

The impact of COVID-19 on blood safety and availability in the Islamic Republic of Iran

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Abstract

Background: The COVID-19 pandemic has affected blood inventory and donation worldwide. The Islamic Republic of Iran was among the first countries to report the COVID-19 pandemic and it faced a significant blood shortage during the first weeks of the pandemic.

Aims: We aimed to evaluate the impact of COVID-19 pandemic on the number, type, and safety of blood donations, comparing the periods before and during the pandemic.

Methods: This retrospective study evaluated data from all volunteers who attended the blood transfusion centres in the Islamic Republic of Iran from March to December 2020 (during the COVID-19 pandemic) and during the same period in 2019, i.e. pre-pandemic. Data on the number of blood collections, confirmed transfusion transmissible infection marker test results, and donor demographic information were collected from the Iranian Blood Transfusion Organization integrated donor database.

Results: Total blood donations decreased by 8.38%. The number of first-time, lapsed, and female blood donors increased by 4.41%, 0.17%, and 0.90% respectively. Regular blood donation decreased by 4.58%. The distribution of the 3 main blood products, red cell concentrate, frozen fresh plasma and platelets, decreased by 7.86%. All changes were statistically significant. The prevalence rates of hepatitis C virus and hepatitis B surface antigen increased significantly during the pandemic.

Conclusion: COVID-19 had a negative effect on blood safety and availability in the Islamic Republic of Iran. To improve blood supply and enhance regular blood donation, the Iranian Blood Transfusion Organization needs to reassure blood donors of the safety and hygiene measures being observed at blood collection sites.

Keywords: COVID-19, blood donation, donors, blood safety, blood transfusion, Iran

Citation: Divkolaye N; Arabkhaeali A; Hajibeigi B; Eshghi P. The impact of COVID-19 on blood safety and availability in the Islamic Republic of Iran. *East Mediterr Health J.* 2022;28(11):823–828. <https://doi.org/10.26719/emhj.22.080>

Received: 15/09/21; accepted: 29/06/22

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Introduction

The World Health Organization declared a pandemic status for COVID-19 on 11 March 2020. On 19 February 2020, the Islamic Republic of Iran reported its first confirmed cases of COVID-19. As of 19 February 2021, more than 7 million confirmed coronavirus cases and almost 136 000 deaths had been reported by the Ministry of Health and Medical Education (1).

The COVID-19 pandemic caused a worldwide blood inventory shortage and a significant reduction in blood donation. In the United States of America (USA), nearly 4000 American Red Cross blood drives were cancelled, representing approximately 130 000 fewer donations (2). A significant drop in blood donors was reported in Zhejiang Province in China, up to 67% during the first weeks of the pandemic (3). While this shortfall was less serious in countries such as Canada (30%) and Greece (36%) (4), some African countries reported up to 80% decrease in blood collection (5). Among the Eastern

Mediterranean Region Member States, the reduction in blood supply in the early stages of the pandemic ranged from 10% to 75% (6). Reduced in-house collections and cancellation of blood drives as well as public fear of contracting COVID-19 contributed to the decrease in donations in this region. This gap was partly filled by a reduction in demand due to the cancellation of elective surgeries and the unwillingness of patients to be referred to hospitals because of fear of contracting COVID-19 (7). However, blood services reported that blood utilization returned almost to the same levels shortly after the critical phase of the pandemic (8).

During the first 8 weeks of the pandemic in the Islamic Republic of Iran, which has a centralized blood transfusion organization, the number of blood donations decreased by about 29.4%. By implementing emergency and precautionary measures, the number of donations gradually increased, from 23 465 to 29 665 blood units (26.4%) within the next 2 weeks. Improving the online blood donation appointment system, changes in the

eligibility criteria for blood donation, interacting with hospitals to better manage blood wastage, and engaging with social media may have contributed to this increase (9).

Some studies showed that the COVID-19 pandemic may have had an impact on the type (first-time/regular) and demographic profile of blood donors as well as on blood safety (10–12). In a 2021 study, it was found that the numbers of first time and female blood donors increased in the Islamic Republic of Iran during the pandemic compared to February to April 2019 and 2020 (11). A study conducted in the USA showed an increase in the number of female and middle-aged donors during the pandemic (10).

To further assess these possible changes, we compared the numbers, types and demographic characteristics of blood donors as well as the rates of transfusion-transmissible infections (TTIs) during the 10-month pre-pandemic and pandemic periods in the Islamic Republic of Iran.

Methods

This retrospective study was conducted at the Iranian Blood Transfusion Organization (IBTO). We included all volunteers ($n = 3\,307\,062$) who attended the blood collection centres for whole blood donation. All the data collected from March to December 2020 (during the COVID-19 pandemic) along with data from the same period in 2019 (pre-COVID) were collected from the IBTO integrated donor database.

The total number of blood collections, the total extent of the distribution of the 3 main blood products (red cell concentrate, frozen fresh plasma and platelets) to hospitals and health care centres, and demographic information such as type (regular, first, lapsed) and sex of blood donors were retrieved for the study periods. A regular blood donor is one who donates at least 2 times a year; a lapsed blood donor is one who has a record of blood donation but has not made any donation in the past year.

Test results from all donations received during the 2 study periods were used to report TTI markers. Reported rates (per 100 000) included only confirmed reactive results using ELISA tests in 2019 and

electrochemiluminescence and chemiluminescence tests in 2020 after a reactive screening test for human HBsAg, anti-hepatitis C virus antibody (anti-HCV Ab) and HIV antigen/antibody (HIV Ag/Ab).

Comparisons for total blood donations and distribution of total blood products were carried out for the study periods in 2019 and 2020. Chi-square testing (*RStudio Team*, 2020) was used to compare TTI markers for the corresponding periods in 2019 and 2020. Odds ratio (OR) and 95% confidence intervals were calculated. P -value < 0.05 was considered statistically significant.

The study was approved by the ethical committee of the Iranian High Institute for Research and Education in Transfusion Medicine.

Results

In total, 1 581 174 blood donations were made during the 10 months of the COVID-19 pandemic in the Islamic Republic of Iran, indicating an 8.38% reduction compared with the same period pre-pandemic in 2019 (1 725 882) (Table 1).

First-time blood donors accounted for 15.79% (248 631) of these donations, an increase of 4.41% during the pandemic period in 2020 ($P < 0.001$) (Table 1). The share of lapsed blood donors was slightly higher, from 28.98% in 2019 to 29.15% in 2020 ($P < 0.001$). Conversely, the share of regular donors decreased from 59.64% to 55.06% (4.58% reduction) during the study period ($P < 0.001$). However, the number of female blood donors during the study period in 2020 was 81 856 (5.05%), an increase of 0.90% over the same period in 2019 (4.29%) ($P < 0.001$). The participation of female blood donors was the highest since the 5.16% recorded in 2012.

Altogether, 2 755 708 allotments of the 3 main blood products (red cell concentrate, frozen fresh plasma and platelets) were distributed to the hospitals during March–December 2020 (Table 2). Compared with the same period in 2019, this shows a 7.86% total reduction ($P < 0.0001$). However, the request/distribution ratio was 83.00% and 86.42% during the 2 study periods, indicating that hospitals and health care centres did not face any shortage in their needs; this was mainly due to the cancellation of elective surgeries.

Table 1 Distribution of blood collection according to type in the Islamic Republic of Iran pre- and during the COVID-19 pandemic, 2019/2020

Type of blood donor	Date		% change ^a +/-
	Mar–Dec 2019 (No.)	Mar–Dec 2020 (No.)	
Regular	1 029 326	870 661	-15.4
Lapsed	500 218	460 876	-7.8
First time	196 338	249 637	+27.0
Total blood collections	1 725 882	1 581 174	-8.38
Female blood donors	73 866	81 856	+10.0

^aNote: in this column we compared the growth rate between the 2 years, regardless of their relation to the total donor population.

Table 2 Comparison of number of blood products distributed in the Islamic Republic of Iran before and during the COVID-19 pandemic, 2019/2020

Blood product	Mar–Dec 2019 (No.)	Mar–Dec 2020 (No.)	% change +/-
Red cell concentrate	1 617 224	1 506 984	-6.8
Platelets	828 200	733 815	-10.0
Frozen fresh plasma	546 278	504 910	-7.5
Total	2 990 702	2 755 708	-7.8

The prevalence of HIV markers among blood donors was 0.0028% in 2019 (Table 3); this increased non-significantly to 0.0038% in 2020 ($P = 0.129$). The prevalence of human T-lymphotropic virus was relatively unchanged. However, the prevalence of HCV and HBsAg increased significantly ($P < 0.05$) in 2020 compared with the same period in 2019, from 0.016% to 0.020% and 0.036% to 0.045% respectively.

Discussion

The COVID-19 pandemic greatly affected the number and type of blood donations in the Islamic Republic of Iran. While it caused a significant reduction in the number of blood collections from regular donors, the share of first-time, lapsed and female donors increased.

Blood shortage during the 10 months studied was reported as 8.38%. Although IBTO filled the initial shortfall, the fear of infection at collection sites and the government's lockdown measures had an impact on the number of donors. The rate of reduction was lower than the average shortfall rate worldwide and in the World Health Organization Region for the Eastern Mediterranean considering estimates that the COVID-19 pandemic reduced blood supply by 20-30% across all 6 World Health Organization regions (13). Similarly, during the influenza pandemic in 2009, 10-30% fewer blood donations were recorded worldwide (14). A recent study in Europe found that almost half of the donors reported

fewer donations than during the normal situation, which shows a concerning drop in the number of blood collections during the COVID-19 pandemic (15). However, research conducted in the USA showed an improvement for blood centres during the COVID-19 pandemic; a recent study reported a significant increase in blood donations during the pandemic compared with the pre-pandemic period (16). Launching targeted blood donation campaigns for traditional blood donors (first, repeat and lapsed) and offering to test all allogeneic donations for SARS-CoV-2 antibodies were 2 of the main reasons for this increase. Although offering to test for SARS-CoV-2 antibodies did not adversely affect blood safety, it seems the offer acted as an incentive for blood donors in the USA.

Considering the results of a study that showed a low rate of COVID-19 deferrals among Iranian donors, it seems that lower blood collection during the pandemic was related to other factors (11). The findings of another study from the Eastern Mediterranean Region showed that representatives of most countries believed that fear of infection was the factor contributing the most to a decrease in blood collections (6). Australian researchers believe that during the pandemic blood donors needed to be reassured that all safety measures were in place to protect them from infection in public places such as collection sites and blood centres (17). These findings have also been confirmed in Hong Kong (18).

As in other disaster situations, the number of female and first-time blood donors increased significantly in the

Table 3 Prevalence of transfusion transmissible infection markers in donated blood in the Islamic Republic of Iran before (2019) and during (2020) the COVID 19 pandemic

Item	Year, method		Odds ratio	95% CI	P-value
	2019, ELISA	2020, ECL & CL			
Donations (No.)	1 725 882	1 581 180			
Infection marker	No. (%)	No. (%)			
HIV	48 (0.0028)	60 (0.0038)	1.36	0.93–1.99	0.1299
HCV	278 (0.0161)	316 (0.0200)	1.24	1.06–1.46	0.0097
HBV	629 (0.0364)	708 (0.0448)	1.23	1.10–1.37	0.0002
HTLV	146 (0.0085)	138 (0.0087)	1.03	0.82–1.30	0.8387

ELISA = enzyme-linked immunosorbent assay.

ECL = electrochemiluminescence.

CL = chemiluminescence.

CI = confidence interval.

HIV = human immunodeficiency virus.

HCV = hepatitis C virus.

HBV = hepatitis B virus.

HTLV = human T-lymphotropic virus.

Islamic Republic of Iran during the COVID-19 pandemic. During the 2 days following the burning down of the Plasco Building in Tehran, the proportion of first-time and female blood donors increased by 62.7% and 12.0% respectively (19). Conversely, the proportion of regular blood donors decreased by 25%. This pattern was also evident after the Bam earthquake in the Islamic Republic of Iran, during which the number of first-time and female blood donors was significantly higher than normal (20). A study from the USA reported an increase in first-time, lapsed and female blood donors during the COVID-19 pandemic (17).

Another reason for a higher rate of female blood donations during 2020 is related to the centralization of IBTO activities to encourage more females to donate blood by launching targeted campaigns such as involving the Women's Basij Organization.

The prevalence of all TTIs among blood donors increased during the pandemic in the Islamic Republic of Iran. However, the changes were only statistically significant for HBsAg and HCV. Our findings confirm the results of other studies in which the prevalence of TTI markers increased after the disasters, mainly due to an increase in first-time donors (20,21). It is known that first-time blood donors have a 2.5-3.5-fold greater

residual risk for TTI markers than repeat donors, and any increase in the number of first-time blood donors may raise the prevalence of these markers (22). However, the temporary influx of reactive and first-time blood donors during the pandemic seems not to have had a great or enduring impact on blood safety in the country since the slight increases in the prevalence of HIV and human T-lymphotropic virus were not statistically significant.

Conclusion

In conclusion, to maintain a stable blood supply, IBTO needs to regain the confidence of its regular donors by encouraging them to keep donating blood during the COVID-19 pandemic and reassuring them of the safety and adherence to hygiene protocols at collection sites. IBTO should increase its mobile collection sites to facilitate donations by donors who may be reluctant to travel long distances to collection sites during the pandemic. At the same time, an increase in the number of first-time and female blood donors is an opportunity for IBTO to retain those with low residual risk for TTIs in the blood supply chain.

Further assessment is recommended to evaluate the motives of those blood donors who donated and those who avoided donating during the COVID-19 pandemic.

Acknowledgement

We thank the Blood Donor Recruitment and Retention and the Planning and Programming departments of IBTO for extracting the necessary data from the IBTO integrated database.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Competing interests: None declared.

Impact de la COVID-19 sur la sécurité transfusionnelle et la disponibilité du sang en République islamique d'Iran

Résumé

Contexte : La pandémie de COVID-19 a affecté l'inventaire et les dons de sang dans le monde entier. La République islamique d'Iran a été l'un des premiers pays à signaler la pandémie de COVID-19 et a été confrontée à une importante pénurie de sang au cours des premières semaines de la pandémie.

Objectifs : Notre objectif était d'évaluer l'impact de la pandémie de COVID-19 sur le nombre, le type et la sécurité des dons de sang, en comparant les périodes avant et pendant la pandémie.

Méthodes : La présente étude rétrospective a évalué les données de tous les volontaires qui se sont rendus dans les centres de transfusion sanguine de la République islamique d'Iran entre mars et décembre 2020 (pendant la pandémie de COVID-19) et durant la même période en 2019, c'est-à-dire avant la pandémie. Des données sur le nombre de collectes de sang, les résultats des tests de marqueurs d'infections transmissibles par la transfusion confirmés ainsi que des informations démographiques des donneurs ont été collectées dans la base de données intégrée des donneurs de l'Organisation iranienne de transfusion sanguine.

Résultats : Le total des dons de sang a diminué de 8,38 %. Le nombre de nouveaux donneurs, de donneurs inactifs et de femmes donneuses de sang a augmenté respectivement de 4,41 %, 0,17 % et 0,90 %. Le don de sang régulier a diminué de 4,58 %. La distribution des trois principaux produits sanguins – concentré érythrocytaire, plasma frais

congelé et plaquettes – a diminué de 7,86 %. Tous les changements étaient statistiquement significatifs. Les taux de prévalence du virus de l'hépatite C et de l'antigène de surface de l'hépatite B ont considérablement augmenté pendant la pandémie.

Conclusion : La COVID-19 a eu un effet négatif sur la sécurité transfusionnelle et la disponibilité du sang en République islamique d'Iran. Afin d'améliorer l'approvisionnement en sang et d'augmenter les dons de sang réguliers, l'Organisation iranienne de transfusion sanguine doit rassurer les donateurs de sang quant aux mesures de sécurité et d'hygiène observées sur les sites de collecte de sang.

أثر كوفيد-19 على مأمونية الدم وتوفره في جمهورية إيران الإسلامية

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الخلاصة

الخلفية: أثرت جائحة كوفيد-19 على مخزون الدم والتبرع به في جميع أنحاء العالم. وكانت جمهورية إيران الإسلامية من أوائل البلدان التي أبلغت عن إصابات في جائحة كوفيد-19، وواجهت نقصاً كبيراً في الدم خلال الأسابيع الأولى من الجائحة.

الأهداف: هدفت هذه الدراسة إلى تقييم تأثير جائحة كوفيد-19 على عدد التبرعات بالدم وأنواعها ومأمونيتها، والمقارنة بين ما قبل الجائحة وفي أثنائها.

طرق البحث: قيّمت هذه الدراسة الاستراتيجية بيانات جميع المتطوعين الذين حضروا إلى مراكز نقل الدم في جمهورية إيران الإسلامية في المدة من مارس/ آذار إلى ديسمبر/ كانون الأول 2020 (في أثناء جائحة كوفيد-19) وخلال المدة نفسها في عام 2019، أي قبل حدوث الجائحة. وجمعت بيانات عن عدد عمليات جمع الدم، ونتائج اختبارات علامات العدوى المؤكدة قابلية انتقالها عبر الدم، والمعلومات السكانية الخاصة بالجهات المانحة، من قاعدة البيانات المتكاملة للجهات المانحة التابعة لمنظمة نقل الدم الإيرانية.

النتائج: انخفض إجمالي التبرع بالدم بنسبة 8.38%. وارتفع عدد المتبرعين بالدم لأول مرة، وعدد المتبرعين الذين انقضى عامان على آخر تبرع لهم، والمتبرعات الإناث بنسبة 4.41%، و0.17%، و0.90% على الترتيب. وتراجع التبرع المنتظم بالدم بنسبة 4.58%. وانخفض توزيع 3 منتجات رئيسية من الدم، هي: تركيز الخلايا الحمراء، والبلازما الطازجة المجمدة، والصفائح الدموية، بنسبة 7.86%. وكانت جميع التغييرات ذات دلالة إحصائية. وقد زادت معدلات انتشار فيروس التهاب الكبد C والمستضد السطحي للتهاب الكبد B زيادة كبيرة خلال الجائحة.

الاستنتاجات: أثر كوفيد-19 تأثيراً سلبياً على مأمونية الدم وتوفره في جمهورية إيران الإسلامية. ولتحسين إمدادات الدم وتعزيز التبرع المنتظم بالدم، تحتاج منظمة نقل الدم الإيرانية إلى طمأننة المتبرعين بالدم بشأن تدابير المأمونية والنظافة الصحي التي يجري اتباعها، والحرص عليها في مواقع جمع الدم.

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