

Public Policy Impact of the COVID-19 Pandemic on Blood Supply in the United States

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 See also the COVID-19/Public Health Preparedness and Response section, pp. 842–875.

The COVID-19 pandemic has precipitated an acute blood shortage for medical transfusions, exacerbating an already tenuous blood supply system in the United States, contributing to the public health crisis, and raising deeper questions regarding emergency preparedness planning for ensuring blood availability. However, these issues around blood availability during the pandemic are related primarily to the decline in supply caused by reduced donations during the pandemic rather than increased demand for transfusion of patients with COVID-19.

The challenges to ensure a safe blood supply during the pandemic will continue until a vaccine is developed, effective treatments are available, or the virus goes away. If this virus or a similar virus were capable of transmission through blood, it would have a catastrophic impact on the health care system, causing a future public health emergency that would jeopardize the national blood supply.

In this article, we identify the impact of the COVID-19 pandemic on blood supply adequacy, discuss the public health implications, propose recovery strategies, and present recommendations for preparing for the next disruption in blood supply driven by a public health emergency. (*Am J Public Health*. 2021;111: 860–866. <https://doi.org/10.2105/AJPH.2021.306157>)

Blood donations are a pillar of modern medicine,^{1,2} and an adequate supply of safe blood for transfusion is essential to protect the public's health. The US blood supply system has been seriously threatened by the COVID-19 pandemic, jeopardizing the ability to treat critically ill persons and emergency patients, with significant implications for the health care delivery system. The nation's blood supply was already tenuous before the COVID-19 pandemic,^{3,4} and, since then, issues have been further compounded. Demand for blood has actually been declining since 2008 because of more conservative transfusion practices. This decline in demand caused blood centers to rapidly consolidate through mergers, resulting in reduced blood product availability,^{5–10}

leading to a loss of national surge capacity, leaving the highly complicated blood product supply chain struggling at the local, regional, and national levels.¹¹

Blood is typically collected, processed, and stored at regional nonprofit blood centers and distributed to hospitals on a daily or weekly basis. Moreover, most blood products are perishable, with a short shelf life—42 days for red blood cells and 7 days for platelets—which precludes stockpiling a meaningful inventory for surge capacity or other emergencies. Safety for both the blood donor and recipient is the central concern in transfusion medicine and a key driver of blood availability. The pandemic has produced a heated debate regarding the safety of blood donations in endemic countries. While the

lockdown reduces the amount of health care activity, unavoidable patient care continues. For example, it is estimated that there is a substantial backlog of new cancer patients across the nation¹²; as cancer programs look to restart operations, this backlog will grow.

IMPACT OF THE COVID-19 PANDEMIC ON BLOOD SUPPLY

The blood shortage caused by COVID-19 is an urgent public health issue that interferes with the functioning of the entire health care system. The US blood supply has fallen to critically low levels since the COVID-19 pandemic began, with only a 1 day inventory in some instances,¹³ prompting the blood supply

organizations and the surgeon general to issue an urgent call for blood donations.¹⁴ However, these issues around blood availability during the pandemic are related primarily to the decline in supply caused by reduced donations during the pandemic rather than increased demand for transfusion of patients with COVID-19.¹⁵ This decrease in blood donations is related to 2 main factors. First, the cancellation of blood drives—the Red Cross cancelled more than 30 000 planned blood drives between mid-March and June of 2020,¹⁶ and upward of 500 000 potential units of blood went uncollected.¹⁶ Second, it is possible that shelter-in-place recommendations and fear of infection has an impact on donor willingness to donate blood.

The supply chain is most vulnerable at its first step: obtaining blood donations from healthy donors willing to volunteer their blood. Before the pandemic, our estimates indicate that approximately 37% of the US population was ineligible to donate blood because of 38 exclusion factors.¹⁷ The number of confirmed COVID-19–positive infections as of late December 2020 is 18 million in the United States,¹⁸ and it is estimated that the number of COVID-19 infections in many parts of the United States is more than 10 times higher than the reported rate.^{19,20} Using a factor of 3.34 times confirmed infections, we conservatively estimate that as of December 2020 as many as 60 million persons in the United States have had a COVID-19 infection. In 2017, 8 million donors provided approximately 12.2 million units of transfused blood.²¹ Table 1 shows that there are approximately 205 million eligible blood donors in the total US population of 328.4 million persons.²² The 8 million blood donors represent 3.9% (8 million/205.4 million) of the population eligible

TABLE 1— Estimates of Eligible Blood Donors Before COVID-19 and as of December 2020: United States

Category	Amount
US population	328.2 million persons
Pre-COVID-19 estimates	
Adjustment for exclusion factors (328.2 × 0.626)	205.4 million persons eligible to donate
Actual number of blood donors	8 million donors
Percentage of actual eligible blood donors (8 million/205.4 million)	3.9
COVID-19 estimates	
Impact estimate (18 × 3.34)	60 million persons
Adjustment for exclusion factors (328.2–60 = 268.2 × 0.626)	167 million persons eligible to donate
Actual number of blood donors (167 × 0.039)	6.5 million donors
Percentage change in actual eligible blood donors ((6.5–8)/8)	19

to donate blood before the COVID-19 era. Based on the estimate that as many as 60 million persons in the nation could have had a COVID-19 infection, it is possible that the pool of eligible blood donors could decrease by 38.4 million persons if COVID-infected persons are deferred from blood donations, reducing the pool from 205.4 million eligible donors to 167 million eligible donors. This results in a 19% potential decrease in the pool of eligible blood donors (from 8 million to 6.5 million eligible blood donors).

This estimate only takes into account the potential exclusions for blood transfusion. To the extent that convalescent plasma treatment becomes an accepted practice, this would be a new demand on the blood system, and it is not included in the previous calculation. Turning convalescent plasma donors into return blood donors is evolving and could become a rapidly expanding area of collections. Studies show no evidence to support transfusion-transmitted COVID-19,²³ and there is no long-term deferral from blood donation following COVID-19 recovery.²⁴ While it is increasingly clear that a small portion of

COVID-19 patients will have lingering problems that will prevent these patients from being blood donors,^{25,26} this virus is part of the family of respiratory viruses that has been shown to not be transmitted by transfusion.²⁷ Preliminary studies indicate that neutralizing antibodies are stably produced for at least 5 to 7 months after severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection,²⁸ and serum antibodies to SARS-CoV-2 are maintained in the majority of COVID-19 patients for at least 3 months after symptom onset.²⁹ However, it is not conclusively known how long the antibodies will persist nor which kinds of antibodies will be the most beneficial. Antibodies can be measured in a variety of ways, and, thus, it will be important to determine which of these antibody assays is most clinically relevant. If this virus or a similar virus were capable of transmission through blood, it would have a catastrophic impact on the health care system.

During the COVID-19 pandemic, blood donations have decreased, but blood transfusions have also decreased because of the closure of medical clinics

and a reduction of hospital inpatient census by 20%.³⁰ A person with an active COVID-19 infection is ineligible to donate blood, although there is little evidence that blood transfusion will transmit the infection. However, the duration of the COVID-19 virus is quite variable—spanning from a few days to a few weeks or even months, and it seems likely that some persons will have long-term sequelae that eliminate them as blood donors. The impact of donor exclusion on the pool of eligible donors caused by COVID-19 may be substantial. COVID-19 could be classified as either a short-term (1–59 days) donor exclusion factor, a long-term (60–365 days) exclusion factor, or possibly a permanent exclusion factor.^{4,17} Currently, the US Food and Drug Administration (FDA) suggests a 14-day deferral based on testing and symptoms with most blood collection centers not using a permanent deferral.³¹

The COVID-19 pandemic is precipitating innovative mechanisms for increasing the blood supply throughout the nation. For example, Facebook and the American Association of Blood Banks (AABB) announced a partnership to connect more people to their local blood banks.¹⁴ However, such partnerships raise serious privacy concerns, which will require discussion and resolution. Several facets that are part of the pandemic will likely persist (see [box](#) on p. 863). The success of remote working will likely lead to its persistence to some extent, thus decreasing the number of large groups of potential blood donors. The public is likely to be more concerned by viral infections, and, thus, some social distancing will persist. There may be increased fear of receiving a transfusion-transmitted infection as well as the donor's misconception that they will become infected while donating blood

from exposure to an infected person within the blood collection center.

These changes resulting from the pandemic will necessitate changes in the operation of blood supply organizations (see [box](#) on p. 864). The pandemic has altered work practices, perhaps permanently in some cases. This substantial transition toward remote work disrupts the traditional work setting with a number of residual impacts on traditional blood collection. For example, blood drives that used to take place at large gatherings of people such as places of employment will no longer be as relevant because of the large transition to virtual remote work. With these changing work practices, blood supply organizations will need to adapt and restructure their traditional modes of collecting blood. These and other not-yet-recognized effects will have an impact of how blood collection organizations will have to operate (see [box](#) on p. 864). These will likely necessitate change in the structure and operation of blood supply organizations and may lead to cost increases and further decrease ability to innovate.³² A list describing potential factors that may change the operation of blood supply organizations related to the COVID-19 pandemic is shown in the [box](#) on p. 864.

EMERGENCY PREPAREDNESS

A blood emergency refers to an event that requires a larger amount of blood than usual or that temporarily restricts or eliminates the ability to collect blood.³³ Emergency response preparation for blood supply has not been as extensive as other preparedness activities,³⁴ and the COVID-19 pandemic highlights several deficiencies of the public health emergency preparedness system for blood. A

recent study undertaken for the Department of Health and Human Services (HHS) explored the ways in which a global pandemic could disrupt the US blood supply,³⁵ a scenario that is now playing out in real time.

Blood and blood products are a critical element of public health emergency preparedness and an essential component of the Emergency Support Functions of the National Response Framework.³⁴ The Center for Preparedness and Response in the Centers for Disease Control and Prevention (CDC) coordinates public health preparedness,³⁶ while HHS monitors and coordinates the need for blood and blood products and related medical supplies in coordination with the AABB.³⁷ While Congress identified ensuring an adequate blood supply as an important strategic issue facing the US blood system, this concern has not received sufficient attention, and there has not been substantial progress toward this goal.³⁵ Although blood collection centers are among the few organizations allowed to stay open during closures of nonessential business during the pandemic, they have operated at a substantially reduced capacity, experiencing difficulty in reliably meeting blood requirements. Indeed, COVID-19 has significantly decreased the rate of blood donations around the world.³⁸

Emergency preparedness for transfusion medicine is based on the assumption that demand will increase dramatically. For example, the AABB *Disaster Operations Handbook* identifies a pandemic as a high threat, related to an increase in the demand for blood, but does not identify the lack of blood supply as a substantial risk³³ as has occurred in the COVID-19 pandemic. As indicated previously, the COVID-19 pandemic blood shortage is related to

Potential Ongoing Factors From the COVID-19 Pandemic That Can Have an Impact on Blood Donations

1. Decreased donor willingness to donate
2. Continued emphasis on remote work
3. Decrease in large concentrations of workers
4. Concerns regarding the infection risk during travel to donation site
5. Social distancing
6. Fear of receiving blood transfusion
7. Fear of infection from donating blood

the inability to maintain supply rather than an increase in the need for blood or distribution difficulties.

The COVID-19 pandemic has raised a number of concerns regarding how to equitably allocate supplies that are needed to respond to the pandemic, such as vaccinations,³⁹ personal protective equipment,⁴⁰ and ventilators. There are similar concerns regarding how to set equitable allocation of blood to hospitals, how to determine first-tier transfusion recipients, and how to account for such factors, as health care disparities have not been discussed. A framework needs to be developed for equitable allocation of blood for transfusions. Public health practitioners and other partners need clear and accessible guidance regarding effective practices to respond to public emergencies,⁴¹ which also applies to the blood supply for transfusion medicine. For example, a lottery system has been proposed to allocate scarce COVID-19 medications to promote fairness, and the National Academies released a preliminary framework for equitable allocation of COVID-19 vaccines on September 1, 2020.^{42,43}

IMPLICATIONS

The blood supply system has been described as a public good, operating in an undefined partnership with

government.⁴⁴ However, the blood supply system functions in the private sector with independent organizations, which compete with each other both for donors and for hospital distribution accounts.³

The COVID-19 pandemic has led to a serious shortage of blood in the United States, jeopardizing the ability of the health care system to treat patients, creating a public health emergency for the foreseeable future. Although some spot shortages caused procedures to be postponed—such as solid organ transplants—it does not appear that there were severe patient problems or fatalities attributable to the lack of blood.⁴⁵ These decreases in demand were met with greater decreases in supply of blood during the COVID-19 pandemic.⁴⁶ This blood shortage reflects longstanding challenges in the blood collection and distribution system, requiring both short-term and long-term solutions.^{3,36}

In the short term, several actions can be taken to ensure voluntary blood donors provide a continuous and safe donation of blood components. This includes a timely appeal to donate blood when a shortage is foreseeable, careful planning of the donor schedule at blood collection centers to ensure compliance with social distancing measures and avoiding an excess number of donors at any given time, use of adequate personal protective equipment, and

meticulous adherence to hygiene regulations. Travel by potential blood donors to make donations is the most feasible way to acquire the needed blood supply and should be considered essential by governments. These strategies have had a demonstrated effect. For example, following an initial 10% decrease in whole blood collection in Italy, the strict application of these measures resulted in a stable volume of blood donations, guaranteeing blood component self-sufficiency.⁴⁷ Avoiding shortages requires the ability to maintain supply-and-demand equilibrium by ensuring coordination among blood supply organizations, transfusion physicians, hospital systems, and government agencies. The governance for these strategies is unclear and needs resolution. For example, state requirements for personal protective equipment and distancing vary widely, while the CDC recommendations fluctuate. Although this is a short-term concern, we recommend a long-term national strategy with apolitical guidelines. Historically, the FDA sets donor requirements that are standardized on a national basis, and the AABB uses those same requirements.³¹

To provide a long-term foundation for improving preparedness in public health emergencies, we propose 3 recommendations. First, create national policies for capacity building. The absence of a national system for blood supply management has made it difficult to match supply and demand (see [box](#) on this page). Second, structural changes in the blood supply chain must be deployed, and blood supply organizations will need to change their operating structure to react efficaciously to COVID-19 (see [box](#) on this page). This includes integrating the community blood centers responsible for the collection and distribution of blood and blood

Potential Changes in Blood Supply Organizations' Operations Because of the COVID-19 Pandemic

1. Fewer large blood drives may be offered because remote working decreases donor pool in central locations.
2. Shelter-in-place orders and donor fear of infection may decrease donor willingness to donate.
3. Addition of new donor exclusion criteria may lead to a decrease of eligible blood donors.
4. Fewer large blood drives may mean that more blood will be collected in fixed sites.
5. New kinds of sites, such as stadiums or convention centers, may be used to facilitate social distancing.
6. Blood supply organizations may emphasize increased effort to recruit donors who are friends and relatives of patients using blood.
7. The need for cleaning equipment and facilities between donors may result in reduced productivity.
8. Greater use of personal protective equipment for staff may increase costs and worker discomfort.
9. More scheduled donations may be required involving increased costs attributable to scheduling.

products into the emergency management planning efforts with the addition of blood-related scenarios in the drill and exercise programs. This helps to ensure that blood centers are appropriately prioritized for emergency communications equipment and frequencies, transportation during disasters, restoration of utilities, and re-entry access into affected disaster areas. Third, crisis management leadership throughout the blood supply system is needed. This leadership begins with the Federal Emergency Management Agency working closely with community blood centers to ensure that blood and blood products are available when needed during emergencies. For example, the FDA issued 4 blood donor eligibility guidelines on April 2, 2020, to help alleviate blood shortages during the COVID-19 pandemic, including alternative procedures for blood and blood components collected during the COVID-19 public health emergency (these alternatives are only in effect until the end of the public health emergency).

One of the difficulties in the blood supply response has been the lack of a federal policy to coordinate the response to emergency shortages on a national basis. The US blood supply system involves a number of individual

blood organizations that could be organized to function as a national emergency supply preparedness system. This national system for blood collection management could include an information technology infrastructure that connects all blood operators within the United States to more freely move needed blood products across blood collection organizations. The system could be overseen by a US government body that manages a universal blood supply organization with the independent nonprofit blood collection organizations functioning as collection and distribution hubs. This proposed integrated structure could be filled by government employees working directly within the blood centers or blood center employees that serve on integrated government-level committees. The [box](#) on p. 865 summarizes several recommendations to improve blood supply for future emergencies.

The recommendations for short-term and long-term recovery strategies will involve sustainable collaboration to continue after the epidemic is over, and blood supply organizations will need to adapt their operations to respond to these changes. The pandemic has altered work practices, perhaps permanently in some cases. This substantial

transition toward remote work⁴⁸ disrupts the traditional work setting with a number of impacts on traditional blood collection. For example, blood drives that used to take place at large gatherings of people such as places of employment will no longer be as relevant because of the large transition to virtual remote work. With these changing work practices, blood supply organizations will need to adapt and restructure their traditional modes of collecting blood. To be more responsive to donor convenience, blood supply organizations understand the need to develop smaller, more mobile blood collection systems to supplement more traditional modes of collecting blood. For example, mobile blood units small enough to make house calls can enhance consumer convenience.

CONCLUSION

In this article we describe the US blood supply system, the impact of the pandemic upon blood supply, and implications for emergency preparedness. The COVID-19 pandemic exposes the gaps and vulnerabilities of the nation's blood supply system, contributing to public health emergency preparedness challenges. Dialogue between key policy and public health leaders, health care delivery systems, and physicians has been conspicuously absent. While there is a heightened need for rigor in emergency planning and response activities, this response has not been well coordinated or responsive to the needs of public health.

The blood transfusion supply chain has unique characteristics. Even before the onset of COVID-19, the transfusion medicine blood supply chain had structural challenges related to supply chain factors including sole source supply from human donors, limited

Recommendations to Improve Blood Supply in Preparation for Future Emergencies

1. Create national policies for capacity building.
2. Establish national system for inventory management.
3. Change operating structure of blood supply organizations to improve ability to react to emergencies.
4. Make structural changes to improve supply chain.
5. Integrate blood supply organizations into emergency planning activities.
6. Include blood-related scenarios in emergency drill and exercise programs.
7. Ensure that blood suppliers have appropriate priority within emergency communications, transportation, and restoration of utilities.
8. Define structure for comprehensive unified crisis management related to blood supply.
9. Ensure that blood centers are considered essential services during emergencies.
10. Create national stockpile of key supplies, equipment, and reagents to support continued blood supply organization function during emergency.

ability to create meaningful inventory because of the short shelf life of blood products, and economic pressures leading to industry consolidation. These structural challenges are mirrored across the globe, with 119 of the 195 nations of the world having an inadequate blood supply to meet health care needs.⁴⁹

The COVID-19 pandemic introduces severe stressors into the supply chain, contributing to the public health emergency and threatening population health. However, this acute blood shortage reflects deeper issues for public health emergency preparedness as well as the structure of the blood collection system. There is no known end date for the COVID-19 pandemic and no guarantee that COVID-19 will be the last epidemic or pandemic,⁵⁰ underscoring the challenge to immediately identify strategies to improve long-term sustainability of the United States' blood supply. The short-term and long-term recommendations presented in this article can be used as a call to action to help ensure an adequate and safe blood supply. *AJPH*

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CONTRIBUTORS

W. Riley led the writing of the article, contributed to the design of the study, and takes responsibility for the concepts expressed in the article. K. Love led the literature review, contributed to writing the article, and assisted with the article revision. J. McCullough originated the study concept, contributed to writing the article, and takes responsibility for the concepts expressed in the article.

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The authors report no conflicts of interest.

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