

ORIGINAL ARTICLE

International Society of Blood Transfusion survey of experiences of blood banks and transfusion services during the COVID-19 pandemic

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Abstract

Background and Objectives: The coronavirus disease 2019 (COVID-19) pandemic has impacted blood systems worldwide. Challenges included maintaining blood supplies and initiating the collection and use of COVID-19 convalescent plasma (CCP). Sharing information on the challenges can help improve blood collection and utilization.

Materials and Methods: A survey questionnaire was distributed to International Society of Blood Transfusion members in 95 countries. We recorded respondents' demographic information, impacts on the blood supply, CCP collection and use, transfusion demands and operational challenges.

Results: Eighty-two responses from 42 countries, including 24 low- and middle-income countries, were analysed. Participants worked in national (26.8%) and regional (26.8%) blood establishments and hospital-based (42.7%) institutions. CCP collection and transfusion were reported by 63% and 36.6% of respondents, respectively. Decreases in blood donations occurred in 70.6% of collecting facilities. Despite safety measures and recruitment strategies, donor fear and refusal of institutions to host blood drives were major contributing factors. Almost half of respondents working at transfusion medicine services were from large hospitals with over 10,000 red cell transfusions per year, and 76.8% of those hospitals experienced blood shortages. Practices varied in accepting donors for blood or CCP donations after a history of COVID-19 infection, CCP transfusion, or

vaccination. Operational challenges included loss of staff, increased workloads and delays in reagent supplies. Almost half of the institutions modified their disaster plans during the pandemic.

Conclusion: The challenges faced by blood systems during the COVID-19 pandemic highlight the need for guidance, harmonization, and strengthening of the preparedness and the capacity of blood systems against future infectious threats.

KEYWORDS

blood supply, convalescent plasma, COVID-19, pandemic, transfusion

Highlights

- This article summarizes the impact of the coronavirus disease 2019 (COVID-19) pandemic on the blood systems worldwide including blood supply challenges, transfusion demand, convalescent plasma collection and use, and operational challenges.
- To the best of our knowledge, this is the largest survey conducted to assess the impact of the COVID-19 pandemic on blood establishments and transfusion medicine services worldwide.

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has created challenges for many blood establishments (BEs) and transfusion medicine services (TMS) worldwide. African [1], Asian [2], Eastern Mediterranean [3] and some Western countries [4–6] reported blood supply challenges. They faced decreased rates of donations [1, 3], public fear of infection when donating blood [7] and decreased numbers of, or outright cancellations of, blood drives [3] due to lockdown measures. In addition, unpredictable clinical demands for blood, linked to cancellations of elective surgeries and non-urgent interventions, were described, while blood demand for emergency situations and patients on chronic transfusion support remained relatively unchanged [3, 6]. Some centres reported lower blood supply in the early stages of the pandemic, compensated by decreased blood demand for elective surgeries and other medical procedures [8].

Many institutions collected COVID-19 convalescent plasma (CCP) and/or used it for passive immunotherapy on a compassionate basis or for clinical trials. Guidelines on the collection and use of CCP in high-income and low- and middle-income countries (LMICs) have been published [9–13]. During the period covered by the survey, the World Health Organization (WHO) developed interim guidances, which underwent updates throughout the pandemic, for maintaining a safe and adequate blood supply and applying COVID-19-related donor deferral criteria, temporary deferral after vaccination and CCP usage [14, 15].

Early in the pandemic, the International Society of Blood Transfusion (ISBT) established a multidisciplinary working group, comprised of international transfusion experts, to review the impacts of COVID-19 on blood systems and existing practices on CCP collection and use from donor, product and patient perspectives [11, 16–18]. This survey aims to assess the impact of COVID-19 pandemic on BEs and TMS

around the world to summarize the experiences and provide guidance to prepare for future pandemics.

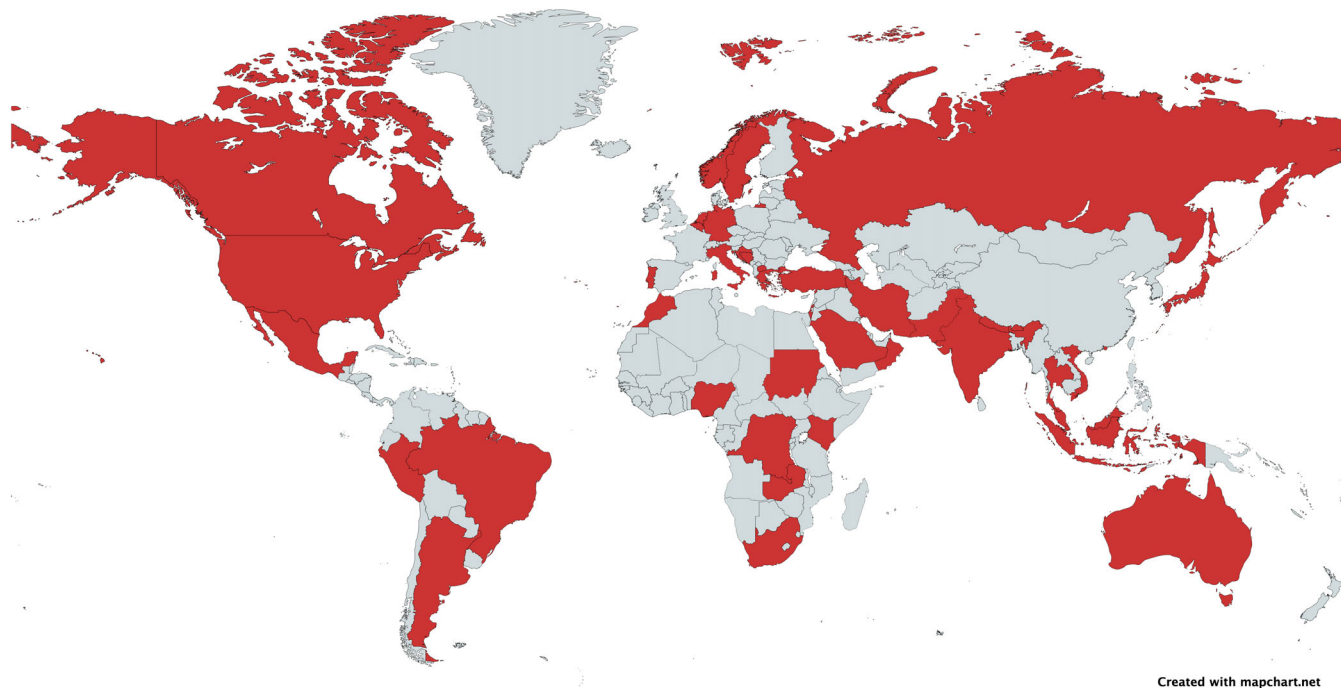
MATERIALS AND METHODS

A web-based survey was designed using Survey Monkey and piloted for content validity and avoidance of ambiguity by the working group. The survey, written in English, was distributed by the ISBT central office to 1481 ISBT members from 95 countries spanning all WHO regions. Respondents provided consent through completing the survey. Data were collected between 25 May and 9 July 2021.

The survey contained 77 questions covering demographics ($n = 13$), and questions tailored to BEs ($n = 33$) and TMS ($n = 31$) and others addressing blood supply challenges ($n = 10$) and demand ($n = 11$), and CCP collection ($n = 23$) and transfusions ($n = 15$). All respondents were invited to complete five questions on the operational challenges faced and to list recommendations for future pandemics. Descriptive statistics were performed, and the reported variables are expressed in numbers and percentages.

RESULTS

Ninety-three ISBT members participated. In total, 82 responses from 42 countries across all WHO regions, including 24 LMICs [19], were included in the analysis after excluding participants with <75% completion of the survey (Figure 1; Table S1). At the time of completion of this survey, most respondents indicated that their countries were either in the second wave of COVID-19 with a decreasing number of cases or in the third wave with either decreasing or increasing number of cases.



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FIGURE 1 Geographical distribution and demographics of survey respondents ($n = 82$, from 42 countries)

Respondents worked in national ($n = 22$, 26.8%), regional ($n = 22$, 26.8%) and hospital-based ($n = 35$, 42.7%) institutions. These included respondents who worked in institutions involved in blood donations ($n = 69$, 84.1%) and TMS ($n = 57$, 69.5%). Most institutions involved in donation activities annually collected $\geq 10,000$ units ($n = 45$, 65.2%) of blood. A majority of respondents working in TMS were from large hospitals offering medical and surgical services with >500 beds ($n = 36$, 63.2%) and $\geq 10,000$ red blood cell (RBC) transfusions per year ($n = 32$, 56.1%).

Impacts of COVID-19 on blood collection and supply

Almost two-thirds of respondents from BEs and hospital-based blood services indicated a decrease in donations during the pandemic, while 23.5% reported fluctuations (Table S2). Blood donation drives were either cancelled or decreased in two-thirds of institutions, primarily due to increased COVID-19 cases and lockdowns. Several institutions reported blood donors' fear of visiting hospital-based blood banks. Other stated reasons were donor deferrals due to infections or quarantine requirements.

Some respondents described declines during the lockdown period in the first wave, while in a few countries, the number of donors decreased at the start of the pandemic but improved over the following months. One respondent reported decreased donations at the start of the pandemic due to increasing imported cases with a lockdown, followed by a temporary recovery before a drop due to surging numbers of COVID-19 cases. A respondent from a blood collector in the United States described a sharp decline in blood donations when

COVID-19 was declared a national emergency and stay-at-home orders were mandated in multiple states. Free donor testing for antibodies against severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) was initiated, and donations steadily increased thereafter. Other respondents shared similar experiences, unveiling a decline in blood donations in the first and third waves of the pandemic, with decreased demand for elective surgeries and transplants, followed by an increase over the usual demand thereafter. In contrast, in Italy, donations increased in the early stages of the pandemic as a result of calls for blood donors.

COVID-19 infection-related deferrals

At the time of undertaking this survey, most institutions were applying a 14- (50.7%) or 28-day (38.8%) deferral period for donors with a history of COVID-19 infection after full recovery/resolution of symptoms (Table S2). In one Nigerian institution, testing for COVID-19 was needed before a blood donation. Policies with regard to donor deferral after a CCP transfusion varied. Over one-quarter of respondents (27.7%) indicated a 12-month temporary deferral, and 7.7% respondents reported permanent deferral (from the Netherlands, Malaysia, Congo, Kenya and one center in Saudi Arabia), while 13.8% were awaiting a policy decision. In Germany, a 4-month deferral period was applied.

SARS-CoV-2 vaccine-related deferrals

A wide variety of SARS-CoV-2 vaccines were available in the responding countries, with the commonest being Oxford/AstraZeneca

and Pfizer/BioNTech. Others included Moderna, Sinovac-CoronaVac, Johnson & Johnson, Sputnik V, Sinopharm, Covaxin and Verocell (Table S2).

Post-vaccination deferrals for blood donations varied, with a majority implementing 14- (33.8%) or 7-day (20.6%) deferrals. A few reported a 48-h deferral for mRNA or non-replicative vector-based vaccines ($n = 4$), or a 72-h deferral period after vector-based or inactivated vaccines ($n = 2$). Elsewhere, the practice varied depending on the vaccine type, including no or 7 days deferral post mRNA, 7 days up to 4 weeks deferral post vector-based vaccines, 48 or 72-h deferral for inactivated virus vaccines and 1 year deferral if the donor was enrolled in vaccine-related clinical trials.

In the United States, individuals who received a live-attenuated viral vaccine had to refrain from donating blood for 14 days, but no such vaccines were authorized in that country. In Singapore, individuals receiving mRNA or inactivated vaccines were deferred by the national BE for 3 days post vaccination if free from side effects, for 1 week after resolution of localized pain at the injection site and for 4 weeks after resolution of a fever, generalized muscle aches, rashes, or lymph node swelling. The deferral period for vector-based or live-attenuated vaccines was 28 days.

Safety measures to protect blood donors and staff

Safety measures were implemented to protect donors and staff in BEs and hospital-based blood services (Table S2). Almost one-third of BEs performed CCP collection procedures in a room separate from standard donations. Other measures included screening donors for signs and symptoms of COVID-19 and a relevant travel history, frequent disinfection of equipment and donation chairs and minimizing snack consumption post-donation. In addition, social distancing was applied, as well as installation of an electronic appointment system, extending working hours, increasing the number of donation sites and setting up collection areas outside hospital-based blood services.

Challenges in donor recruitment and strategies utilized

The most common challenges were donor fear of contracting COVID-19 at blood donation facilities, refusal of partner institutions to host blood drives and lockdowns (Table S2). Staff concerns from handling blood donors were reported by 40% of respondents. Other reported concerns included the inability to conduct donation drives due to a lack of resources/mobile units, closure of public venues (such as shopping centres) and the cancellation of gatherings by community organizations where blood drives are usually conducted. There were staff and donor losses due to COVID-19 infection or exposure, and staff fears of job security.

Strategies to recruit donors and reduce blood shortages encompassed increased blood donation promotion via text messages, phone calls and key societal influencers. Hospital employees were encouraged to donate blood. Use of social media and collaboration with voluntary organizations were done to recruit donors and conduct donation drives. Other solutions included donor transportation and the

issuance of travel passes to help donors reach donation sites during lockdowns. The use of virtual blood drives to recruit donors by inviting individuals and supporters to promote donations at any of its fixed donation sites was reported [20]. Another operation allocated funds to retain workers and provided supplies including thermometers, personal protective equipment (PPE) and hand-held equipment at blood drives.

COVID-19 convalescent plasma collection

Fifty-two institutions collected CCP during the pandemic (Table S3). Most institutions accepted first-time apheresis donors, and 40.4% accepted family/relative donations, which accounted for more than one-third of CCP donors in five institutions in LMICs. Almost two-thirds of respondents (66.7%) indicated that their institutions could meet CCP demands. In the Netherlands, there were long waiting lists for CCP donations. In the United States, as more of the general population began to get vaccinated and increasing questions about CCP efficacy appeared in the literature, hospital demand declined and the need for CCP donations substantially decreased.

Almost two-thirds of the institutions used a specific consent form for CCP donation. This included details on CCP donations, testing to be performed, donation by apheresis and trial/research use. At U.S. centres, the consent form specified that high-titre donations, as defined by the Food and Drug Administration (FDA), and non-reactivity for relevant transfusion-transmitted infections qualified the plasma to be labelled as CCP under an FDA-approved Expanded Access protocol.

Most respondents accepted donors recovered from COVID-19 infection for CCP donations after at least 14 ($n = 29$, 49.2%) or 28 ($n = 18$, 30.5%) days after recovery. With the majority mandating a history of natural COVID-19 infection, 27 institutions accepted vaccinated donors. CCP donors were accepted post vaccination with a variable deferral period ranging from none ($n = 4$) to 7 ($n = 4$) and 14 ($n = 14$) days. The period of deferral varied based on the type of vaccine in three institutions, while two remained undecided. For vaccines, the FDA required prior symptomatic COVID-19 infection, documented by a swab polymerase chain reaction test for 14 days to 6 months after the last symptoms before a CCP donation [21].

Six institutions from three countries accepted vaccinated donors to donate CCP for fractionation if they had a history of COVID-19 infection. In a blood service in Canada, plasma collection for fractionation paralleled that for transfusions. Six respondents reported competition for CCP collection from plasma fractionators. Two reported that this worked in favour of their institutions and helped them to acquire additional apheresis machines. Twenty-one respondents indicated a lack of a domestic fractionation programme.

Most institutions collected CCP by apheresis. Three performed only whole-blood (WB) collection, and 14 simultaneously conducted WB and apheresis collection. In 10 institutions, WB donations contributed to >50% of the CCP source (Argentina, North Macedonia, Iran, Indonesia, Israel, Nepal, Italy, Sweden, and two in India). Of those countries that performed WB collection, all but three reported that RBCs or platelet units derived from WB convalescent donations were used for standard transfusions.

Most institutions utilized in-house-generated labels for the CCP, while six used the standard ISBT label and 16 uses specific ISBT label for CCP. Two institutions used a nationally developed label. CCP was kept frozen for up to 1 year in 83% of those institutions. Plans for the utilization of excess CCP were variable, with the commonest being to ship it for regular fractionation (27.1%).

Blood inventory and demand

Three-quarters of the 56 TMS experienced blood shortages during the COVID-19 pandemic, and in 35 (62.5%), the shortage correlated with the number of cases reported in their countries (Table S4). Most of these respondents reported <10% red cell wastage (86%). While RBC demands fluctuated in almost half of these institutions, platelet demands were variable. Shortages affected a wide range of patients including those with underlying haemoglobinopathies and with haematological malignancies and transplant patients. Two respondents from the Middle East indicated that the demand did not change since most transfusions in their institutions were for patients with haemoglobinopathies and haematological malignancies. While some respondents indicated that

the blood demand had decreased because of cancellations of surgeries, for others the major procedures could not be conducted owing to blood shortages. One country in Africa reported that challenges in meeting transfusion demands led to rescheduling of surgeries.

Different measures were applied to meet transfusion demands. The most common strategies were to cancel elective surgeries/procedures (90.5%) and maximize the use of alternatives to RBC transfusions (50%). Respondents indicated the usefulness of maintaining effective communication with clinical teams and BEs and applying patient blood management. In addition, respondents described screening transfusion requests, extending the shelf life of platelets to 7 days after bacterial testing, splitting platelet units and issuing RBC units up to 2- weeks-old to patients with haemoglobinopathies and to neonates.

COVID-19 convalescent plasma transfusions

Thirty TMS transfused CCP to patients with SARS-CoV-2 infection, including five that transfused CCP into paediatric patients (Table S5). More than half of institutions transfused CCP as part of national

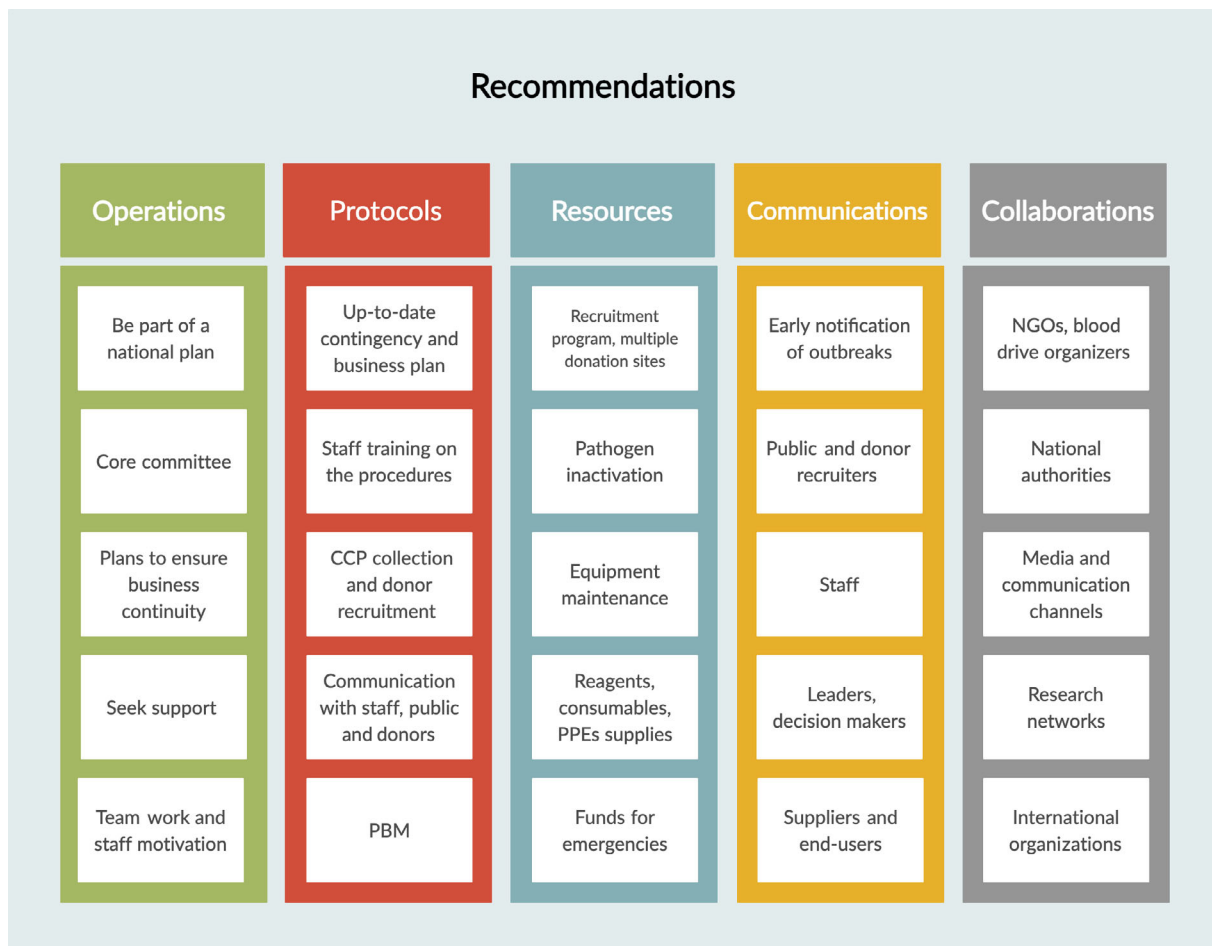


FIGURE 2 Operational recommendations for blood establishments and transfusion services to prepare for future viral threats/pandemics. CCP, COVID-19 convalescent plasma; PBM, patient blood management; PPE, personal protective equipment; NGO, non-governmental organization

programmes (60%) and for both clinical trials and compassionate/emergency use. Most institutions enrolled in clinical trials used CCP therapeutically for hospitalized patients. Only three institutions were enrolled in clinical trials assessing CCP use in a pre-hospital setting, and only one as a prophylactic measure for high-risk exposure. The vast majority of institutions utilizing CCP on a compassionate basis used a specific consent form for treated patients. More than half of the respondents indicated having sufficient CCP supply.

The protocol for unit selection—if more than one dose of CCP was given—ranged from random selection to selecting units from the same donor (Table S5). ABO-matched CCP was used by 56.7% of the respondents. The ISBT haemovigilance definition was used by 46.7% of institutions when reporting adverse reactions to transfused CCP [22]. Most institutions reported to the blood bank, national haemovigilance committee and/or a blood transfusion/safety committee.

Operational challenges

The commonest operational challenges faced during the pandemic were staff losses due to sickness or quarantine and increased workloads (Table S6). More than one-quarter of respondents reported staff deployment to other services such as to support a virology laboratory. One-third of respondents reported a lack of PPE. Other challenges included delays in reagent supplies and instrument maintenance, and the need for team segregation for business continuity planning, resulting in longer working hours and higher workloads in blood processing and testing laboratories. A respondent from one LMIC described a lack of support for blood systems in the country.

Challenges upon initiating a CCP collection and transfusion programme included cost/funding, setting up clinical trials, and obtaining institutional review board approvals. One respondent from Africa described challenges with the lack of sufficiently qualified physicians to initiate clinical trials and slow initial patient enrollment. Another respondent described donor recruitment as the main challenge, as donors were unwilling to come to the hospital to donate CCP or had transportation difficulties due to lockdowns. Two respondents indicated that collecting CCP on a voluntary, non-remunerated basis without proof of its benefits for hospitalized patients was extremely difficult. Challenges with the demand exceeding supply at certain stages of the pandemic were described by respondents from India and Portugal. Other challenges included donor recruitment and eligibility determination, managing human and testing resources, apheresis equipment and required logistics.

For 47 institutions, contingency/disaster plans were effective in meeting transfusion demands. However, almost one-half of the respondents indicated a change in disaster plans, such as adding a section of operating plans during a pandemic. Others indicated updates on safety/infection control measures, staff management and redeployment, extending working hours, and management of inventories of blood and critical reagents. Specific changes in relationships with BEs included donations by appointment only, defining donor workflow and modifying eligibility criteria as per national protocols.

Respondents shared the lessons learned and recommendations to help in preventing/managing blood shortages, meeting transfusion demands during a pandemic, establishing a CCP programme and overcoming operational challenges (Table S7; Figure 2).

DISCUSSION

To the best of our knowledge, this is the largest survey conducted to assess the impact of the COVID-19 pandemic on BEs and TMS worldwide. This survey highlights some specific challenges faced during different waves of the pandemic and the mitigation steps undertaken.

National measures to contend with the pandemic had negative impacts on the blood supply in most BEs, with the demand fluctuating in half of the TMS. Challenges included public fear, transport restrictions and staff shortages. These specifically threatened transfusion support to certain patient populations in some institutions, in line with previous reports [3, 23–25]. Although cancellations of surgeries were reported to decrease blood demand in the early stages of the pandemic [8, 26], most of the participants reported blood shortages. This could be explained by the proportion of participants in our survey from LMICs. The fragility of blood supply systems in LMICs likely makes it particularly challenging for blood banks in those countries to meet ongoing demands. In the early stages of the pandemic, the WHO recommended that centres be prepared to move quickly in response to changes in managing demands for blood and blood products while mitigating potential risks to staff and donors from exposure to SARS-CoV-2 [15]. With universal impacts on the blood supply and donation rates, there is a need for a global message to the public and national authorities on the continuing need for blood donors.

The need to initiate CCP donation and transfusion trials and programmes has added extra challenges. The survey reveals wide variations in donor eligibilities, donation methods, types of donors enrolled in CCP donation and methodologies used in obtaining consent. While the majority reported meeting CCP demands, certain local challenges were highlighted such as competition with other parties for CCP collection, lack of standardization in labelling CCP units, variations in the shelf life of frozen units and plans to utilize excess units. Common challenges of funding and the lack of test facilities should be resolved in preparation for future pandemics.

We report variation in certain practices, such as donor deferral post-recovery from COVID-19 or for recipients of CCP transfusions, and deferral after receiving COVID-19 vaccines for blood and CCP donations. While there was guidance from different organizations such as the WHO [14], ISBT [9, 11] and Association for the Advancement of Blood & Biotherapies [12], there was variability in practice, which may be ascribed to slightly diverging recommendations in those guidelines over time, local policies and regulations, resources, facilities and expertise. This highlights the need for harmonization of international guidelines and updating them as scientifically based knowledge and circumstances (such as vaccinations) evolve throughout the pandemic. A harmonized reporting scheme for CCP reactions is also required.

This survey also highlights the wide range of operational challenges encountered during the pandemic. The lack of PPEs in one-third of institutions reflects that experienced in other sectors of healthcare systems worldwide, especially in the early stages of the pandemic [27, 28]. A lack of previous experience with pandemics resulted in one-half of the institutions changing their contingency/disaster plans, which illustrates the need that essential plans be developed for pandemic preparedness, preferably in line with national policy responses.

One limitation of this cross-sectional survey is that it captured data only at a single moment in time. Hence, the survey results do not reflect the trend or the magnitude of the blood shortages and challenges observed beyond the period assessed. This limitation is particularly relevant considering the variable degree of virus spread between different countries worldwide. In addition, relying on voluntary participants may have introduced a selection bias. Furthermore, a non-response bias could arise, as the set of people willing to participate may differ from those who did not respond. Finally, the survey was provided only in English, which may have hindered non-English-speaking respondents. However, to the best of our knowledge, this is the most extensive assessment of the impact of the COVID-19 pandemic on BEs and TMS worldwide. The participation from all WHO regions provides a broad comparative snapshot of this impact.

In conclusion, the COVID-19 pandemic imposed challenges on BEs and TMS worldwide. The information gathered through this survey and recommendations can be used to guide policymakers and governmental and non-governmental organizations to strengthen the capacities of national blood transfusion systems, enhance risk mitigation and develop preparedness plans for future pandemics.

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A.Z.R. acquired and analysed the data and wrote the first draft of the manuscript; T.B. initiated the research idea, supervised the research, and reviewed and edited the manuscript; A.Z.R., T.B., E.M.W., D.V.D., A.O., T.O.A., R.G., E.M.B., K.D.B., M.G., V.L., N.R.L., A.L.A., C.K.L., E.H. and C.S.O. designed the survey. The remaining authors participated in the survey and provided detailed responses. All authors reviewed the manuscript.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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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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