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Original article

The impact of COVID-19 pandemic on blood supplies and transfusion services in Eastern Mediterranean Region

Impact de la pandémie du COVID-19 sur les services d'approvisionnement en sang et de transfusion sanguine dans la région de la Méditerranée orientale

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ABSTRACT

Background. – Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has spurred a global health crisis. The safety and supply of blood during this pandemic has been a concern of blood banks and transfusion services as it is expected to adversely affect blood system activities. We aim to assess the situation in the Eastern Mediterranean Region (EMR) during the first months of the pandemic.
Materials and methods. – A survey was designed to address blood supply, transfusion demand, and donor management during the coronavirus disease-19 (COVID-19) pandemic. Medical directors of different blood banks were invited to participate.
Results. – A total of 16 centers participated with representation from 15/19 countries in the region. In total, 75% were from national blood banks. Most centres had a decrease in the blood supply, ranging from 26–50%. Representatives from 14 countries (93.3%) believed that public fear has contributed to a decrease in donations. Most centres ($n = 12$, 75%) had a reduction in transfusion demand, while those who did not, reported heavy involvement in treating patients with underlying haemoglobinopathies and haematological malignancies. Half of the centres activated their contingency plans. Four centres had to alter the blood donor eligibility criteria to meet demands. All centres implemented donor deferral criteria in relation to SARS-CoV-2, but were variable in measures to mitigate the risk of donor and staff exposure.

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Conclusion. – Blood services in the region faced variable degrees of blood shortages. We summarize lessons learnt during this pandemic for the blood banks to consider to plan, assess, and respond proportionately to future similar pandemics.

1. Introduction

The coronavirus disease 2019 (COVID-19) is a worldwide pandemic caused by the Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1,2]. On the 29th of January, WHO reported the first cases in the Eastern Mediterranean Region (EMR) in the United Arab Emirates (UAE) [3]. By that time, the total of numbers confirmed globally has reached 6065 cases, involving 68 countries outside China [3]. There was no indication of the source of infection, however, the report of first cases coincides with the opening of the Arab Health Exhibition and Congress, in Dubai on 27-30th January, which included more than 4250 medical manufacturers from all around the world [4,5]. The second country to report cases was Egypt, which was also the first country to report from the African continent [6]. This was followed by the emergence of the virus in other countries in EMR (Appendix 1Supplement table). By 1st March, there were 11 countries had reports of SARS-CoV-2 infection. WHO risk assessment at that stage was very high regionally and globally [7]. By the 8th of April, all EMR countries had evidence of local transmission of the virus [8]. Yemen was the last country to report confirmed cases [9]. By the 30th of April, there was a total of 182,417 confirmed cases and 7447 deaths reported in the region, the highest being in Iran with a total of 93,657 cases and 5957 deaths [10]. Most countries had a cluster of cases reported, while community transmission was evident in Iran, Tunisia, and Syrian Arab Republic [10].

Based on experience from other viral pandemics [11,12], the COVID-19 pandemic was expected to adversely affect the blood system activities and reduce blood supply as an unintended consequence of social distancing measures on blood donation activities. Influenza and coronaviruses share the low risk of transmission by transfusion, but were predicted to have remarkable effects on the blood collection [13]. During the Severe Acute Respiratory Syndrome pandemic, the blood supply in Beijing was significantly compromised, as donation drives could not be held in public places, and donors were worried about contracting the virus at donation centres. Assistance was required through shipping blood in from centres in other less affected parts of the country [11]. A report from Japan described a rapid decrease in the number of donors by 21% within one week of the influenza A (H1N1) pandemic necessitating vigorous donor mobilization [14]. Other major challenges that blood centres face during such a pandemic is the recruitment of healthy blood donors, ensuring staff, donor, and patient safety, and inventory management.

In anticipation of such an impact with the COVID-19 pandemic, the WHO has released an interim guidance on maintaining a safe and adequate blood supply during the COVID-19 pandemic [15]. There is a need that the transfusion medicine professionals undertake an active role in risk communication and provide data to policymakers to address the effectiveness of their contingency plans. Sharing knowledge and policies among regional transfusion networks and international organizations during previous viral pandemics was found to be helpful to ensure access to the best recommendations and practices at the time of a pandemic [12]. The aim of this survey is to assess the impact of the COVID-19 pandemic on the blood supply, transfusion demand, and donor management in the EMR during the first months of the pandemic.

2. Material and methods

The draft survey was developed by a transfusion consultant to address donor, blood supply, and transfusion demand management during the COVID-19 pandemic. The survey was reviewed/revised with input from two transfusion experts, including an expert at the WHO Eastern Mediterranean Regional Office (EMRO). The survey was created by googleforms and tested before distribution. A total of 22 blood bank medical directors from 19 EMR countries were invited to participate. Invitations were sent by email and the survey was shared electronically with those who agreed to participate. All responses were recorded electronically. SPSS version 23 was used for data analysis. Frequency tables were used to display percentages for categorized variables. Ethical approval was obtained from the Ethics Committee at the College of Medicine and Health Sciences at the Sultan Qaboos University, Oman.

3. Results

A total of 16 representatives responded (overall 72% response rate). The survey responses were received between the 21st and 31st of May. Most of the centres ($n = 12$, 75%) were national blood banks, while the rest were hospital-based (Table 1). All blood banks collect blood from voluntary blood donors, and the majority had family replacement donors ($n = 14$, 88%). Most centres were self-sufficient ($n = 11$, 69%), while the rest had other sources of blood. Five centres (31%) had reagent shortages and loss of staff due to COVID-19 illness.

3.1. Blood supplies and demands during COVID-19

Most centres had a decrease in the blood supply during the first month of the pandemic, ranging between 10–75%. This was due to different factors including decreased in-house collections and cancellation of blood drives due to the closure of universities and institutions ($n = 12$, 75%) (Table 2). Representatives from 14 countries believed that public fear of contracting COVID-19 contributed to the decrease in donations. Most of these countries had their governments actively asking the public to remain home. Two centres did not face blood shortages. These were able to maintain blood supply through intensifying donation drives, conducting drives in military settings, and intensifying marketing and donor recruitment including mobilizing donors from healthcare workers. The centre at the UAE utilized a sports hall for blood donation while maintaining physical distancing. The centre at Morocco has created a crisis committee early in the pandemic to monitor closely the stock status, consumable and reagent needs for all regional centres. A hotline for public inquiries was also created.

Most centres ($n = 12$, 75%) had a reduction in transfusion demand ranging between 26–75%. The main factors were cancellation of elective surgeries ($n = 12$, 75%), decreased admissions to the hospitals ($n = 10$, 63%), and closure of hospitals/wards ($n = 8$, 50%). Three centres reported increased blood demands by 10–25% along with the decrease in blood supply (Bahrain, Lebanon, Yemen), while two (Oman and Libya) reported similar demand levels despite the cancellation of surgeries. All these five centres shared the need

Table 1
Characteristics of the blood banks involved in the survey and blood supply and demand status during the pandemic.

Country	Type of centre	Donation type	Other blood supply source	Degree of decreased blood supply[a] (%)	Degree of decreased demand[a] (%)	Confirmed cases (deaths)[b]
Islamic Republic of Iran	National	Voluntary donation	No	26–50	< 10	148,950 (7734)
Saudi Arabia	Hospital-based	Voluntary donation Family replacement	No	26–50	26–50	83,384 (480)
	Hospital-based	Voluntary donation Family replacement Directed donation	No	51–75	10–25	
Pakistan	National	Voluntary donation Family replacement	Regional Blood Centers	26–50	10–25	69,496 (1483)
UAE	National	Voluntary donations Directed donation	No	< 10	< 10	33,896 (262)
Qatar	National	Voluntary donation Family replacement Directed donation	No	10–25	26–50	55 262 (36)
Bahrain	Hospital based	Voluntary donation Family replacement Directed donation	Other governmental blood bank	10–25	Demand increased by 10–25%	10,793 (17)
Oman	Hospital based	Voluntary donation Family replacement	Other governmental blood bank	10–25	Demand remained the same	10,423 (42)
Morocco	National	Voluntary donation Family replacement	No	NA	26–50	7780 (204)
Sudan	National	Voluntary donation Family replacement Directed donation	No	26–50	26–50	4800 (262)
Lebanon	National	Voluntary donation Family replacement	No	10–25	Demand increased by 10–25%	1191 (26)
Tunisia	National	Voluntary donation Family replacement	Other governmental blood bank	26–50	26–50	1076 (48)
Jordan	National	Voluntary donation Family replacement Directed donation	No	51–75	10–25	734 (9)
Yemen	National	Voluntary donation Family replacement Directed donation	No	< 10	Demand increased by 10–25%	314 (78)
Libya	National	Voluntary donation Family replacement	No	26–50	Demand remained the same	130 (5)
Palestine	National	Voluntary donation Family replacement	Other governmental blood bank Private blood banks	26–50	10–25	626 (5)

UAE; United Arab Emirates; NA; not applicable.
[a] Estimation during the first month of pandemic.
[b] WHO situation report on day of survey completion [17].

Table 2
Factors for the decline in the blood supply.

Country	Cancellation of blood drives	Decrease in inhouse blood donation	Social distanc-ing/lockdown	Closure of universities and institutions	Decrease number of eligible donors due to COVID-19 related factors	Governmental requests to the public to stay at home	Public fear from contracting COVID-19
Oman[a]	√			√		√	√
Tunisia		√	√	√		√	
Jordan	√	√	√	√		√	√
Sudan	√	√		√		√	√
Palestine	√	√	√	√		√	√
Saudi Arabia[a]	√	√	√			√	√
Saudi Arabia[a]	√	√	√	√	√	√	√
UAE	√	√		√	√	√	√
Islamic republic of Iran						√	√
Morocco	√	√	√	√		√	
Qatar	√	√	√	√	√	√	√
Libya		√		√		√	√
Yemen	√			√			√
Pakistan	√	√	√	√			√
Lebanon	√	√	√				√
Bahrain[a]	√	√		√	√		√

UAE; United Arab Emirates; COVID-19; coronavirus disease-19.
[a] Highlights practices for hospital based blood banks and may not reflect other blood banks in the reporting country.

for supporting patients with underlying haemoglobinopathies, while some were involved in treating patients with haematological malignancies. In addition, all these five centres had donor sources from voluntary non-renumerated and replacement blood donations. The reporting centre in Bahrain is a hospital-based blood bank, and most of the demand was for patients with underlying haematological and solid malignancies, patients undergoing bone marrow transplantation and surgical oncology patients. The workload in this centre during the pandemic has increased due to an increased number of patient referrals for continuation of care from a hospital that was dedicated for treating COVID-19 patients. As a result, the demand for blood has increased at the time the centre had challenges in blood supply due to cancellation of blood drives, social distancing and increased donor deferral due to either COVID-19 infection or direct contact with infected patients.

In Lebanon, the blood bank system includes the Lebanese Red Cross and hospital-based collections. The demand was mainly for patients with underlying haemoglobinopathies, haematological and solid malignancies and surgical/obstetrical patients. In Yemen, where the blood bank system is fragmented and includes a national-based and hospital-based blood establishments, many hospitals had to close due to COVID-19 pandemic. However, the care of patients with haemoglobinopathies was continued. As a result of decrease donor collections in the hospitals, the requests to supply blood from the national blood bank have increased. This was augmented by challenges in donor recruitment due to existing conflict in the country, limited resources, financial constraints in addition to public fear from blood donation during the pandemic and cancellation of blood drives.

The centre from Oman is a hospital-based blood bank in a reference tertiary-based hospital treating a variety of adult and paediatric patients, including patients with haematological malignancies and haemoglobinopathies. It is also the only allogenic bone marrow transplant centre in the country. Most of the demand during this period was for patients with underlying haemoglobinopathies and haematological malignancies including bone marrow transplant recipients. The centre in Libya is a national-based blood bank.

3.2. Procedures are undertaken in facing demands

All centres have applied measures to increase donations and overcome blood supply shortages (Table 3). These measures were thought to have a variable degree of effectiveness in maintaining the blood supply in participating institutions. Most centres ($n = 14$, 88%) utilized social media and volunteer blood donor groups in mobilizing donors; while more than half ($n = 10$, 63%) used phone text messages and obtained assistance of public figures and leaders in the society. Radio, TV interviews, and calling the donors by phone were used by 65% of centres. Five centres have gone as far as providing donor transportation &/or home visits for blood collection. More than half of the centres had to activate their emergency & contingency plans. Four centres altered the blood donor eligibility criteria (in Oman, Palestine, Bahrain, and Saudi Arabia). The centre in Oman reduced the inter-donation deferral criteria for male donors from 12 weeks to 8 weeks provided that finger prick haemoglobin upon donor return was $\geq$ 12.5 g/dL. Reducing the inter-donation interval was also applied at the centres in Bahrain and Palestine. In Saudi Arabia, a hospital-based blood bank reduced the deferral interval for individuals who underwent piercing and tattoo procedures from 12 to 3 months.

Ten centres (63%) had implemented measures to minimize wastage of blood components if collected at levels exceeding demands; including redistribution of blood to centres in need ($n = 6$), active inventory management, avoiding recruitment of donors of blood types not in need ($n = 4$) and extending shelf-life of platelets ($n = 4$).

3.3. Donor and staff safety

Tables 4 and 5 describe the procedures that were undertaken for donor and staff management during the COVID-19 pandemic respectively. All centres implemented donor deferral criteria based on a history of fever, respiratory symptoms, and contact with someone suspected or confirmed to be infected with SARS-CoV-2. All centres except for the one in Sudan included history of international travel within 28 days as a deferral criterion.

Measures undertaken to mitigate the risk of donor exposure were variable. Where all centres instated physical distancing of the donors, most centres applied hand washing/use of alcohol before and after donation, measuring donor temperatures, and the use of surgical masks ($n = 14$, 88%). Nine centres used an appointment system for donation (56%). The National blood transfusion organization in Iran installed a separator glass at donor reception to physically separate the donors from the staff at the time of registration. The centre in the UAE instated barriers to separate staff in

Table 3
Measures to overcome blood supply shortages.

Country	Change in donor eligibility criteria	Collaboration with military and governmental institutions	Continuation of donation drives	Home blood collection	Donor transportation	Extending shelf-life of platelets	Blood supply from unaffected cities	Activation of contingency plans	Degree of effectiveness
Oman[a]	√	√				√		√	Very much
Tunisia					√			√	Somewhat
Jordan		√	√		√			√	Somewhat
Sudan			√						Very much
Palestine	√	√		√			√	√	Very much
Saudi Arabia[a]	√							√	Somewhat
Saudi Arabia[a]		√		√		√			Somewhat
United Arab Emirates			√	√	√	√		√	Very much
Islamic republic of Iran							√	√	Very much
Morocco		√	√		√				Very much
Qatar		√	√			√		√	Somewhat
Libya			√					√	Somewhat
Yemen		√							Neutral
Pakistan		√	√	√	√		√	√	Very much
Lebanon							√		Somewhat
Bahrain[a]	√	√	√						Very much

UAE; United Arab Emirates.
[a] Highlights practices for hospital based blood banks and may not reflect other blood banks in the reporting country.

Table 4
Procedures that were undertaken for donor management during the COVID-19 pandemic.

Country	Physical distancing between donors	Self-deferral if feeling unwell or for history of exposure	Instating donation appoint-ment system	Washing hands/use of alcohol pre- and post-blood donation	Using surgical masks for the donors	Using N95 masks for the donors	Measuring donor's tempera-ture	Donor education
Oman[a]	√	√	√	√	√		√	√
Tunisia	√	√		√	√			
Jordan	√	√		√	√	√	√	√
Sudan	√	√		√	√			√
Palestine	√	√			√		√	
Saudi Arabia[a]	√		√	√			√	√
Saudi Arabia[a]	√	√	√	√	√		√	√
United Arab Emirates	√	√	√	√	√		√	√
Islamic Republic of Iran	√	√	√	√	√		√	√
Morocco	√	√	√	√	√		√	√
Qatar	√	√		√	√		√	√
Libya	√	√		√	√		√	√
Yemen	√	√					√	√
Pakistan	√	√	√	√	√		√	√
Lebanon	√	√	√	√	√		√	√
Bahrain[a]	√	√	√	√	√		√	√

UAE; United Arab Emirates.
[a] Highlights practices for hospital based blood banks and may not reflect other blood banks in the reporting country.

Table 5
Procedures that were undertaken for staff management during the COVID-19 pandemic.

Country	Staff self-deferral if feeling unwell or for history of exposure	Measuring staff temperature	Use of surgical masks for the staff	Use of N95 masks for the staff	Reducing number of staff on shifts
Oman[a]	√		√		
Tunisia	√		√		√
Jordan	√			√	√
Sudan	√		√		√
Palestine	√	√	√		
Saudi Arabia[a]	√		√		√
Saudi Arabia[a]	√	√	√		√
United Arab Emirates	√	√	√		√
Islamic Republic of Iran	√	√	√	√	√
Morocco	√		√		√
Qatar	√	√	√		
Libya	√		√		√
Yemen	√	√	√		
Pakistan	√	√	√	√	√
Lebanon	√	√	√		√
Bahrain[a]	√	√	√	√	√

UAE; United Arab Emirates.
[a] Highlights practices for hospital based blood bank and may not reflect other blood banks in the reporting country

different units of the lab, instated a shift change procedure to minimize staff contact, and performed screening of staff for SARS-CoV-2 by nasopharyngeal swabs and serological testing. As for measures to mitigate the risk of staff exposure, all blood banks applied staff self-deferral, reduced the number of staff on shift ($n = 13$, 81%), and staff temperature measurement ($n = 10$, 63%). Most centres instated the use of surgical masks for the staff ($n = 15$; 94%), while some offered N95 masks as well ($n = 4$, 25%).

All surveyed blood banks applied the donor deferral criteria concerning COVID-19 exposure or infection. Nine centres applied criteria of retrieval of in-date blood products based on a report of post-donation illness in the donor (56%). The centres in Pakistan and Morocco had a quarantine system for plasma with late release based on the absence of reported symptoms. Pathogen inactivation of platelets was in use in three centres (two centres in Saudi, one in Libya) and of plasma & platelets in two national blood bank centres in UAE & Qatar. Pathogen inactivation was in use for convalescent plasma trials in UAE, Oman, Qatar, and Saudi Arabia. None of the centres initiated SARS-CoV-2 molecular or serological testing on blood donors. The participants summarized lessons learnt on handling similar threats in the future (Table 6).

4. Discussion

Responding to threats to blood banks and transfusion services entails assessing the risk of the threat to the blood supply and the recipients' health, and communicating this information to blood donors, recipients, clinicians, and the community [16]. At the time of survey completion, the absolute number of confirmed COVID-19 cases in EMR reached 505,001 cases; ranging from 122 (Syrian Arab Republic) to 148,950 (Islamic Republic of Iran) [17]. The decrease in the blood supply during the first month of the pandemic in the reporting countries was variable and likely reflected the degree of community spread of the virus and the governmental actions. The degree of supply change depends on the organizational structure of the blood supply system and the sources of blood, which is variable among the countries in the region. Different factors can adversely affect the number of blood donors during a viral pandemic. The

Table 6
Lessons learnt from the perspective of the blood bank medical directors to handle similar viral threats in the future.

Donor mobilization
Assess requirements daily and mobilize blood donors based on specific components in need
Utilize spacious community centres (such as sport halls) as temporary donation sites
Assess the possibility of collecting blood donations from areas/cities that are less affected by the pandemic
Initiate measures to mobilize regular and repeat blood donors
Utilize volunteers and community groups in mobilizing blood donors
For hospital based blood banks, mobilize hospital staff for blood donation early in the pandemic before increased exposure to infected patients
Assess regularly governmental decisions on travel restriction that can impact donor mobility
Maintain communication with the authorities to ensure maintaining donor access to the donation sites at the time of the lockdown
Communication with the public
Be proactive in communicating with the public on the need for blood donors
Educate the public on who should not be attending donation sites (e.g. those who are febrile or in contact with patients)
Gain public confidence in the safety of blood donations with the measures in place
Utilize different communication channels to mobilize blood donors; such as text messages, TV, radio, etc.
Maintain strong continuous messages of the need for blood donors throughout the pandemic on TV and radio channels
Collaborate with telecommunication companies to reach out to the public using mass text-messaging
Use social media channels to promote blood donation and communicating the status with the public
Utilize different languages in educating and communicating with the public
Produce different educational materials in different languages to educate the public
Collaborate with public figures and influencers in reaching out to the public
Consider a hotline for addressing public concerns
Donor and staff safety
Instate a screening mechanism of blood donors including temperature checks before entry to the donation site
Minimize contact between staff in different sections in the laboratory and between different shifts
Ensure sufficient supply of personal protective equipment (e.g face masks) and hand sensitizers
Educate the donors on additional eligibility criteria applied during the pandemic
Enforce the application of the appointment system for blood donation
Limit access to donation sites to blood donors only
Ensure application of infection control measures in the donation sites and blood drives, and increase the frequency of cleaning
Consider the application of separators between the staff and the donors
Blood stock management
Instate a mechanism for donor reporting post-donation illness and maintain a procedure for managing donated units from these donors
Consider the possibility of obtaining supplies from areas/cities that are not affected by the pandemic
Closely monitor the blood inventory to maintain a sufficient blood supply
Collaborate with other blood banks to replenish blood stocks
Maintain a wide and regularly updated database of donors of different blood groups and phenotypes
Instate a redistribution program between blood banks to minimize wastage
Discuss with key stakeholders (including transfusion committee members) for measures to minimize blood use (such as cancellation of elective surgeries) and intensifying measures of patient blood management
Maintain continuous communication with the clinicians on the status of the bloodstock
Apply measures for transfusion services to screen for appropriateness of blood requests
Secure a sustainable and safe blood supply to meet transfusion demand for a certain group of patients such as patients with underlying haemoglobinopathies and haematological and solid malignancies
Staff management
Prepare your staff capacity for multi-tasking in the event of staff shortages
Minimize staff working in shifts as possible to minimize exposure and recover from fatigue
Maintain open communication with the staff and provide support throughout
Keep institution management aware of any loss in staff due to illness and request for a replacement
Reagents and equipment
Determine the safety level of reagents and consumables
Maintain a separate emergency stock of reagent and consumables with at least 3 months of expiry
Assess access of supplies at time of the lockdown and airport closures
Maintain communication with the authorities to ensure maintaining access of supplies
Have a backup plan for equipment emergency failure
Disaster and contingency plan
Have an alternative blood collection and testing facility
Consider the reduction of whole blood donation intervals for donors with robust haemoglobin levels who are able to can tolerate more frequent donations
Collaborate with other sectors for maintaining bloodstock e.g., the military and civil society
Establish a web-based infrastructure to coordinate stock management at a national level
Be upfront in controlling messages going into the social media and the community
Keep the clinicians and administration in perspective of the status on a regular basis
Establish/maintain a national, regional, and international collaboration with all concerned sectors
Review the blood bank contingency and disaster plans with the dynamics of the pandemic

traditional sources of volunteer blood donors such as universities are affected due to closures. Access to blood services is imposed by external factors such as social distancing and lockdown which can limit access to the blood banks. Donors are also reluctant to attend the blood bank for fear of being infected, and organizations may be reluctant to host donation drives as a measure to prevent community spread of the virus [12]. Donors can become ill or become committed to taking care of others which leads to their deferral from the donor pool.

There are few publications on the status of blood supply during the COVID-19 pandemic. A publication from China reported a significant decrease in blood donors reaching up to 67% [18]. This had led to different initiatives including organizing medical staff and patients' family members and friends to donate blood and sending out text messages to recruit blood donors [18]. On the other hand, a publication from Italy reported an initial 10% reduction in whole blood donations per week, which was followed by a campaign to encourage blood donation leading to a 12% increase in

whole blood collection [19]. A centre in the United States described a dramatic decrease in blood supplies during the first two weeks of the pandemic [20]. On the contrary, the national blood establishment in the Netherlands experienced an initial surge in the number of donations starting from the first week of the strict social distancing as a result of the national media that advocated for blood donation, and the start of research on testing blood donations for SARS-CoV-2 antibodies [21]. A recent international forum reported a variable range of expected shortages in blood supply in different transfusion services with some that did not expect blood shortages, such as the British, Danish, Spanish, and Korean blood services [22]. A publication from India summarized the challenges with regard to maintaining blood availability while ensuring workforce, sufficient supplies and staff safety due to shortage of personal protective equipment [23].

We report multiple factors for the blood supply challenges in different countries in the region during the first phase of COVID-19 pandemic, augmenting the existing challenges that the region is facing with regard to blood supply. Blood drives cancellation along with public fear from donation and social distancing measures appear to have the largest impact. Different countries in the region have existing challenges with regard to blood supply. For instance, the Lebanese healthcare system has a decentralized blood system and relies on the private sector for many services including transfusions [24,25]. Most of the national transfusion activities are carried out by the healthcare facilities while a quarter is carried out by the Lebanese Red Cross [24]. Different factors were attributed to difficulties in ensuring sufficient blood supply including the predominance of replacement donations, low rate of voluntary non-renumerated donations, and the existing pressures on the healthcare system due to the huge number of neighbourhood refugees [25]. Several of these factors have resulted in the reliance on the replacement family donation as a main source of blood [26]. Blood supply challenges were further worsened in the pandemic due to public fear from blood donation and the cancellation of blood drives. In Yemen, the blood transfusion services are provided mainly by the National Blood Transfusion and Research Center and the National Center of Public Health Laboratories. In addition, they are provided by public and private hospitals' blood banks with a predominance of family replacement donations [27]. The availability and safety of blood transfusion during humanitarian emergencies remain a major concern in the Region and WHO is working on providing technical assistance to the affected countries to implement the recommendations on the availability and safety of blood transfusion in these situations [28].

It was notable that different centres in the region experienced different degrees of decrease in transfusion demands. It is important to manage the demand for blood through patient blood management (PBM) principles. This includes the cancellation of elective surgeries and non-urgent procedures and lowering the transfusion threshold as appropriate [15]. However, the demand of other patient populations will persist, such as patients with underlying haemoglobinopathies and haematological malignancies. Therefore, different institutions should assess the situation based on the demographics of treated patients and available sources of blood. Maintaining good communication with the clinicians is important for the best utilization of available inventory. Contingency plans should be implemented with good communication with all involved parties and effective coordination with all stakeholders especially that the duration of the pandemic is unpredictable. Blood services should take steps to assess the situation continuously and respond accordingly. The plan needs to take into consideration several factors including the extent of SARS-CoV-2 spread, level of community circulation, quality of healthcare system, and cost-effectiveness of blood safety interventions [15].

We report here precautions that were applied in the blood banks in the region on managing the donors and staff based on international recommendations. These measures include donor deferral for at least 28 days for those who fully recovered from COVID-19, with a history of exposure or travel from areas with ongoing community transmission [15,29]. Educating the donors and the public of self-deferral and reporting immediately to the blood service if any symptoms arise is paramount. Information posters on who should and who should not donate blood should be posted in the donor facilities and spread through different media channels. Other important measures that should be taken at the donor centre include physical distancing between the donors to reduce the risk of transmission, the use of standard laboratory biosafety practices, and infection control measures [15,30–32]. Instating a triage station outside the donation room to screen donors for fever and signs/symptoms of COVID-19 can be considered. Donors may be provided with face masks and hand disinfectants before entering the blood collection area [12]. Temperature monitoring of the staff might be useful, and staff should be informed not to report to work if they are symptomatic. It is important to undertake measures to ensure the flow of blood donors while mitigating the risk of staff and donor exposure to the SARS-CoV-2 virus, through intensifying efforts for appointment scheduling. The blood centre should preferably follow national infection control measures.

Maintaining donor confidence in the safety of the blood donation environment and awareness of the need to continue donating blood is important. This information needs to be communicated to the public including measures undertaken to ensure donor safety even before donor numbers start to decline. There is a need to utilize a wide range of donor recruitment strategies and different communication channels to enable the service to tap into different segments of the society [12]. Testing of the blood supply is premature in the absence of cases of transfusion transmission or evidence of infectivity of the SARS-CoV-2 virus in blood collected from asymptomatic donors [15]. A recent study showed the effectiveness of pathogen reduction technology against SARS-CoV-2 [33]. However, the utility of using pathogen inactivation to reduce transfusion transmission need to be studied.

The study has some strengths. This is the first study to assess the impact of a viral pandemic on blood supplies in the EMR. This is important to report especially with the presence of countries in the region that are suffering from humanitarian emergencies and conflicts. However, this study has some limitations. The majority of the blood banks were national-based with minor representation from centres that have hospital-based blood banks with donation facilities. In addition, not all countries are represented in this survey. Considering the nature of this study, assessment of the degree of effectiveness of the measures instated in the different banks was made based on the subjective perception of the participating medical directors. This survey was undertaken early in the pandemic, and the obtained findings can vary at later stages.

5. Conclusion

COVID-19 pandemic had a major impact on the blood supply in the WHO EMR region during the early phases of the pandemic. Blood services must reflect on its plans to prepare and manage the blood supply during similar future threats based on the experience in this pandemic. There is a need to develop measures to manage blood supply shortage while ensuring recipient, donor and staff safety. In addition, there is a need to make the general population aware of the scientific precautions for donor attendance. Collaboration with other blood services and institutions is essential. Recognition of the government of such a basic need to maintain this important healthcare service and to develop a stringent emergency

and disaster plan to face blood supply challenges is important. Low- and middle- income countries and countries suffering from humanitarian emergencies and conflicts are expected to face more challenges given the limited resources.

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Contribution

AZR initiated the research idea and designed the survey. YEA and MAB reviewed the survey and edited it. SMP created the survey online and performed statistical analysis. Remaining authors provided data through the survey. All authors reviewed the manuscript and agreed for submission.

Disclosure of interest

The authors declare that they have no competing interest.

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Appendix 1. Supplementary table Sequence of the emergence of COVID-19 in countries of the Eastern Mediterranean region

Country	Date of first WHO reported case	Likely place of exposure of first reported case	Transmission classification at time of data collection[a]	Total confirmed cases (deaths)[a]	Total confirmed cases per 1 million population (deaths)[b]
UAE	29th January	Travel history to China (new)	Pending	53,614 (244)	5505.86 (33.47)
Egypt	15th February	In reporting country (new)	Cluster of cases	80,235 (3702)	793.07 (36.83)
Islamic Republic of Iran	20th February	Unknown	Community transmission	252,720 (12,447)	303,736 (150.43)
Lebanon	22nd February	Outside reporting country and outside China (new)	Cluster of cases	2082 (36)	317.66 (5.27)
Kuwait	24th February	Outside reporting country and outside China (new)	Cluster of cases	53,580 (383)	12,656.99 (90.38)
Bahrain	25th February	Outside reporting country and outside China (new)	Cluster of cases	32,039 (104)	19,077.56 (61.1)
Oman	25th February	Outside reporting country and outside China (new)	Cluster of cases	53,614 (244)	10,710 (48.56)
Iraq	25th February	Outside reporting country and outside China (new)	Cluster of cases	72,469 (2,960)	1869.43 (75.95)
Afghanistan	25th February	Outside reporting country and outside China (new)	Cluster of cases	34,351 (975)	884.99 (25.95)
Pakistan	27th February	Outside reporting country and outside China (new)	Cluster of cases	246,351 (5123)	1126.67 (23.53)
Qatar	1st March	Imported case	Community transmission	102,630 (146)	35,795.9 (50.68)
Jordan	3rd March	Imported case	Cluster of cases	1173 (10)	115.26 (0.98)
Saudi Arabia	3rd March	Imported case	Cluster of cases	226,486 (2151)	6591.6 (62,65)
Tunisia	3rd March	Imported case	Community transmission	1240 (50)	105.34 (4.23)
Morocco	3rd March	Imported case	Cluster of cases	15,443 (244)	421.07 (6.64)
Palestine	5th March	Imported case	Cluster of cases	6225 (35)	1311.12 (6.27)
Sudan	14th March	Imported case	Community transmission	10,204 (649)	233.76 (14.82)
Somalia	17th March	Imported case	Sporadic cases	3038 (92)	191.97 (5.79)
Djibouti	19th March	Imported case	Cluster of cases	4968 (56)	5028.34 (56.68)
Syrian Arab Republic	23th March	Imported case	Community transmission	394 (16)	22.51 (0.91)
Libya	25th March	Imported case	Cluster of cases	1342 (38)	202.15 (5.53)
Yemen	11th April	Unknown	pending	1352 (355)	46.57 (12.24)

UAE; United Arab Emirates; WHO; World Health Organization; Sporadic cases: countries/territories/areas with one or more cases, imported or locally detected; Clusters of cases: countries/territories/areas experiencing cases, clustered in time, geographic location and/or by common exposures; Community transmission: countries/area/territories experiencing larger outbreaks of local transmission defined through an assessment of factors including, but not limited to: – large numbers of cases not linkable to transmission chains – large numbers of cases from sentinel lab surveillance – Multiple unrelated clusters in several areas of the country/territory/area.

[a] Latest World Health Organization situation report at time of submission [34].

[b] World Health Organization [35].

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