
19	800 The donor centre was very close to me, so it was easy for me to donate	SM	3.07	3.31	0.128	0.126	0.32	0.343	-	-	-	-

Note: Initial Model fit indices: Chi-square test of model fit 1748.853 ($p < 0.001$); RMSEA = 0.058, CFI = 0.878, TLI = 0.850, SRMR = 0.038. Revised Model fit indices: Chi-Square test of model fit 919.662 ($p < 0.001$); RMSEA = 0.056, CFI = 0.918, TLI = 0.892, SRMR = 0.033. Abbreviations: DB, deterrents and barriers to donating; AB, ability to donate convalescent plasma; SM, social motivations for donating; MF, motivators to, and facilitators of, donating convalescent plasma. Bolding indicates the items loading on to each factor.

TABLE 3 Standardised factor loadings derived from confirmatory factor analysis

Item number	Item	Loadings	
		Estimate	Standard error
<i>Factor 1: Helping relationally</i>			
7	I like to help others, and donating convalescent plasma is just one way I could help.	0.801	0.038
11	Donating convalescent plasma could potentially help my family and friends if they became ill.	0.631	0.041
10	Donating convalescent plasma could help research into COVID-19 treatments.	0.805	0.038
4	Donating convalescent plasma would make me feel proud.	0.585	0.046
2	Through donating convalescent plasma, I could help others. (a)	0.819	0.045
12	Donating convalescent plasma was the morally right thing to do. (d)	0.483	0.063
1	I was in a unique position to help by donating convalescent plasma where other people could not. (a)	0.638	0.061
<i>Factor 2: Donation deterrents</i>			
8	I worried that donating convalescent plasma would mean I lost valuable antibodies that I still needed.	0.785	0.048
14	I worried I would become ill again if I donated convalescent plasma. (b)	0.879	0.037
13	If I donated convalescent plasma again, it would set my recovery back. (b)	0.852	0.045
6	I would have felt like a guinea pig if I donated convalescent plasma.	0.752	0.07
15	I worried that I might inadvertently infect others with COVID-19 through donating.	0.842	0.05
7	My friends and family would not have wanted me to donate convalescent plasma.	0.698	0.072
12	I needed more time to recover from COVID-19 before I could donate.	0.813	0.042
1	I was worried about getting re-infected if I donated convalescent plasma.	0.739	0.055
40	Donating convalescent plasma took too much of a toll on my body.	0.695	0.048
2	I did not really feel well enough to donate convalescent plasma.	0.79	0.037
11	Others who were fitter than me could donate convalescent plasma.	0.635	0.054
5	I did not think that convalescent plasma would be an effective therapy for COVID-19.	0.617	0.056
4	I did not want to be around other people in the donor centre. (c)	0.641	0.05
38	I have been asked to donate convalescent plasma too often.	0.537	0.064
<i>Factor 3: Social facilitators</i>			
15	Donating convalescent plasma could help me get back some sense of control over my life.	0.839	0.031
16	Donating convalescent plasma would be a way to repay being saved.	0.729	0.037
13	I have felt a little 'down' since recovery and donating convalescent plasma was something I could do to pull myself back up.	0.673	0.039
17	Donating convalescent plasma was a way for me to get out of the house and see other people.	0.507	0.051
14	Donating convalescent plasma was part of my civic duty. (d)	0.423	0.058
20	Friends/family/people around me were encouraging me to donate.	0.341	0.057
3	If convalescent plasma were available when I had COVID-19, then it could have helped me.	0.335	0.053
9	I would have felt guilty if I did not sign up to donate convalescent plasma.	0.406	0.055
18	I was not working or in school, so I had time to donate convalescent plasma.	0.235	0.058
<i>Factor 4: Access to the donation centre</i>			
41	It was difficult for me to get to a centre to donate convalescent plasma.	0.773	0.05
39	It was not easy for me to donate convalescent plasma given my other commitments.	0.605	0.062
3	I did not want to travel to the donor centre to donate convalescent plasma. (c)	0.808	0.04

Note: Items with matching letters were modelled to have correlated residual variances. Model fit: Chi-Square Test of model fit: 1090.267 ($p < 0.001$); RMSEA = 0.055; CFI = 0.889, TLI = 0.878, SRMR = 0.077.

TABLE 4 Intent to donate convalescent plasma and blood products models

Effect	Intent to donate convalescent plasma						Intent to donate blood products							
	Model 1			Model 2			Model 1			Model 2				
	Odds ratio	95% Confidence limits	p Value	Odds ratio	95% Confidence limits	p Value	Odds ratio	95% Confidence limits	p Value	Odds ratio	95% Confidence limits	p Value		
Helping relationally	1.03	1.01	1.06	1.03	1.00	0.0627	1.05	1.02	1.09	0.0004	1.05	1.01	1.08	0.0042
Donation deterrents	0.98	0.96	1.00	0.98	0.96	0.0074	0.98	0.96	1.00	0.0389	0.98	0.96	1.00	0.019
Social facilitators	1.01	0.99	1.03	1.01	0.99	0.2772	1.01	0.99	1.03	0.3844	1.01	0.99	1.03	0.3803
Access to donation centre	1.00	0.95	1.05	1.00	0.95	0.9875	1.01	0.95	1.06	0.82	1.01	0.96	1.07	0.6896
Age 18–35 (vs. age 36–55)				1.17	0.81	0.3912					1.42	0.93	2.17	0.1078
Age > 55 (vs. age 36–55)				0.72	0.48	0.1093					0.71	0.46	1.11	0.1343
Woman (vs. man)				1.09	0.79	0.5806					1.13	0.78	1.62	0.5179
High school or less (vs. university)				1.15	0.54	0.7176					1.46	0.64	3.32	0.3679
College (vs. university)				1.16	0.78	0.4694					1.02	0.66	1.60	0.9148
other (vs. university)				0.79	0.52	0.254					1.14	0.69	1.90	0.611
Rural (vs. urban)				0.91	0.48	0.7758					1.00	0.50	2.01	0.9998
Donated in the past year				1.88	1.36	0.0001					4.72	2.92	7.65	<0.0001

that correlating the residual variances of several pairs of items would improve model fit. The three pairs of items with high modification index values were sequentially placed in the survey and spoke to a similar concept (e.g., 'I worried I would become ill again if I donated convalescent plasma' and 'If I donated convalescent plasma again, it would set my recovery back'); thus, modelling a correlation between the residual errors seemed reasonable. A fourth pair of items was not sequential, but similarly worded, speaking to types of duty (e.g., 'Donating convalescent plasma was the morally right thing to do' and 'Donating convalescent plasma was part of my civic duty'). We reasoned those concepts of moral and civic duty may have been understood similarly for many participants and that modelling a correlation between residual variances was justified. After adding the correlations, model fit was deemed adequate with two out of the four indices meeting recommended cutoffs (RMSEA = 0.055, CFI = 0.89, TLI = 0.88 and SRMR = 0.077). According to Kenny, if the RMSEA for the null model is <0.158, incremental fit indices (i.e., CFI/TLI) are not informative because of a mathematical fact that the null version of a model with an RMSEA of 0.05 and TLI of 0.90 must have had a RMSEA of 0.158.³¹ As the null model had an RMSEA of exactly 0.158, very little improvement in the CFI/TLI would be possible. With this knowledge, we opted to avoid adding more ad hoc correlated errors and accepted the model with no further changes (Table 3).

5.3 | Internal consistency

Cronbach's alpha indicated good internal consistency for the overall scale ($\alpha = 0.84$) and each subscale (helping $\alpha = 0.88$; donation deterrents $\alpha = 0.95$; social facilitators $\alpha = 0.78$; access $\alpha = 0.78$). Similar results were found when calculating composite reliability, although the coefficient for the overall scale was higher ($\Sigma = 0.96$) and each subscale was slightly lower (helping $\Sigma = 0.86$; donation deterrents $\Sigma = 0.94$; social facilitators $\Sigma = 0.76$; access $\Sigma = 0.78$).

5.4 | Scale descriptives

The highest average item scores were found for the helping relationally subscale; scores for the donation deterrents subscale were lowest, and scores for the other social facilitators subscale were closest to neutral. The mean total scores for the subscales based on the 33-item scale were as follows: helping = 41.8 (SD = 7.1), donation deterrents = 21.9 (SD = 13.0), other social facilitators = 28.6 (SD = 9.9) and access = 6.0 (3.9).

5.5 | Prediction of intent to donate

Approximately two-thirds of study participants (67.0%) agreed with the statement that they would consider donating *plasma* as a regular donor going forward ($n = 501$), with mean score of 5.4 (SD = 1.7) out of 7. This proportion was slightly higher for participants agreeing with

the statement that they would consider donating *blood products* as a regular donor going forward ($n = 630$, 77.0%), with a mean score of 5.7 (SD = 1.6) out of 7.

Intention to donate plasma was associated with higher scores on the helping relationally scale (Odds Ratio [OR] = 1.03; 95% CI = 1.01–1.06), and lower scores on the donation deterrents scale (OR = 0.98, 95% CI = 0.96–1). Neither of the social facilitators or access subscales were found to be independently associated with intent to donate convalescent plasma. A similar pattern of results was found when using intent to donate blood products as the outcome (Table 4). When adjusting for covariates, the deterrents scale remained significantly associated with intent to donate both convalescent plasma and blood products; however, helping relationally only remained a significant predictor of intent to donate blood products.

6 | DISCUSSION

With less than 5% of survey registrants being current plasma donors, the context of the pandemic and the clinical trial presented an opportunity for these registrants to become plasma donors. Understanding the motivations, deterrents, and intentions to donate from this group could provide insight into how to recruit future source plasma donors.

Our analysis revealed that motivators and deterrents of donating convalescent plasma could be grouped to represent four factors: 'helping relationally', 'deterrents to donation', 'social facilitators', and 'access to the donation centre'. Furthermore, some factors predicted intention to donate plasma in the future, while others did not. Importantly, 'helping relationally' was found to be a significant motivator of intention to donate plasma again. This subscale contained items relating to wanting to donate to help people who are ill with COVID-19 and to help their family and friends, indicating that helping is meaningful in relation to people they know, and to people who are ill. The motivation to help also extended to supporting a broader research community devoted to finding treatments. Furthermore, helping because it is morally right, or to feel proud, suggests that helping via donation makes the participant feel good about themselves. These reasons, that help is about relationships with others and about feeling positive about oneself, support the view that altruism is constructed relationally. Our analysis supports previous literature suggesting that donation is a social exchange,^{8,13–16} particularly in a pandemic context where a person's family, friends and community could benefit from a treatment for COVID-19. In this study, helping was about a contribution to the community, which produced a sense that the donor was doing the right thing and generating a sense of pride.

These findings suggest that donating plasma can be more than a unidirectional act of giving, but also a critical contribution to one's community in a time of crisis. Blood collection was one of the few permitted activities during lockdowns, with proper safety precautions in place.³² Our findings suggest that in a context where there are many restrictions on peoples' ability to offer help, donating convalescent plasma was one way they felt they could do their part. Furthermore, giving was connected to an interest in helping family members



that could become ill and benefit from treatment—a bidirectional relationship that signals the importance of community and social networks.⁸ The act of supporting research on COVID-19 treatments also suggests an interest in contributing to finding a solution that could impact the whole community, indicating a level of reciprocity.²⁵ Our findings about helping others relationally are relevant in the sourcing of plasma to produce plasma protein products, such as immune globulin. While the clinical trial for convalescent plasma has closed, potential donors could be made aware of other lifesaving treatments produced with plasma protein products, and the impacts of those treatments for people in their communities.

Our findings concur with Masser and colleagues,¹² in that motivations were countered by fears about donating and the donation process, collectively understood as donation deterrents. The deterrents we measured indicated that participants were hesitant to donate during a pandemic and concerned about risks to their own health. Participants worried that they could become reinfected, or that donating convalescent plasma would set their recovery back. There was also a relational component to these concerns, as they involved the possibility of infecting others with COVID-19 through donation, or that others who are physically fitter were better candidates for donation. These findings resonate with the literature on donating convalescent plasma in the context of an epidemic,^{33–35} suggesting that clinical trial perspectives are influenced by the contexts surrounding the relevant virus, and deserve further exploration.

‘Access to the donation centre’ did not predict intention to donate. While this could indicate that prospective donors were motivated to help others in a time of crisis despite any barriers to access, it may be more indicative of a study sample that did not face significant issues around travel or competing commitments. Most survey respondents reported high socio-economic status, including university-level education and high-income levels, and were predominantly white and heterosexual. As a convenience sample who volunteered to donate convalescent plasma and participate in research, the sample may represent those most able to engage with Canadian Blood Services. Further research should examine whether access to donation centres is significant for source plasma donors who are asked to consider donating on an ongoing basis.

Furthermore, the items termed ‘social facilitators in a pandemic’ did not predict intention to donate. Many of these motivations were specific to the COVID-19 context, such as getting back a sense of control, repaying being saved, getting out of the house, and feeling better after recovering from COVID-19. Since the nature of the COVID-19 context and ‘crisis’ differed across waves of infection, these items may not have fully captured all relevant social factors and contextual features across the entire pandemic period. Thus, these social facilitators to donation are likely highly context-specific, and it is understandable that they would not predict an interest in continuing donation outside of the specific crisis context.

Despite common rhetoric during the pandemic that ‘we are all in this together,’ we now understand that experiences of the pandemic and its impacts were highly stratified depending on social location, which has differentially affected working conditions and employment,

caregiving responsibilities, housing, and health. Thus, further research is required to investigate the nature of motivators and deterrents, including issues of access related to distance, travel, cost, and competing commitments, across a more diverse sample and across various social locations.

This research contribution should be considered in light of the following limitations. To gather data in a timely way, we employed a convenience sampling method and had a low-response rate (35.1%). However, the analysis was adequately powered, and the results reflect the motivations and deterrents of those most motivated to engage with Canadian Blood Services and related activities, which is a meaningful sample even if compromised by selection bias. The study was also likely limited by recall bias, given that participants were asked to reflect on motivations and deterrents at the time that they signed up to the registry, which could have been up to 3 months to 1 year prior to survey administration. While the factor structure was validated internally using the random split sample approach, external validation of the scale will be needed to provide more robust evidence regarding dimensionality. Several items were found to cross-load and others had very low-loading values. It is possible that selecting a model with more factors would have resulted in less items being removed. However, as this was not a replication study, and given the important contextual differences, we sought to develop an instrument that could account for important aspects of the pandemic context, including social factors, to predict intentions to donate plasma going forward. Thus, we decided to select a model with high interpretability, rather than preserving all the original items. While the added social facilitator items when treated as a composite scale did not predict intent to donate, future research should try to determine whether these facilitators interact with measures of social position to produce more or less intention in different social groups. Finally, this clinical trial and the global pandemic were unprecedented and required a quick response from researchers wanting to measure its effects. Thus, we did not test the added items for face validity but relied on the scholarly literature in this area and theory on donation studies.

We investigated motivations and deterrents to donating convalescent plasma to better understand this unique donor population and determine if their motivations and deterrents were possible predictors of future intention to donate plasma outside of the context of a clinical trial. We applied a sociological lens to our analysis to consider how motivations and deterrents are situated in the social context, and how social relations inform motivations and deterrents. Participants in this study appeared to be motivated by an interest in helping others because they wanted to be a part of the solution to the pandemic, and they were in a unique position to help. Beyond the crisis context, these results suggest that blood service operators seeking to recruit source plasma donors should emphasise its lifesaving potential, particularly for people living with conditions for which plasma-derived medicines are indicated, its impact on their community, and the feeling of pride that one can gain from donation. Furthermore, in the context of a pandemic, blood services can mitigate deterrents by emphasising the extensive safety precautions that have been put in place at all blood donation centres across jurisdictions.

AUTHOR CONTRIBUTIONS

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The full anonymous data set is available from the authors upon rea- sonable request.

ETHICS STATEMENT

This study was approved by the University of Toronto (Ref#: 40052) and the Canadian Blood Services (Ref #: 2020.056).

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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