

PRACTICE FORUM

Challenges facing an outsourcing dialysis program amid the COVID-19 pandemic: Diaverum AB experience

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Abstract

Coronavirus disease 2019 (COVID-19), a disease caused by a novel coronavirus, is a major global human threat that has turned into a pandemic. Elderly patients and patients with comorbid conditions have a higher risk of complications and morbidity. Patients suffering from kidney disease on hemodialysis have an intrinsic fragility combined with a frequent burden of comorbidities in hemodialysis centers, a setting in which many patients are repeatedly treated in the same area. Moreover, if infected, the intensity of dialysis requiring specialized resources and staff is further complicated by requirements for isolation, control and prevention, putting healthcare systems under additional and exceptional strain. Therefore, all measures to slow if not eradicate the pandemic and to control unmanageably high incidence rates must be taken very seriously. Diaverum is a renal health services company playing a major role in providing end-stage kidney disease (ESKD) patients with optimum dialysis services. The aim of the present review is to shed light on the challenges and steps taken by an outsourcing dialysis program to provide recommendations for the prevention, mitigation, and containment of the emerging COVID-19 pandemic in hemodialysis centers.

Keywords: COVID-19; coronavirus; renal dialysis; infection control; pandemics; Saudi Arabia

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COVID-19 is short for coronavirus disease 2019, the name the World Health Organization (WHO) gave to the illness caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (1). Following the outbreak of the novel coronavirus, the Kingdom of Saudi Arabia started implementing multiple preventative measures including a screening form for patients in healthcare settings and considering any person coming from China, Iran, South Korea, Japan, or Singapore to be an exposure risk. Hemodialysis patients are at increased risk of COVID-19 and its complications, owing to the presence of multiple comorbid conditions and impaired immunity (2). Dialysis patients are a susceptible population because of their older age and less efficient immune systems, and they are therefore more prone to develop severe infectious diseases than the general population (3, 4). Dialysis patients are exposed and re-exposed to a higher contamination risk than the general population because their routine treatment usually requires three dialysis sessions per week. Moreover, if infected, the intensity of dialysis requiring specialized

resources and staff is further complicated by requirements for isolation, control, and prevention, putting healthcare systems under additional and exceptional strain. In addition, hemodialysis is a lifesaving modality of treatment and cannot be stopped or delayed; therefore, measures are needed to adapt and provide care during crisis and pandemics. Therefore, all measures to slow if not to eradicate the pandemic and to control unmanageably high incidence rates must be taken very seriously. Preventing the epidemic spread of infection requires early recognition of infection, isolation, meticulous tracking of contacts, and enhancing the awareness of both patient and healthcare worker (HCW); it also entails the implementation of strategies to prevent further spread such as social distancing, widespread use of face masks for patients with suspected or confirmed disease to limit transmission, and appropriate personal protective equipment (PPE) for HCWs and others who have direct contact with patients infected with COVID-19 (5).

Diaverum is a renal health services company playing a major role in providing end-stage kidney disease (ESKD)

patients with optimum dialysis services. Currently, more than 4,400 patients are receiving hemodialysis services in 39 dialysis clinics distributed throughout Saudi Arabia, as part of an outsourcing program adopted by the Ministry of Health of Saudi Arabia (MOH) in 2013. Diaverum Saudi has been closely monitoring the COVID-19 situation since the first confirmed cases in the country on March 2, 2020. A modified visual triage checklist was implemented, with the COVID-19 virus added to a visual triage form that had been used since the outbreak of SARS to screen all patients prior to entering treatment areas. We have used a specific scoring system adopted by the MOH to identify suspected cases and refer them to the nearest designated hospitals for further evaluation and diagnosis including testing for COVID-19 reverse transcriptase polymerase chain reaction (PCR), and for dialysis treatment if proven positive.

An internal task force group was established at Diaverum Saudi to manage the anticipated new challenges dialysis units will face during the pandemic, across the entire geographical network of dialysis units. The task force objectives were to ensure the implementation of Centerers for disease control and prevention (CDC) (6) and MOH guidelines related to handling suspected COVID-19 cases; create guidelines to protect both staff and patients from contracting the virus; ensure sufficient supplies at all clinics for at least 3 months in advance; raise awareness and conduct serial educational programs for all staff, patients, and relatives to ensure alignment with the new guidelines; and ensure daily follow-up of referred suspected and confirmed cases. A registry of data for all suspected and confirmed cases was established to monitor the outcomes of all referred cases. In addition, direct communication about guideline updates and other developments was established between MOH hospitals and the Central Committee of the Dialysis Outsourcing Project. The management team was provided with daily updates, and support from different functional areas of the company was established.

The task force group held daily virtual conference calls to discuss all updated news and conducted several calls with all medical directors of all units. The main challenge was balancing the continual delivery of excellent dialysis service while facing new challenges that could disturb our workflow. During the first meeting, the following challenges were identified, and action plans were initiated to deal with any developments anticipated to occur during the crisis:

- How to screen and refer suspected cases?
- Where to dialyze suspected cases?
- What method of disinfection is needed in case an outbreak occurs in any dialysis unit?
- How to deal with anticipated staff shortages resulting from any imposed travel bans or in case of staff being affected by COVID-19 disease?

- When to accept positive cases back to our units?
- How to protect our staff?
- What to do with staff exposed to positive cases?
- When affected health workers can return to work?
- How to continue delivering the best medical services amid the current situation?

Strategies proposed for the prevention and management of COVID-19 transmission for ESKD patients in the outpatient dialysis facilities have been dynamic and changing according to the new guidelines adopted by CDC (6), in concordance with the MOH updated guidelines (Table 1) and following new learnings from increased experience. The task force members held daily meetings and adopted several policies to overcome the expected challenges noted above, and the following measures were taken:

Regional rapid response team

A backup team was initiated to facilitate easy staff replacement and movement across cities when needs arise. The nursing team identified a backup team of 128 nurses from all clinics to provide support for other clinics.

Lockdown management

During April–June 2020, there were widespread curfews, and larger cities went into lockdowns. To overcome such obstacles, clinics were supported as follows:

- Curfew letters were issued to staff to cover working hours.
- Transportation and special government permits were arranged for staff when public transportation services were stopped.
- Many housekeeping staff were transferred to clinic accommodation because their usual areas of residence were infected.

Establishing and implementing guidelines related to handling suspected COVID-19 cases

We followed clear and strict guidelines when dealing with suspected cases to protect our HCWs and other patients. These guidelines were continually revised and updated according to any new development in the management of the COVID-19 pandemic.

Dealing with continuous staff shortages

Receiving staff from abroad (mostly from Philippines)

Because all international flights were suspended, some of our medical staff were stranded on vacation in their home countries and were unable to return to work. Twenty-one staff from the Philippines were needed to cover the staff shortages expected during the pandemic.

Table 1. Overall list of approaches to prevention and control of COVID-19 infection in hemodialysis facilities

Education:	Screening:	Facility workflow:
A-Education of patients and related individuals:	1. Instruct all patients to call ahead if they develop symptoms.	1. Define separate area and shift for patients with symptoms (COVID-19-positive section).
1. Hand and respiratory hygiene and coughing etiquette.	2. Temperature check for all patients on arrival and departure.	2. Separate all COVID-19-positive patients 2 m in all directions from each other.
2. Use of masks.	3. Implement triage protocol for patients who are suspected to have COVID-19.	3. PPE utilization.
3. Basic signs and symptoms associated with the disease.	4. Transfer sicker patients to emergency departments.	4. Provide all patients with a surgical mask.
4. Place signs to direct patients who are symptomatic or have been exposed to a designated screening location in an appropriate space.	5. Perform screening RT-PCR test in all suspected cases (done in the MOH facilities).	5. Use eye and face protection for the management of patients who are suspected or positive for the disease.
5. Patients' relatives and caregivers were not allowed to enter the treatment areas.	6. Prioritize testing of dialysis personnel according to the MOH protocol.	6. Maintain routine cleaning and disinfection procedures.
B-Education of HCWs:		7. All waiting areas were closed.
1. Training for appropriate use of PPE.		8. Patients and relatives were instructed not to bring food or personal blankets.
2. Re-emphasis of universal precautions for infection control in the facility.		
3. All staff were educated to practice social distancing during break time.		
4. Social gathering was not allowed in the treatment area or any area in the clinic.		

A charter commercial plane was hired following arrangement with local authorities, and we managed to get 10 staff back to work after being quarantined for 14 days upon arrival, as per protocol. This was arranged through government initiatives of the MOH and Ministry of Interior to bring back citizens who were locked down in other countries, and the Philippines were a major part of this.

Extending contracts for staff

With international flights on hold, many staff with contracts ending were unable to travel. To support clinics, human resources (HR) offered contract extensions to staff willing to continue working until normal flights returned. Around 30 nurses extended their contracts, providing additional nursing workforce during the crisis.

Continuous staff recruitment

To overcome the challenges of manpower shortage, HR continuously headhunted qualified nurses to join the company. With the support of clinic head nurses, personal and call interviews were conducted. There were around 20 batches of Saudi interviews since March 2020. Among

these, there were 12 Saudi nurses hired thus far. In addition, virtual interviews for Philippines recruitment continued in May 2020.

HR action plan for psychological support of the health workers

The global pandemic of COVID-19 has led to unprecedented psychological stress on HCWs. COVID-19 imposes a significant level of anxiety and stress on HCWs caring for infected patients, with their main concern being the risk of transmitting the infection to their families or acquiring it themselves (7). Therefore, optimizing the compliance of HCWs with proper infection prevention and control measures is paramount during infectious disease outbreaks to ensure their safety, to decrease the likelihood of getting infected or transmitting the infection to others, and to consequently alleviate their psychological stress and anxiety. The company has supported HCWs through a specialized program, 'Staff for Life Support'. The main goal of this unique program was to provide HCWs with the social and psychological support needed. The program was built on four pillars aimed at driving a sustainable organization: promoting employee quality of

life, promoting healthy lifestyle, investing in staff development, and feeling connected. It also included psychological consultation, arranged by HR through a contracted private health provider, to give psychological support to staff who needed it.

Availability of supplies

Availability of supplies of all consumables and medications required by dialysis patients receiving treatment throughout the country was a top priority, despite the difficulties following implementation of curfew in all cities and the delay in importing essential hemodialysis products from outside the country. Each dialysis center was provided with a 3-month supply of stock and a minimum 3-month supply in central store.

The learning points from initial events

Challenges encountered with the first outbreak in the clinics

The first two confirmed positive cases in our dialysis facilities – in Madinah on 20 March and in Makkah on 25 March – affected our practice due to staff, patients, and their relatives not being fully aware of the new threat and some guidelines not being carried out properly. The initial recommendation was to isolate all contact staff for 14 days before allowing them to resume work regardless of their PCR results for COVID-19. However, this protocol would have caused a sudden shortage of medical staff forcing us to mobilize and replace exposed staff in both clinics with staff from units located in other areas. Furthermore, swabbing for COVID-19 PCR is usually carried out in the MOH facilities with some time delay for logistical reasons. Our initial protocol did not implement the wearing of full PPE by all staff because of shortages and unavailability in the local market. Instead, wearing surgical masks was recommended. Immediately after identifying these cases, new policies were implemented and stricter guidelines were established to deal with future cases (Table 2). The lessons learned from the first two cases were tremendous and were reflected positively in our handling of new suspected or positive cases. This experience was quickly communicated to all clinics so that our medical staff were well oriented and gained the confidence to deal with all suspected cases. The task force group continues to supervise, support, and facilitate the workflow in all clinics.

Delivering a continued high standard of medical services

During this crisis, Diaverum remained committed to delivering the usual excellent standard of medical care to our dialysis patients in spite of the challenges. We closely observed our global and contractual clinical performance measures (CPM). We continued to be on the top rank of all global Diaverum clinics during the pandemic, and we

managed to meet the required key performance indicators (KPIs) requested by the MOH for all clinical and laboratory parameters. The main issue during this crisis was the delay in creating new arteriovenous fistulas (AVF) due to governments and private hospitals only providing services for emergency cases. The biggest challenge faced during this pandemic was maintaining the functioning catheters and AVFs to avoid the need for any surgical intervention. This challenge was met by following our protocol of handling vascular accesses, and we allocated extra nursing care to avoid any catheter malfunction. During the current crisis, only emergency vascular accesses procedures were carried out.

Conclusion

COVID-19 is a major global human threat that has turned into a pandemic (8). COVID-19 infection presents particular challenges for patients on chronic hemodialysis. Patients with uremia are particularly vulnerable to infection and may exhibit greater variations in clinical symptoms and infectivity (5). Early reports have shown that dialysis patients are a highly susceptible population, and hemodialysis centers are at higher risk for an outbreak of a COVID-19 epidemic (9). The management of patients on dialysis affected by COVID-19 must be carried out according to strict protocols to minimize the risk of cross infection to other patients and to staff taking care of these patients. Implementation of the infection control steps, full protective measures of staff and patients, continuous application of screening, and proper isolation of suspected cases during and post recovery have been shown to be most efficient in these settings (10). From the beginning of the crisis and following the first reported cases in our dialysis units, our strategy was clear and was built on two principles: minimizing the spread of infection among our staff and patients and maintaining the delivery of optimum dialysis care. Establishing strict guidelines and application of protective measures outlined in Table 2 reduced the number of cases among our staff and patients. The majority of the recorded cases were community-acquired infections, and no cross infection was observed within our dialysis units. Ensuring delivery of adequate dialysis prescription was a priority during the pandemic to avoid unwanted complications of poor or shortage of dialysis treatment. For this reason, our task force group was initiated to make sure that adequate supplies needed for hemodialysis treatments were delivered to all dialysis units on time and for a sufficient period of not less than 3 months. Moreover, no suspected cases were denied their dialysis treatments but were modified according to our protocol, with all suspected cases dialyzed in a designated area, and full precautionary measures were taken to protect our medical staff (Table 2). Devoting a backup team helped to manage these patients in an isolated area by

Table 2. Management protocol of suspected or positive cases

<p>1. The decision to dialyze a suspected/confirmed case should be aligned with the Regional Medical Director and Infection Control Specialist.</p> <p>2. Ensure the implementation of empiric additional precautions (droplet and contact and, whenever applicable, airborne precautions) for suspected cases.</p> <p>In addition to Standard Precautions, all individuals including family members, visitors, and HCWs should apply contact and droplet precautions. Standard precautions should be applied at all times.</p> <ul style="list-style-type: none"> • Place patients in adequately ventilated single rooms with door closed. • When single rooms are not available, cohort suspected COVID-19-positive patients together. Place patient beds at least 2 m apart, and when possible, cohort HCWs to exclusively care for cases to reduce the risk of spreading transmission due to inadvertent infection control breaches. • Use a surgical mask with an eye/facial protection (i.e. goggles or a face shield). • Use gloves and a clean, non-sterile, long-sleeved fluid-resistant gown. • Use either single-use (disposable) equipment or dedicated equipment (e.g. stethoscopes, blood pressure cuffs and thermometers). If equipment needs to be shared among patients, clean and disinfect between each patient use (e.g. ethyl alcohol 70%). • Refrain from touching eyes, nose, or mouth with potentially contaminated hands. • Avoid the movement and transport of patients out of the room or area unless medically necessary. <p>3. Ensure airborne precautions for aerosol-generating procedures for suspected COVID-19 or during care of patients with confirmed COVID-19.</p> <p>Some aerosol-generating procedures have been associated with the increased risk of transmission of coronaviruses (SARS-CoV and MERS-CoV), such as nasopharyngeal swabbing, tracheal intubation, non-invasive ventilation, tracheotomy, cardiopulmonary resuscitation, and manual ventilation before intubation and bronchoscopy. HCWs performing aerosol-generating procedures should note the following:</p> <ul style="list-style-type: none"> • Place patients in adequately ventilated single rooms with the door closed and in the last shift of the day. • Use a fit-tested particulate respirator (certified N95). HCWs should avoid using aerosol-generating procedures or use powered air-purifying respirator (PAPR). • Always perform the seal-check when putting on a disposable particulate respirator (certified N95). • Facial hair (beard) prevents proper respirator fit; either avoid aerosol-generating procedures or use PAPR. • Use eye protection (i.e. goggles or a face shield) during all moments of care with the patient. • Single-use, clean, non-sterile, long-sleeved gown, and gloves are used. If gowns are not fluid resistant, use a waterproof apron for procedures with expected high fluid volumes that might penetrate the gown. • Perform procedures in negative pressure rooms with at least 12 air changes per hour (ACH) if available. • Use ventilated single room with portable high-efficiency particulate air (HEPA) filter; preferably situated in the middle part of the room. • Limit the number of persons present in the room to the absolute minimum required for the patient's care and support. <p>4. Ensure suspected or confirmed COVID-19 patients are dialyzed in a separate room with the door closed and with dedicated HCWs. Dedicated means that HCWs are assigned to care only for these patients during their shift. Suspected and confirmed patients must NOT be dialyzed together.</p> <p>5. If a hemodialysis facility is dialyzing more than one patient with suspected or confirmed COVID-19, consideration should be given to cohort these patients and the HCWs caring for them together in the same section of the unit and on the same shift.</p> <p>6. If a separate room is not available, the suspected patient can be treated at a corner or end-of-row station, away from the main flow of traffic. The patient should be separated by at least 2 m from the nearest negative patient (in all directions).</p> <p>7. Staff and care management:</p>

Table 2. (Continued)

<ul style="list-style-type: none"> • A dedicated team should be assigned to care only for these patients. • A record of the staff caring for COVID-19 patients must be kept. Staff at high risk of complications must NOT care for suspected or confirmed COVID-19 patients. • All staff MUST be compliant with standard precautions, control, and prevention of airborne and droplet infectious disease transmission. • Physicians should keep a distance of 2 m between patients whenever possible and proper use of PPE is required. • During the shift, staff should wear PPE as per diagnosis. • Patients should be assessed and monitored as per standard operations procedures. Body temperature should be measured and recorded hourly. • Staff should strictly follow basic infection control practices between patients (e.g. hand hygiene, cleaning and disinfecting shared equipment). • Staff are responsible to self-report any signs and symptoms of acute respiratory disease to their direct report. <p>8. Environment management:</p> <ul style="list-style-type: none"> • Adequate ventilation should be available in all areas. • Dedicated hand sinks and alcohol gel must be easily accessible in all areas of the clinic. Hand hygiene supplies are readily available to all personnel in every care location. • Items in the treatment room should be kept to a minimum necessary for the shift. • All products and medication should be prepared in advance and taken to the 'positive' room only when needed. All products and medication not used should be discarded as clinical waste. • All equipment is either single-use or disposable. If equipment (e.g. stethoscopes, blood pressure cuffs, and thermometers) needs to be used or shared among patients, clean and disinfect between each patient use using ethyl alcohol 70%. • Staff workstations (shared personal computers (PCs) phones, treatment guidance system (TGS) tablets, remote controls, etc.) must be disinfected frequently and at the end of each shift. • Complete cleaning and disinfection of the isolation room must be carried out after each patient by the HCPs responsible for the treatments: <ul style="list-style-type: none"> A. Disposable linen removal and disposed as clinical waste B. External decontamination of the dialysis machine C. Decontamination of shared equipment. • More frequent cleaning and disinfection may be indicated for high-touch surfaces and following aerosol producing procedures (e.g. tables, hard-backed chairs, doorknobs, light switches, remotes, handles, desks, toilets, and sinks). • Cleaning staff should wear disposable gloves, surgical mask, face shield, and isolation gowns for all tasks in the cleaning process, including handling of waste. • Housekeepers should not enter the room until all the patients have left. • Cleaning and disinfection of the environmental surfaces should be with approved disinfectant, for example, hydrogen peroxide, quaternary ammonium chloride fourth generation that should be used on precleared, hard, non-porous surfaces in accordance with manufacturer's instructions for environmental surface disinfection. • Terminal cleaning should be done using a manual method and /or ultraviolet germicidal irradiation or hydrogen peroxide dry mist or vapor. <p>Common environmental disinfectants to be used are as follows:</p> <ul style="list-style-type: none"> - Quaternary ammonium sprays - Concentrated quaternary ammonium compounds should be diluted according to the recommendations of the manufacturing company

Table 2. (Continued)

<ul style="list-style-type: none"> - Chlorhexidine swabs - Chlorine 5,000 ppm <p>9. Laundry:</p> <p>Positive and/or suspected patients' laundry MUST be washed between 60°C and 90°C, after each session and after the washing of negatives patients' laundry. Linen (blankets) should be removed from the isolation room in a hermetic plastic bag. If possible, disposable blankets should be available.</p> <p>10. Ensure to follow the recommendations for cleaning ambulances after transporting a patient with suspected or confirmed COVID-19.</p> <ul style="list-style-type: none"> • Once the patient has been handed over at the designated receiving healthcare facility, the ambulance should be aerated with several cycles of air changes by leaving its rear doors open. This will get rid of possibly infected particles. • Prior to cleaning the ambulance, staff should don disposable gowns and gloves. Eye/face protection PPE (goggles, face shields, or facemasks) are recommended if the cleaning procedure will generate splashes or sprays. • Environmental cleaning and disinfection should be carried out following procedures consistently and correctly. This includes assuring adequate ventilation when chemicals are used by keeping doors open. • Routine cleaning and disinfection procedures (e.g. using cleaners and water to pre-clean surfaces prior to applying approved disinfectant to frequently touched surfaces or objects for appropriate contact times as indicated on the product's label) are appropriate for SARS-CoV-2 in healthcare settings, including those patient-care areas in which aerosol-generating procedures are performed. • Following approved procedures, the ambulance must be cleaned and disinfected ensuring that all contaminated surfaces including stretcher, rails, control panels, floors, walls, and work surfaces are thoroughly cleansed with approved disinfectant, according to manufacturer's instructions. • Clean and disinfect reusable patient-care equipment before use on another patient, according to manufacturer's instructions. • Ambulance staff should follow approved procedures for the containment and disposal of used PPE and regulated medical waste as well as laundering used linen. Avoid shaking the linen.
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applying the ratio of 1:1 (one nurse looking after one patient; normally the ratio is 1:3).

Despite taking all recommended measures, an outbreak in a dialysis unit can potentially occur, during which the goal should be to reduce the number of infected cases and to protect medical staff from contracting the infection. Therefore, strict vigilance is always required by the dialysis unit team with a high level of support to overcome these difficult times. Such major crisis requires group management, good communication, and full administrative supports to navigate peacefully and avoid any interruption of dialysis treatments, and prevent any cross infection within the dialysis units.

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References

1. Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A. World Health Organization declares global emergency. A review of the 2019 novel coronavirus (COVID-19). *Int J Surg* 2020; 76: 71–76. doi: 10.1016/j.ijssu.2020.02.034
2. Kliger AS, Cozzolino M, Jha V, et al. Managing the COVID-19 pandemic: international comparisons in dialysis patients. *Kidney Int* 2020; 98: 12–16. doi: 10.1016/j.kint.2020.04.007
3. Syed-Ahmed M, Narayanan M. Immune dysfunction and risk of infection in chronic kidney disease. *Adv Chronic Kidney Dis* 2019; 26: 8–15. doi: 10.1053/j.ackd.2019.01.004
4. Betjes MG. Immune cell dysfunction and inflammation in end-stage renal disease. *Nat Rev Nephrol* 2013; 9: 255–65. doi: 10.1038/nrneph.2013.44
5. Dudreuilh C, Kumar N, Moxham V, et al. De-isolation of COVID-19-positive hemodialysis patients in the outpatient setting: a single-center experience. *Kidney Int* 2020; 98: 228–239. doi: 10.1016/j.kint.2020.04.021
6. Centers for Disease Control and Prevention. Interim additional guidance for infection prevention and control recommendations for patients with suspected or confirmed COVID-19 in outpatient hemodialysis facilities, 2020. Available from: <https://www.cdc.gov/coronavirus/2019-ncov/healthcare-facilities/dialysis.html> [cited 19 March 2020].

7. Temsah M, Al-Sohime F, Alamro N, et al. The psychological impact of COVID-19 pandemic on health care workers in a MERS-CoV endemic country. *J Infect Public Health* 2020; 13: 877–82. doi: 10.1016/j.jiph.2020.05.021
8. Alberici F, Delbarba E, Manenti C, et al. A report from the Brescia Renal COVID Task Force on the clinical characteristics and short-term outcome of hemodialysis patients with SARS-CoV2 infection. *Kidney Int* 2020; 98: 20–26. doi: 10.1016/j.kint.2020.04.030
9. Goicoechea M, Sánchez Cámara LA, Macías N, et al. COVID-19: clinical course and outcomes of 36 maintenance hemodialysis patients from a single center in Spain. *Kidney Int* 2020; 98: 27–34. doi: 10.1016/j.kint.2020.04.031
10. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area. *JAMA* 2020; 323(20): 2052–2059. doi: 10.1001/jama.2020.6775

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