





RESEARCH ARTICLE

Analysis of responses of the health care workers recovered from COVID-19 on convalescent plasma donation by apheresis: A single-center survey study

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Abstract

Background: The COVID-19 convalescent plasma (CCP) has been tried as a therapy in moderate COVID-19 pneumonia. Donation of CCP requires motivation from recovered patients. This study evaluated the response of such recovered health care workers (HCWs) when they were motivated for CCP donation.

Methods: An interview-based survey was carried out with recovered HCWs as study participants between August 2020 and November 2020. A qualified social worker explained the details of CCP donation over a mobile call; he clarified all their doubts and motivated them for the plasma donation. Their responses were recorded as “interested” or “not interested” followed by analysis.

Results: We tried to call 624 recovered HCWs, but could not reach 213, and the final group available for the study was 411 participants. Of these 411, 186 were deferred. Finally, we analyzed a total of 225 responses. Eventually, 105 out of 225 HCWs (47%) were interested; there were no significant differences in responses among males and females and between different age groups ($<.001$) and the “doctors” designation category ($P = .01$) had a maximum number of “interested” responses. In multivariate logistic regression, only the “interested” responses of the doctors were significantly higher after adjusting the confounding effect of the “graduate and above” educational qualification category.

Conclusion: This study found that nearly half of the eligible HCWs were interested in CCP donation. The educational qualification and designation among the recovered HCWs had an impact on CCP donation interest. The doctors were more interested in CCP donation compared to others.

KEYWORDS

donor motivation, educational status, health personnel, physicians

1 | INTRODUCTION

Convalescent plasma (CP) had been used in the past on a smaller scale to treat various infections, including SARS-CoV-1, MERS-CoV, influenza, and Argentine

hemorrhagic fever.¹⁻³ The antibodies present in the CP mediate their therapeutic effect either by neutralizing the infectivity of the virus directly or by other antibody-mediated pathways, such as complement activation, antibody-dependent cellular cytotoxicity, and

phagocytosis. Non-neutralizing antibodies contribute to prophylaxis and may enhance recovery.⁴ In SARS-CoV-2 infection, COVID-19 convalescent plasma (CCP) transfers passive immune antibodies, may confer immediate immunity to susceptible individuals by identical mechanisms, and reduce target organ damage. Initial studies have shown promising outcomes in patients with moderate to severe COVID-19, and hence CCP has been deployed on a massive scale globally.^{5,6}

There are limited treatment options available for COVID-19, CCP is one of them. The accessibility and availability of the CCP to the patients are challenging and need to be addressed. For an effective CCP collection program, numerous challenges faced by transfusion services include support from regulators, donor center logistics, staff management, availability of recovered donors, recruitment of CCP donors, and well-equipped blood transfusion facilities.⁷ CCP is collected through plasmapheresis in most developed countries and in some developing countries; however, cost constrain and lack of technical expertise in lower- and middle-income countries allowed them to collect whole blood-derived CCP as an alternative but had the disadvantage of more miniature volume collection in a single sitting and the increased interval between each sitting.⁸ Measurement of neutralizing antibody titer among the donors is similarly difficult in resource poor countries. Lateral flow test, ELISA, and chemiluminescence-based measurement of IgG antibody against SARS-CoV-2 are available to test and quantify the antibody level against spike protein or nucleocapsid antigen of SARS-CoV-2.^{9,10}

Selection criteria of candidates for CCP donation are somehow different from normal plasma donor. A past positive nasopharyngeal swab RT-PCR report is mandatory while time to collect CCP is 28 days following resolution of symptoms or at least 14 days following resolution of symptoms along with two consecutive negative RT-PCR reports 24 hours apart.¹¹ CCP donors have to meet this additional eligibility requirement along with the eligibility requirements for the whole blood donation. The routine microbiological screening test of the donor has to be negative as per the local regulation, similar to whole blood donation. Pregnancies in the past is another issue in female CCP donors needed to be ruled out before collection to prevent transfusion related acute lung injury in the recipient.

Motivating recovered donors for CCP donation is difficult as similar ignorance of blood donation and anxiety factors prevail; for example, fear of the needle, fear of feeling low, and others. Therefore, it is a similar challenge for blood centers in a developing country due to various social factors involving the donation of blood or blood components. Even in the developed world, the

recruitment and retention of sufficient numbers of willing and eligible CCP donors have been proved challenging.¹² Deterrents of CCP donation like fear of health and weakness and family pressure to not donate are the foremost reasons in Indian scenario.¹³ Earlier studies discussed various motivating factors and barriers to donation for CCP donation in recovered donors of the general population.^{12,13} In this study, we assessed and analyzed the responses of recovered health care workers (HCWs) of our Institute when asked to donate CCP by apheresis procedure. The current pandemic has witnessed how the HCWs are working as front-line warriors to save countless lives in every possible way. This study has tried to evaluate the altruistic behavior and attitude toward CCP donation well above their noble service.

2 | MATERIALS AND METHODS

This study was a retrospective observational interview-based survey carried in the Department of Transfusion Medicine after getting approval from the Institutional Ethics Committee with the Reference number: T/IM-NF/Trans.Med/20/172. The study period was 4 months, that is, from August 2020 to November 2020. The study participants were HCWs who came positive for SARS-CoV-2 by RT-PCR. These HCWs were tested because they either had symptoms of COVID 19 or had come in close contact with SARS-CoV-2 RT-PCR positive cases. The list of patients positive for SARS-CoV-2(RT-PCR) who attended our Institute was collected from the SARS-CoV-2 Screening area managed by the Department of Community and Family Medicine (CMFM). The list contains the details of patients like age, gender, contact number, address, sign and symptoms, and whether they are HCWs of our Institute or not. We excluded the patients of age <18 years, age >60 years, HCWs of other hospitals, and the diseased. We prepared a separate list containing the HCWs of our Institute.

We included the HCWs who came in direct contact with the patients like doctors, nursing officers, technicians, ward attendants, and others who had a supportive role in managing the hospital like electricians, mechanics, plumbers, security personnel, and so on. For the study purpose, age-wise, all the staff were divided into two groups, one having age less than 30 years and other more than equals to 30 years. They were further categorized both as per designation and educational qualification. Designation categories were as category 1 that included the ward attendants and supportive staff; category 2 included students of M.B.B.S., B.Sc. Nursing, M.Sc. Nursing and B.Sc. Medical Laboratory Technology (BSc.

MLT); category 3 included the paramedical staff like the nursing officer, laboratory technician, OT technicians, and trainee technicians; category 4 included the doctors: interns, junior residents, senior residents, and faculty. The educational qualifications categories were 1. Graduate and above, 2. Intermediate and under-graduate, and 3. Under-metric (up to 10th grade).¹⁴

A dedicated Medical Social Service Officer was given the training to counsel recovered patients of COVID-19 for CCP donation. He was a Master of Social Work and had experience in motivating and guiding for blood

donation. Details of CCP like donor screening, eligibility criteria, collection procedure, and adverse reaction to the donors were explained to him before starting the interview of recovered donors. He tried to contact all the recovered HCWs, those who responded were interviewed. Further, we elucidated the CCP collection process, clarified their doubts, and motivated them for plasma donation. Their responses were noted after confirming their eligibility. We called only the interested HCWs for screening and CCP donation to our department. For those who were not interested, the reason for

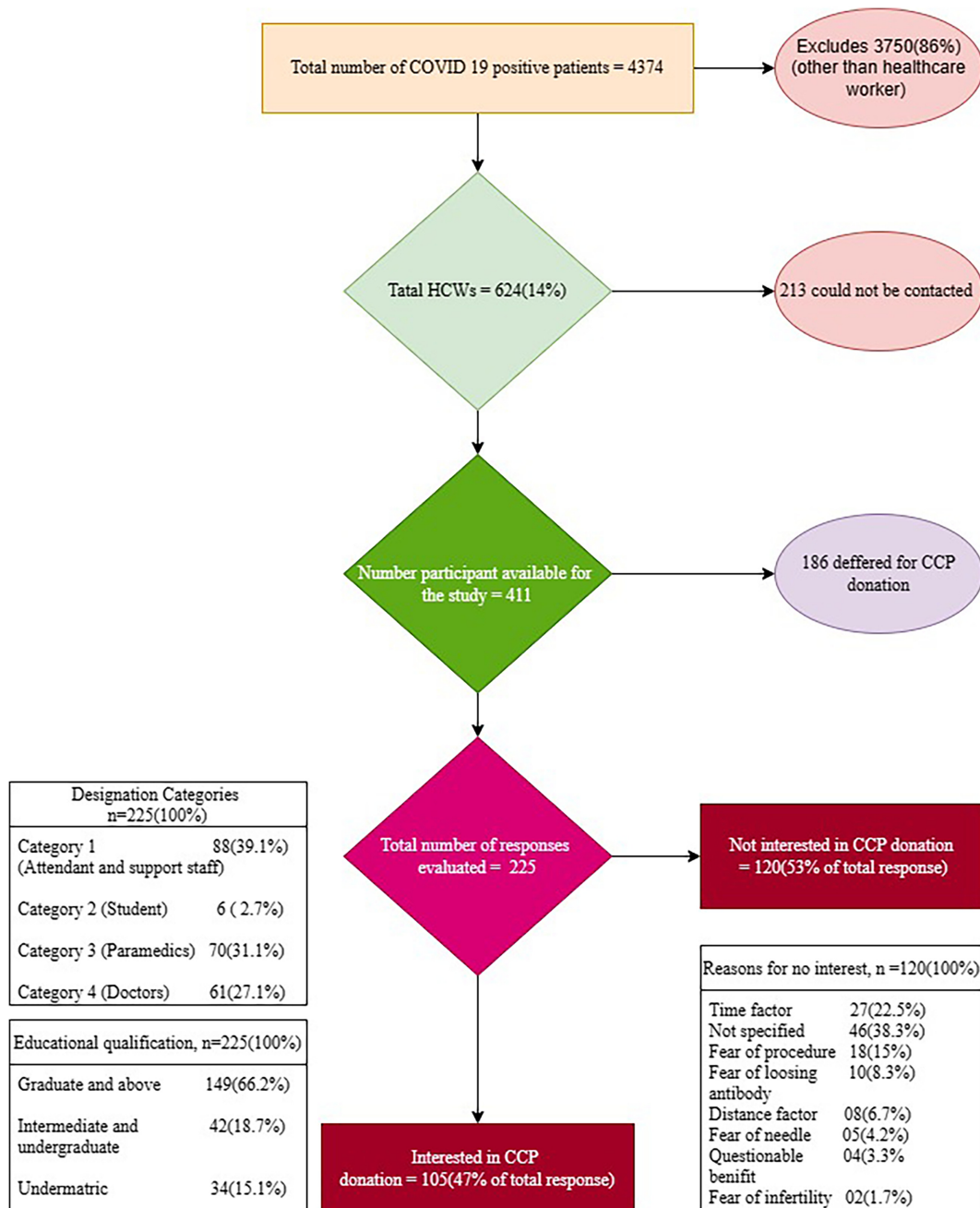


FIGURE 1 Flow diagram of COVID-19 recovered Health Care Workers' response for COVID-19 convalescent plasma donation

unwillingness was recorded. We performed an internal validity of the study by comparing the variables of the study participants between respondents vs those who could not be contacted.

2.1 | Statistical analysis

Detailed data of recovered HCWs like demography, eligibility, and response, that is, whether interested or not interested, were entered in the Excel Sheet of MS Office 2016. The “R” software version 4.1.0 was used for data analysis. Fisher’s Exact Test for Count Data was used to test the significance of age and sex for CP donation. Univariate analysis for designation and qualification was carried using the “prop.test.” The “4-sample test for equality of proportions without continuity correction” was used to analyze the relation of designation categories with “interested” response for CCP donation. The “3-sample test for equality of proportions without continuity correction” was used for qualification. Multivariate logistic regression (MLR) was carried out to exclude any confounder in the univariate model. The “ggplot 2” package of the software was used to draw the graphical representation of the data. For internal validity, chi-square test was used for study variables to check for the difference between respondents vs those who could not be contacted.

3 | RESULTS

Till October 13, 2020, a total of 4374 patients including HCWs were RT-PCR positive for SARS-CoV-2. The Department of Community Medicine and Family Medicine provided the RT-PCR positive list, and of which 624 were HCWs of our Institute. We tried to call all 624 persons, but could not reach 213 due to various reasons like the call went unanswered, the wrong number given and “out of network” coverage area even after repeated calling at an interval of 7 days. The final group available for the study was 411 persons. The ineligible recovered donors were 186 due to various reasons, including deferral causes for exclusive plasma donation as well as whole blood donation. So, the total responses of 225 eligible HCWs were selected for analysis. Out of them, the majority were male (84%) HCWs. Designation-wise, category 1 had the maximum number of eligible CCP donors ($n = 88$, 39.1%) followed by category 3 ($n = 70$, 31.1%). Qualification wise “Graduates and above” (149) category had the maximum number of eligible recovered donors, followed by the “undergraduate and intermediate” category (42) (Figures 1 and 2).

When we carried out the internal validity test between respondents vs those who could not be contacted, the difference was significant for age, ($P < .000$) and sex ($P < .000$) whereas it was not significant for designation and educational qualification (Table 1).

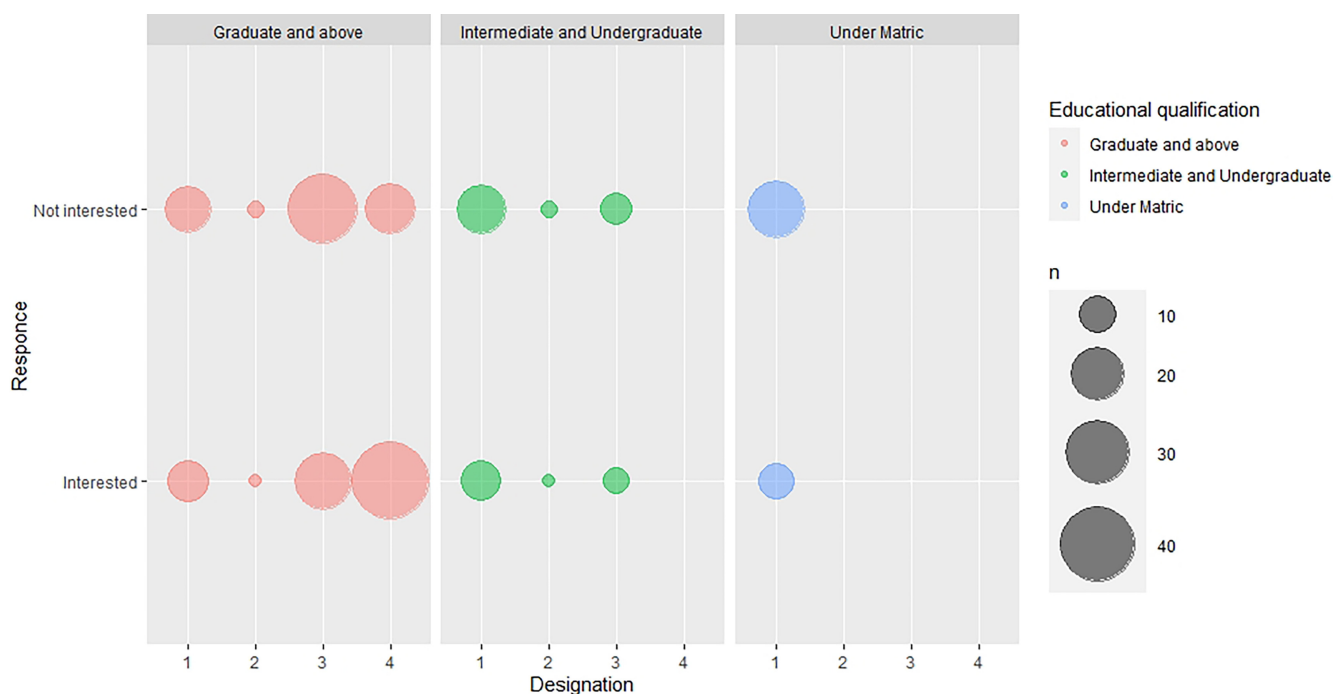


FIGURE 2 Comparison of responses of COVID-19 recovered Health Care Workers for COVID-19 convalescent plasma donation in relation to designation and educational qualification

3.1 | Univariate analysis and MLR

“Fisher’s Exact Test for Count Data” for both age groups and sex distribution showed no significant difference in “willing” and “non-willing” response for CCP donation between different age group and sex distribution. “4-sample test for equality of proportions without continuity correction” for different educational qualification categories showed the “graduate and above” had a significantly higher number of “interested” or “willing” responses for CCP donation compared to others. Correspondingly, category 4 that is, the “doctors” had a significantly higher number of “interested” or “willing” responses among the designation categories (Table 2). The designation category 4 (Doctors) and qualification category “graduate and above” were confounders as all the doctors were graduates. Therefore, MLR was carried out to exclude this confounder effect. The regression

analysis showed more number of “interested” or “willing” response for CCP donation was only associated with designation category 4 that is, Doctors, and not the qualification category “graduate and above” (Table 3).

3.2 | Causes of unwillingness

Among the “not interested” HCWs, 38.3% did not have specified reasons or gave non-specific reasons like weakness, muscle cramps, not feeling well, while 22.5% felt CCP donation by apheresis was time-consuming (Figure 1). The other causes for unwillingness included were fear of apheresis procedure, fear of losing neutralizing SARS-CoV-2 antibodies, and fear of needle piercing. Eight (6.7%) of them had given reason that they were not interested because they had been shifted to some other location. Four (3.3%) of them doubted CCP therapy;

TABLE 1 Internal validity testing of the variables analyzed in the study

Variables		Respondent	Participants who could not be contacted	P-value (OR)
Sex	Female	36	97	$P < .000$
	Male	189	116	
Age	Age <30	162	107	$P < .000$
	Age \geq 30	63	105	
Designation category				
Category 1		88	62	$P\text{-value} = .07$
Category 2		6	2	
Category 3		70	84	
Category 4		61	55	
Educational qualification category				
Under-matric		33	18	$P\text{-value} = .09$
Intermediate and undergraduate		42	32	
Graduate and above		149	153	

TABLE 2 Univariate analysis of “interested” response with educational qualification and designation

Variable	Category	“Interested” or “willing”	“Not interested” or “non-willing”	Estimate	P-value
Educational qualification	Under matric	09	24	0.27	$P < .001$
	Intermediate and undergraduate	17	26	0.39	
	Graduate and above	79	70	0.53	
Designation	Category 1	32	56	0.36	$P = .016$
	Category 2	02	04	0.33	
	Category 3	28	42	0.40	
	Category 4	43	18	0.70	

Variables	Estimate	SE	Z-value	P-value
Intercept	0.98	0.39	2.5	.01
Designation category 2	0.36	0.91	0.40	.69
Designation category 3	0.10	0.39	0.265	.79
Designation category 4	-1.16	0.44	-2.62	.01
Intermediate and undergraduate	-0.61	0.51	-1.18	.24
Graduate	0.69	0.51	-1.33	.18

TABLE 3 Confounder adjusted multivariate logistic regression showing the response of COVID-19 convalescent plasma (CCP) donation with designation and educational qualification

hence they were not interested. Two (1.7%) believed that they would be infertile after CCP donation.

4 | DISCUSSION

This study evaluated prospectively eligible SARS-CoV-2-infected healthcare workers' response for CCP donation. The study was internally validated for designation and educational qualification. The eligibility was decided over call based on a blood donor questionnaire, parity, and self-deferral due to known low body weight and low hemoglobin. Those who came to our center for further screening like weight, medical examination, and SARS-CoV-2 antibody testing were considered "Interested" in or "Willing" for CCP donation. Only 47% (105 of total 225) of HCWs were interested in CCP donation by apheresis and came to our center for further screening. 38.3% of the "not interested" HCW did not specify any reason for non-donation of CCP, while 22.5% considered the plasmapheresis procedure time-consuming (Figure 1).

We found no significant difference in response between different age groups and between male and female participants. The number of "interested" responses among doctors was significantly higher compared to other designation categories. "Graduate or above" education category had a significantly higher number of interested responses compared to others. In multiple logistic regression, the confounding effect between designation "doctors" and education "graduate and above" was eliminated, and only the interested response of doctor category was found significant. This response explains that the doctors are much aware of the procedure and can be easily motivated.

Masser et al discussed both motivators and barriers for CCP donation, while Dhiman et al discussed only deterrents for the same in recovered donors in the general population.^{12,13} The barriers were "worry that others will know of COVID-19," "infection and process risk to self and others," "logistics," "not well enough," "generic donation fears," "lack of trust in institutions," "Fear of reinfection."¹² In this study, a similar barrier among HCWs prevail, and the "fear of infertility" following CCP

donation was another curiosity in two of them. Some of them doubted the benefit about CCP therapy (3.4%).

Dhiman and his group reported that 72% of the recruited donor were interested in their study comprising the general population, 34% were deferred following the screening with blood donor questionnaire. They mostly deferred donors who had not completed 28 days post-discharge or end of home isolation.¹³ In our study, we called the donors who had completed 28 days of home isolation following discharge or end of home isolation. Secondly, we analyzed the response of only provisionally eligible HCWs and did not consider the responses of HCWs who were already deferred. This is may be the reason for smaller percent of eligible HCWs interested in CCP donation.

An attitude of HCWs for apheresis blood component donation has not been evaluated yet in the literature. Still, a few pieces of literature were available about the same among the general population. Motivation to be an apheresis donor can occur through the family's influence.¹⁵ It has also been observed that people differentially help close relatives over strangers. Hence, an intervention that could trigger this kin mechanism could be considered for the donation of CCP to a diversity of people.^{16,17} However, socially isolated individuals are sometimes self-motivated for platelet donation by considering it a matter of self-esteem and an opportunity to be part of a special group.¹⁸

In this study, we could not evaluate the responses of medical and paramedical students as they had been sent back home at the initial phase of the pandemic. The personalized approach by our blood bank clinician could have motivated a greater number of them. We could have inspired them for donation by calling them at specified intervals after their discharge or by the treating physician's discharge advice to follow up with our center at a specified time.¹³

Differences between whole blood donation and apheresis donation are that apheresis imposes greater strains on donors, a longer period to donate, a need to recirculate red blood cells (RBCs), infusion of anticoagulant, and saline and sometimes a greater risk of experiencing a

vasovagal reaction.¹⁹ Still, the HCWs can provide a reliable, stable, and safe source of blood and blood component. Health care providers are potential resources and promoters of voluntary blood donation and special types of apheresis donation like CCP donation.²⁰

4.1 | Limitations of the study

This was a survey based study focused on HCWs from a single center; the response we get cannot be generalizable to common people's response for CCP donation. The response of recovered donors and frequency of calling them was changed as the data from the phase II PLACID trial disclosed that CCP was not associated with a reduction in progression to severe COVID-19 or all-cause mortality.²¹ Following this, we did not call all the recovered donors apart from occasions when physicians demanded. We did not evaluate the response of ineligible HCWs who may be interested in CCP donation.

5 | CONCLUSION

To our knowledge, the study is first to evaluate the attitude of HCWs toward CCP donation by apheresis. In the past viral epidemics as well as this pandemic warrant the use of CP. The only source is a recovered patient. The HCWs are the front-line warrior in the war against COVID-19. Their altruistic behavior of CCP donation will motivate common people to donate the same. Further study can be planned to explore the interventions that can encourage the HCWs for apheresis donation or a special type of apheresis donation like CCP.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

ETHICS STATEMENT

The study was approved by Institute Ethics Committee, All India Institute of Medical Sciences, Bhubaneswar.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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REFERENCES

- Xie M, Chen Q. Insight into 2019 novel coronavirus—an updated interim review and lessons from SARS-CoV and MERS-CoV. *Int J Infect Dis*. 2020;94:119-124.
- Luke TC, Kilbane EM, Jackson JL, Hoffman SL. Meta-analysis: convalescent blood products for Spanish influenza pneumonia: a future H5N1 treatment? *Ann Intern Med*. 2006;145(8):599-609.
- Enria DA, Fernandez NJ, Briggiler AM, Levis SC, Maiztegui JI. Importance of dose of neutralising antibodies in treatment of argentine haemorrhagic fever with immune plasma. *Lancet*. 1984;324(8397):255-256.
- Bloch EM, Shoham S, Casadevall A, et al. Deployment of convalescent plasma for the prevention and treatment of COVID-19. *J Clin Invest*. 2020;130(6):2757-2765.
- Duan K, Liu B, Li C, et al. Effectiveness of convalescent plasma therapy in severe COVID-19 patients. *Proc Natl Acad Sci U S A*. 2020;117(17):9490-9496.
- Olivares-Gazca JC, Priesca-Marín JM, Ojeda-Laguna M, et al. Infusion of convalescent plasma is associated with clinical improvement in critically ill patients with COVID-19: a pilot study. *Rev Invest Clin*. 2020;72(3):159-164.
- Wendel S, Land K, Devine DV, et al. Lessons learned in the collection of convalescent plasma during the COVID-19 pandemic. *Vox Sang*. 2021;116(8):872-879. doi:10.1111/vox.13096
- Bloch EM, Goel R, Montemayor C, Cohn C, Tobian AAR. Promoting access to COVID-19 convalescent plasma in low- and middle-income countries. *Transfus Apher Sci*. 2021;60(1):102957.
- Del Fante C, Franchini M, Baldanti F, et al. A retrospective study assessing the characteristics of COVID-19 convalescent plasma donors and donations. *Transfusion*. 2021;61(3):830-838.
- Chew KL, Tan SS, Saw S, et al. Clinical evaluation of serological IgG antibody response on the Abbott Architect for established SARS-CoV-2 infection. *Clin Microbiol Infect*. 2020;26(9):1256.e9-1256.e11.
- Convalescent plasma in COVID-19. Version 1.4 Dated 22nd April, 2021. https://cdsco.gov.in/opencms/resources/UploadCDSCOWeb/2018/UploadPublic_NoticesFiles/amended%20Clinical%20Trial%20protocol%20version%201.4%20%20by%20ICMR%20dated%202020.pdf. Accessed July 25, 2021.
- Masser BM, Ferguson E, Thorpe R, et al. Motivators of and barriers to becoming a COVID-19 convalescent plasma donor: a survey study. *Transfus Med*. 2021;31(3):176-185.
- Dhiman Y, Coshic P, Pandey HC, et al. Deterrents in recruitment of COVID-19 convalescent plasma donors: experience from a hospital-based blood centre in India. *Transfus Med*. 2021;31(3):149-154.
- Tenth grade—Wikipedia [Internet]. https://en.wikipedia.org/wiki/Tenth_grade#India. Accessed July 17, 2021.

15. Charbonneau J, Cloutier MS, Fainstein B. How do people become plasma and platelet donors in a VNR context? *J Clin Apher.* 2018;33(3):236-248.
16. Griffin AS, West SA. Kin selection: fact and fiction. *Trends Ecol. Evol.* 2002;17(1):15-21. doi:10.1016/S0169-5347(01)02355-2
17. Nowak MA. Five rules for the evolution of cooperation. *Science* (80-). 2006;314(5805):1560-1563.
18. Szymanski LS, Cushna B, Jackson BCH, Szymanski IO. Motivation of plateletpheresis donors. *Transfusion.* 1978; 18(1):64-68.
19. Bove LL, Bednall T, Masser B, Buzzza M. Understanding the plasmapheresis donor in a voluntary, nonremunerated environment. *Transfusion.* 2011;51(11):2411-2424.
20. Sousos N, Sfyridou S, Adamidou D, et al. Non-physician health-care workers and voluntary blood donation: an ambiguous relationship. *Transfus Med.* 2018;28(3):216-223.
21. Agarwal A, Mukherjee A, Kumar G, Chatterjee P, Bhatnagar T, Malhotra P. Convalescent plasma in the management of moderate covid-19 in adults in India: open label phase II multi-centre randomised controlled trial (PLACID trial). *BMJ.* 2020; 22:371.

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