Received: 10 October 2020 | Revised: 5 February 2021 | Accepted: 23 February 2021

DOI: 10.1111/1744-9987.13635

Therapeutic Apheresis and Dialysis

WILEY

ORIGINAL ARTICLE

# A COVID-19 pandemic-specific, structured care process for peritoneal dialysis patients facilitated by telemedicine: Therapy continuity, prevention, and complications management

**Elianny Polanco**[1] | **Mercedes Aquey**[1] | **Jhanna Collado**[1] | **Erwin Campos**[1] | **Janny Guzman**[2] | **Miguel Angel Cuevas-Budhart**[3] | **José Carolino Divino-Filho**[4] | **Alfonso Ramos-Sanchez**[5]

[1]Renal Department, Macrotech, Santo Domingo, Dominican Republic

[2]Renal Care Division, Baxter, Bogota, Colombia

[3]Nephrological Diseases Clinical Research Unit, Instituto Mexicano del Seguro Social, Mexico City, Mexico

[4]Division of Renal Medicine, CLINTEC, Karolinska Institutet, Campus Flemingsberg, Stockholm, Sweden

[5]Renal Care Division, Baxter, Mexico City, Mexico

**Correspondence**
José Carolino Divino-Filho, Division of Renal Medicine, CLINTEC, Karolinska Institutet, Campus Flemingsberg, Stockholm, Sweden.
Email: jose.divino@ki.se

## Abstract

Coronavirus disease 2019 (COVID-19) has been declared a pandemic. Peritoneal dialysis (PD), being a home therapy, allows for physical distancing measures and movement restrictions. In order to prevent COVID-19 contagioun among the Dominican Republic National Health System PD program patients, a follow-up virtual protocol for this group was developed. The aim of this study is to outline the protocol established by the PD program's healthcare team using telemedicine in order to avoid COVID-19 transmission and to report initial results and outcomes of this initiative. This is an observational prospective longitudinal study with 946 patients being treated in seven centers distributed throughout the country between April 1 and June 30. The protocol was implemented focusing on the patient follow-up; risk mitigation data were registered and collected from electronic records. During the follow-up period, 95 catheters were implanted, 64 patients initiated PD, and the remaining were in training. A total of 9532 consultations were given by the different team specialists, with 8720 (91%) virtual and 812 (9%) face-to-face consultations. The transfer rate to hemodialysis was 0.29%, whereas the peritonitis rate was 0.11 episode per patient/year. Eighteen adults tested positive for COVID-19. The implementation of the protocol and telemedicine utilization have ensured follow-up and monitoring, preserved therapy, controlled complications, and PD lives protected.

**KEYWORDS**

care process, COVID-19, pandemic, peritoneal dialysis, telemedicine

## 1 | INTRODUCTION

On December 21, 2019, People's Republic of China reported to the World Health Organization (WHO) several cases of pneumonia of unknown etiology in Wuhan, Hubei province [1]. A week later, they confirmed a new coronavirus, called SARS-CoV-2 infection (causing coronavirus disease 2019, COVID-19) [2], which has been declared a pandemic with a rapid spread in countries and territories across all continents. The risk factors for developing or acquiring the disease include age over 60 years and comorbidities such as high blood pressure, diabetes, and chronic kidney disease (CKD) [3]. Patients receiving renal replacement therapy (RRT), that is, hemodialysis (HD) and peritoneal dialysis (PD), are at a high risk of developing severe COVID-19-related clinical manifestations and, ultimately, death [4,5]. The first confirmed COVID-19 case in the Dominican Republic was reported on March 1, 2020 [6].

PD has proven to be a good therapeutic option as HD for the management of CKD patients who require RRT [7,8] Compared with patients on HD, who need to attend the dialysis center twice or thrice a week even during a quarantine period, those on PD possibly have a lower risk of COVID-19 exposure [9]. Moreover, being in a home therapy minimizes the risk of exposure during transport to and from the HD clinic as well as contact with other patients and staff. Often forgotten, transport modality to dialysis may be life-saving [10]. Fernandez-Prado et al. have confirmed the risk, demonstrating that HD patients who had shared the same car presented a 3.3- to 4.7-fold (OR) increased risk of developing COVID-19 [10,11].

PD also facilitates WHO recommendations, allowing public health system measures to reduce exposure and contain transmission, physical distancing measures, and mobility restriction. Nevertheless, there are a few challenges faced by these patients during the COVID-19 pandemic, including safe access to their dialysis supplies and medications as well as the need for clinical monitoring, prevention, and complication management. When the first COVID-19 patients were identified in the Dominican Republic, there were few recommendations for the management of PD patients and COVID-19 infection. To guarantee continuity of assistance to PD patients in the Dominican Republic National Health Service Renal Program in response to the COVID-19 pandemic, Macrotech (PD provider in the Dominican Republic) developed a telemedicine-facilitated PD protocol, allowing the admission of new patients, the continuity of care for prevalent patients, and the safety of the healthcare staff working in the dialysis centers.

This study aims to outline the protocols established by the PD program's healthcare team using telemedicine and to report the initial results obtained, in compliance with the Dominican Republic MoH COVID-19 infection guidelines.

## 2 | PATIENTS AND METHODS

This is an observational, prospective, and longitudinal study evaluating PD patients after changes applied to the protocol of PD care, based on the recommendations dictated by the Ministry of Public Health as an acute response to the pandemic and approved by the Renal and Safety Committee of Macrotech and National Health System (SNS). Data were registered and collected from electronic records. The data available before March were related to hospitalization, transfer to HD, and peritonitis rates. All patients have given their informed consent (Supplemental material S1—*Spanish*).

In the Dominican Republic, with an estimated population of 10.5 million people [12], 946 PD patients were receiving follow-up care in seven centers located in tertiary referral hospitals throughout the country, covering the entire national territory, in March 2020. They were being monitored monthly on a comprehensive presential PD clinic visit by a multidisciplinary team. Each center had a team consisting of a nephrologist, a renal nurse, a psychologist, a dietitian, and a social worker. It is important to note that patients were receiving regular home visits by social workers and renal nurses until the initiation of the pandemic.

Very shortly after the first confirmed COVID-19 case in the Dominican Republic, the Ministry of Public Health issued an official document (Supplemental material S2—*Spanish*) with immediate effect, directed to healthcare professionals taking care of CKD patients undergoing HD and PD, with a set of key recommendations to approach and manage the affected patients in the context of the SARS-CoV-2 pandemic. These recommendations are based on the best available evidence and are to be applied by healthcare professionals to the dialysis patients. Every suspected case must be (obligatory) notified and the medical management executed in accordance with the established Ministry of Health protocols. At the same time, the internal medical and quality departments of the PD provider modified the regular internal process management (Supplemental material S3—*Spanish*).

### 2.1 | Specific COVID-19 care process

#### 2.1.1 | Patient follow-up

To ensure the specific COVID-19 pathway of care and to maintain quality standards, a designed monthly telephone triage process was implemented and conducted by

the nursing team, during which a questionnaire was applied to each patient assessing symptoms associated with COVID-19. A validated virtual survey (Supplemental material S4) was also introduced to identify symptoms of suboptimal dialysis [13]. Moreover, psychological and nutritional surveys were applied to the patients during this period; and they were also required to submit a picture of their daily dialysis records and a photo of their lower limbs (to check for edema) via WhatsApp system (Supplemental material S5). In case the patient did not have internet, telephone calls were made; if it was not possible for the nurse to locate the patient, a home visit was scheduled through the social worker.

Those patients with signs of fluid overload and/or symptoms of uremia were assessed by the multidisciplinary team and a visit to the PD clinic scheduled for a medical/nurse evaluation, whereas asymptomatic patients remained at home. Patients presenting with COVID-19-related symptoms during the phone triage process remained at home following WHO recommendations [14] and the Ministry of Public Health (MSP) notified, following the protocols issued by them [15].

### 2.1.2 | Medical management at the clinic

All patients considered as in need of a medical/nursing evaluation were scheduled an in-person appointment. Upon arrival at the PD clinic, respiratory symptoms were screened and the temperature was measured. Physical or social distancing spaces were extended to 1.5 m between each patient and consultations were limited to renal nurse and nephrologist. If necessary, nutrition and psychology consultations were made over the phone. Patients suspected of being infected by COVID-19 attended the center and were seen by a COVID-19-specific PD team in a previously designated area, only used for these patients.

Unscheduled patients who showed up in the PD clinic seeking help due to a PD emergency (peritonitis, transfer set leaks, drain, or infusion problem) were attended by another member of the response team in another specialized area of the center. This same team was also responsible for the management of patients requiring urgent dialysis. APD was the preferred modality and center's dialysis protocols were used.

### 2.1.3 | Peritoneal access placement

During this period, catheter placements using the percutaneous or surgical approach continued to be performed as usual in designated areas of the hospitals, following the surgical processes recommendations given by the MSP for contagion prevention and depending on the clinical condition of the patient.

### 2.1.4 | Training of new patients and follow-up of the prevalent patients

During the COVID pandemic, new patients are being trained at the PD clinic, by different teams, composed of four professionals: a nephrologist, a nurse, a psychologist, and a nutritionist in 4-h training sessions until certifications are completed. Thereafter, they are monitored and receive virtual advice from the training team by phone/video, as the prevalent patients. A monthly clinical virtual survey is applied to all patients (see Supplemental material S4). The patient must also submit photographs of the exit site, lower limb, and daily records by the messaging system; and depending on the clinical survey results and photo findings, the PD team will make all the necessary recommendations and follow-up. Patients have a video phone call per month with the nursing team, intended to monitor both bag exchange technique and proper care of the exit site (see Supplemental material S5). If the nursing team considers it appropriate, the patient is summoned to the PD clinic and will be checked at arrival with the safety measures earlier described.

### 2.1.5 | Routine procedures

The transfer set changes are scheduled and handled by personnel specific to this procedure. Transfer set change is usually performed every 6 months; however, during the period of pandemic contingency, changes are only performed in case of an emergency. All nonessential procedures (e.g., peritoneal equilibrium test [PET], clearance measurements) have been suspended.

### 2.1.6 | Patients diagnosed with COVID-19

The MSP is notified about the COVID-19 diagnosed patients, who are managed according to the recommendations established for this group [13]. Whenever possible, they should be maintained at home following the recommended isolation measures.

### 2.1.7 | Healthcare staff

All members of the healthcare team should wear personal protective equipment (PPE) and follow the MSP

recommendations. Antiseptic for handwashing is provided at the entrance to the dialysis facility as well as at the access to each of the patient treatment rooms; every person entering the facility should follow hand hygiene measures in accordance with established guidelines [16,17].

Cleaning staff members have been trained in handling and cleaning all areas of the PD center. Cleaning procedures with disinfection products are carried out in each of the rooms at the end of each patient visit and working day. The areas defined for the management of patients with suspected COVID-19 infection are immediately sanitized according to international recommendations.

### 2.1.8 | Multidisciplinary team meetings

The multidisciplinary team continues to hold a monthly virtual meeting for the analysis and follow-up of all at-risk patients, under the protocols established in the program.

## 2.2 | Statistical analysis

Categorical variables were described as percentages, and continuous variables were described using measures of central tendency and dispersion. To compare the data before the pandemic and during the follow-up period, Student's *t*-test for paired samples was used, since the variables were adjusted to the normal curve model.

To compare the median time on PD by the cohort, the Kruskal-Wallis nonparametric statistical test was used for peritonitis rates, transfer to HD, and COVID-19 infection. All statistical analyses were performed using SPSS v. 24.

To perform temporal trends analysis, the effects of time (month) on the COVID-19 infection incidence, case fatality, and hospitalization rates (cases / study population) were evaluated.

# 3 | RESULTS

The results here described covering the follow-up period after the implementation of the protocol (April 1, 2020 to June 30, 2020) for the management of 946 PD patients (932 Continuous Ambulatorial Peritoneal Dialysis (CAPD), 14 Automated Peritoneal Dialysis (APD)) in the event of COVID-19. The median adult patients' age was 51 years ($R$ = 19–96), whereas for pediatric patients it was 9 years ($R$ = 01–17), with a predominance of the male gender (62%) and diabetes mellitus (DM) as the main etiology of the disease in adult patients (48%) (Table 1).

**TABLE 1** Demographics

| | ($n$ = 946) | |
|---|---|---|
| **CAPD** | | **%** |
| Adult | 909 | 96.1 |
| Pediatric | 23 | 2.4 |
| APD | | |
| Adult | 4 | 0.4 |
| Pediatric | 10 | 1.1 |
| Gender | | |
| Male | 584 | 62 |
| Female | 362 | 38 |
| Etiology of CKD | | |
| DM | 451 | 48 |
| Hypertension | 370 | 39 |
| HIV | 22 | 2 |
| Cardiovascular disease | 15 | 2 |
| Chronic glomerulonephritis[a] | 10 | 1 |
| Others | 78 | 8 |

[a]Currently, there is no renal biopsy for the confirmatory diagnosis of Chronic glomerulonephritis (CGN), which is categorized within others.

During 3 months, 95 catheters were placed in incident patients, with 72 being placed by surgical and 23 by percutaneous technique. Out of the 95 patients receiving a PD catheter, 64 started treatment at home; the remaining patients were in training at the time of this report. None of the patients had a diagnosis of COVID-19 at the time of PD catheter placement, and the procedure for this group of patients followed the routine protocol applied in the clinics.

According to the new protocol, in order to avoid an uncontrolled number of patients attending the PD Clinic, incident patients attended the clinic at specific times, some on alternate days. Moreover, the number of training hours per day was increased to decrease the frequency of facility visits and the average training time was 19 hours.

Follow-up was done mostly by WhatsApp video with the nurse in charge of the program; when this was not possible, a phone call was made. According to the new protocol, patients are followed up every month by the different members of the multidisciplinary team by telephone instead of face-to-face PD clinical visits. Table 2 shows the number of face-to-face and virtual consultations per month. During the follow-up period and based on the telephone calls, 375 patients attended unscheduled face-to-face consultations at the PD clinic,

**TABLE 2** Number of face-to-face and virtual consultations during the COVID-19 pandemic

| | | Nephrologist | Nurse | Social worker | Dietitian |
|---|---|---|---|---|---|
| Face-to-face PD clinic visit | Planned | | | | |
| | April | 35 | 35 | 10 | 64 |
| | May | 73 | 73 | 1 | 31 |
| | June | 267 | 267 | 246 | 197 |
| | *n*= | 375 | 375 | 275 | 292 |
| | Unplanned | | | | |
| | April | 1 | 1 | 13 | 3 |
| | May | 14 | 14 | 14 | 14 |
| | June | 16 | 16 | 0 | 2 |
| | *n*= | 31 | 31 | 27 | 19 |
| Face-to-face PD clinic visit[a] | | 406 | 406 | 302 | 311 |
| Virtual PD clinic visit | Planned | | | | |
| | April | 872 | 872 | 463 | 542 |
| | May | 832 | 832 | 710 | 743 |
| | June | 769 | 769 | 678 | 571 |
| | *n*= | 2473 | 2473 | 1851 | 1856 |
| | Unplanned | | | | |
| | April | 9 | 9 | 0 | 0 |
| | May | 6 | 6 | 19 | 0 |
| | June | 8 | 8 | 0 | 2 |
| | *n*= | 23 | 23 | 19 | 2 |
| Virtual PD clinic visit | | 2496 | 2496 | 1870 | 1858 |
| Total | | 2902 | 2902 | 2172 | 2169 |

Abbreviations: COVID-19, coronavirus disease 2019; PD, peritoneal dialysis.
[a]Laboratory tests were carried out in June, which increased the number of face-to-face PD clinic visits.

**TABLE 3** Hospitalization, transfer to HD, and peritonitis: before and after implementation of the strategy

| | **Before implementation of the strategy** | | | **After implementation of the strategy** | | | | |
|---|---|---|---|---|---|---|---|---|
| **Month** | **December 2019** | **January 2020** | **February 2020** | **April 2020** | **May 2020** | **June 2020** | **Student's *t*** | ***P* value** |
| Total patients | 916 | 928 | 946 | 943 | 945 | 947 | | |
| Hospitalizations | 45 | 60 | 61 | 36 | 40 | 52 | 1.79 | 0.147 |
| Transfer to HD | 3 | 5 | 3 | 4 | 1 | 3 | 0.91 | 0.417 |
| Peritonitis | 7 | 2 | 6 | 5 | 9 | 11 | −1.43 | 0.226 |

Abbreviation: HD, hemodialysis.

of which 42 were due to fluid overload and 7 were due to signs of uremia.

The patients attended the clinic and had a face-to-face appointment presented with various clinical conditions; most of them were sent back home after the appointment. Patients who arrived with fluid overload or symptoms of uremia were treated appropriately.

During the first 3 months after the protocol was introduced, eight patients were transferred to HD (transfer rate of 0.29) due to peritonitis [2], inguinal hernia repair

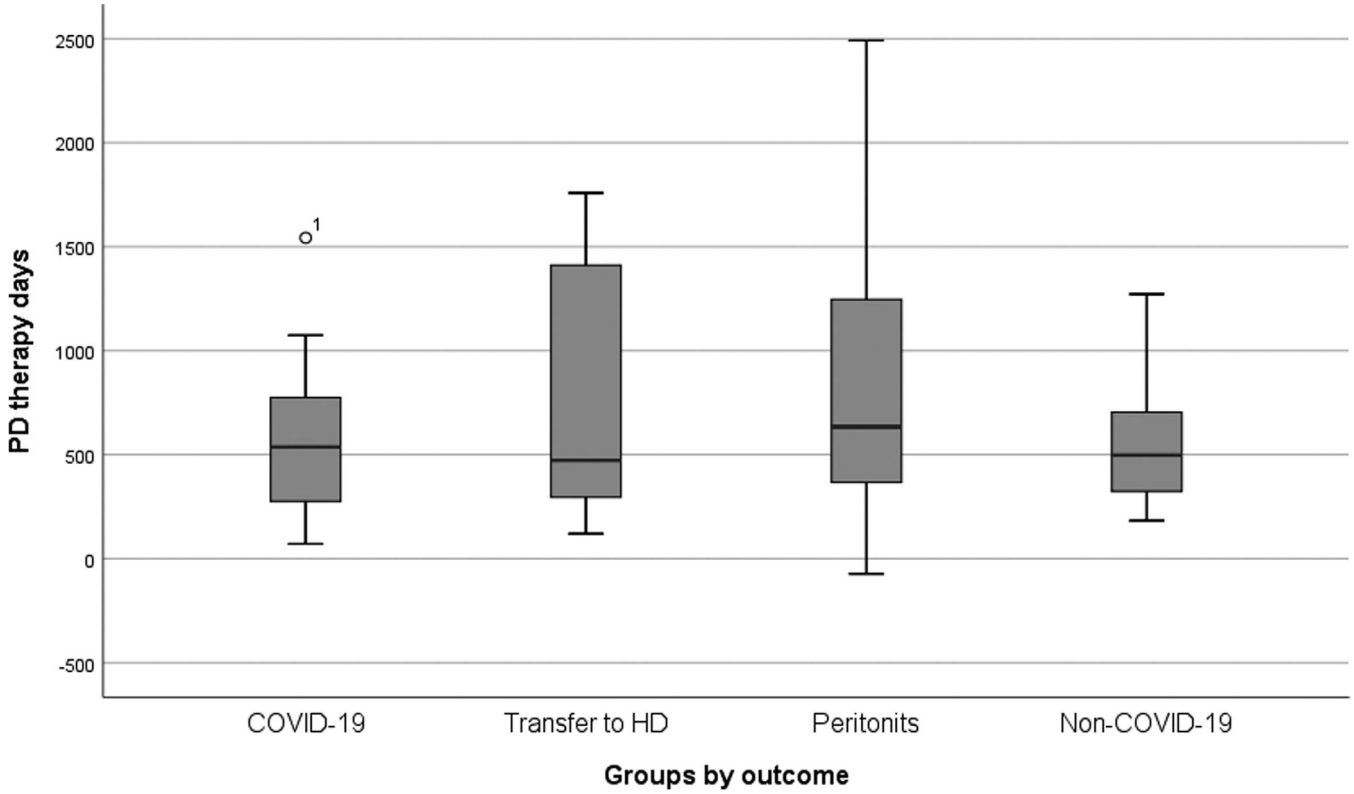


**FIGURE 1** Peritoneal dialysis therapy days by outcome groups: Kruskal-Wallis test

**TABLE 4** COVID-19 patient outcomes

| Patient | Gender | Days on PD | Hospitalization days | Outcome |
|---|---|---|---|---|
| 1 | Male | 1548 | 5 | Death |
| 2 | Male | 629 | 0 | Death |
| 3 | Female | 794 | 19 | Recovery |
| 4 | Male | 455 | 11 | Recovery |
| 5 | Male | 1082 | 14 | Recovery |
| 6 | Female | 332 | 12 | Recovery |
| 7 | Female | 648 | 7 | Recovery |
| 8 | Female | 367 | 23 | Death |
| 9 | Male | 214 | 17 | Recovery |
| 10 | Female | 690 | 13 | Recovery |
| 11 | Female | 74 | 3 | Recovery |
| 12 | Female | 120 | 27 | Hospitalized |
| 13 | Male | 293 | 26 | Death |
| 14 | Female | 277 | 2 | Death |
| 15 | Male | 824 | 16 | Death |
| 16 | Male | 641 | 3 | Death |
| 17 | Male | 397 | 4 | Recovery |
| 18 | Female | 1085 | 11 | Recovery |

Abbreviations: COVID-19, coronavirus disease 2019; PD, peritoneal dialysis.

[1], intestinal perforation [1], membrane failure [1], catheter failure [1], and two for other reasons (psychosocial reason, chronic disease in the primary caregiver). The median time on therapy for this group was 549 days. The peritonitis rate for the follow-up period was 0.11 episodes per patient/year, which is not different from the previous years reported by the clinics (2015: 0.78; 2016: 0.16; 2017: 0.13; 2018: 0.16; 2019: 0.10). None of the patients who presented an event of peritonitis had less than 90 days in the program.

Student's *t*-test analysis showed no statistical significance for the variables hospitalization ($P = 0.147$), transfers to HD ($P = 0.417$), and peritonitis rate ($P = 0.226$). This indicates that the aforementioned variables before the pandemic are not statistically significant or different from those found after the implementation of the strategy (Table 3).

When comparing the median time of PD in all cohort (541 days), no statistical significance was found for transfer to HD (472 days), peritonitis (634 days), or patients with COVID-19 (536 days), $P = 0.306$ (Figure 1), according to the Kruskal-Wallis statistical test.

Before the implementation of the strategy, the hospitalization rate per 100 patients was 21.7 whereas the post-implementation rate decreased to 15.7 per 100 patients.

Out of the 946 patients, only 2% ($n = 18$) tested positive for COVID-19 in the 3 months follow-up period (Table 4). These patients were managed in a specialized area according to the local recommendations. Furthermore, the SARS-CoV-2 infection incidence rate was 0.06 per 100 patients per month, whereas the fatality rate of those patients hospitalized with the diagnosis COVID-19 was 38.9.

## 4 | DISCUSSION

The crisis caused by the novel COVID-19 is one of the most significant biomedical disasters of our time. The virus has induced changes in the practice of nephrology [18], which have reached peritoneal dialysis.

Education, training, monitoring, and follow-up processes of the chronic patient in this modality of therapy have been modified with safety recommendations made by the MSP, affecting both internationally recommended good practices [19,20] and local processes of care. The rapid spread of the virus made it necessary to promptly implement protocols allowing for adequate patient follow-up and health protection of the staff working in PD centers. The recommendations for social distancing limited the monthly monitoring and follow-up in the dialysis units, so that telemedicine, using the telephone and WhatsApp, was established as priority allowing these objectives to be met while ensuring patient monitoring. Evidence has shown that telephone triage and text messaging systems can be appropriate options for the follow-up of home patients [21,22]. The adoption of these communication channels allows the identification of patients at risk and the establishment of correct processes of care that will settle the specific problem detected. The measures taken at the centers have established new processes, focused on early detection of complications associated with uremia and volume overload. A key point in the quality assurance of the centers is the monthly meeting of the multidisciplinary team through videoconferences. These meetings allow us to maintain the standards of care in the centers, as well as to define intervention and follow-up actions for specific patients with risk factors or identified problems, thus reducing as much as possible the attendance to the dialysis center. The launch of the psychology team's online consultation focuses on reducing stress, offering consultation to patients and families with anxiety problems.

The PD unit management and follow-up protocols are based on published evidence, being developed to anticipate the challenge of caring for this group of patients; they do not differ substantially from recent guidelines issued by the International Society of Peritoneal Dialysis (ISPD) [23]. Patient screening measures, indications for patient care, staff attention at the facility, and communication via telemedicine systems are aligned with COVID-19 response groups' recommendations [24]. Yang et al. have suggested that precautionary measurements together with social support may maintain a low COVID-19 infection rate in PD patients and healthcare staff [9]; our initial results confirm their findings.

Since this is a novel virus, our knowledge is still limited and all experience gathered from different corners of the world, either observational or interventional, are much welcomed to be shared within the PD international community. It is still not confirmed whether the spent peritoneal dialysis effluent may contain the coronavirus. The safe disposal of the PD effluent must be carried out based on the local regulations. A recent report by Vischini et al. [25] found positive PCR tests in PD spent dialysate of one of their patients, 1 month after the first symptoms, bringing into question whether the virus itself was present or if it was noncontagious RNA fragments. On the other hand, Candellier et al. [26] in their experience with serial PD effluent samplings from three PD patients, using quantitative reverse transcription PCR analysis based on the highly specific RdRp gene and E gene, found none of 11 PD effluent samplings were positive. A blood sample was positive in only one patient. Their data are in line with the absence of SARS RNA in the effluent from PD patients with SARS infection [27].

The contradictory results suggest performing a SARS-CoV-2 culture to confirm PD effluent contagiousness before imposing specific procedures in PD patients.

For most of our patients who are on CAPD, the recommendation is to discharge the spent effluent in a toilet bowl, whereas those few patients on APD are advised to drain the spent dialysate below the waterline in a bucket or toilet bowl. Healthcare workers or caregivers should dispose of the bag with sodium hypochlorite and put it into the garbage. For the proper disposal of the PD fluid, the same protocols used before COVID-19 still apply, consisting of pouring 20 mL of sodium hypochlorite 7.5% per bag (10 cc per 1000 mL of PD effluent) [28]. In Supplemental material S2, photographs are shown as evidence of blood pressure control, ultrafiltration, exit site, PD effluent inspection, and PD prescription daily reports. One limitation of the study is that the observation period is very short to draw statistical-related conclusions; however, the results here presented reflect an immediate response to the COVID-19 pandemic, an unknown and unforeseen global medical catastrophe.

The recommendations made and interventions performed in this period are in line with considerations and recommendations reported by Yang et al. [9] and Alfano et al. [29]. On the other hand, the strength of the study is the number of PD patients involved and the fact that they belong to only one national PD provider. Furthermore, the concentrated efforts and preparedness of the PD team, dialysis provider, and health authorities have certainly contributed to keep the Dominican PD patients at their homes. Another strength of the study is the possibility to convey and share real-life experience with the global PD community, allowing others to be able to replicate the results of performed interventions based on recommendations proposed.

The implementation of a bidirectional communication virtual channel and COVID-specific follow-up protocol has allowed patients to continue their treatment without putting their health at risk in the Dominican Republic. The bidirectional virtual communication keeps them in constant contact with their dialysis center and maintains the presence of the multidisciplinary team in a structured and safe manner. Peritonitis rates did not increase despite changes in the protocols of care, HD transfer rate did not differ from the monthly average with face-to-face follow-up, and the rate of COVID-19 infection was lower than that reported internationally (16%) in HD units [30].

## 5 | CONCLUSIONS

COVID-19 infection poses challenges for dialysis patients. Patients on peritoneal dialysis (PD) treatment have the home advantage over patients on satellite clinics-based HD treatment, as they do not need to attend the facility three times a week. An appropriate and structured process of care, a COVID-specific PD follow-up protocol, and telemedicine utilization provided treatment continuity, complications management, and protection of the lives of PD patients.

## ORCID

*Elianny Polanco* https://orcid.org/0000-0002-3740-0089
*Mercedes Aquey* https://orcid.org/0000-0002-0258-6346
*Jhanna Collado* https://orcid.org/0000-0002-1638-0920
*Erwin Campos* https://orcid.org/0000-0001-7672-9787
*Janny Guzman* https://orcid.org/0000-0001-9293-7631
*Miguel Angel Cuevas-Budhart* https://orcid.org/0000-0002-3379-0147
*José Carolino Divino-Filho* https://orcid.org/0000-0002-6705-9408
*Alfonso Ramos-Sanchez* https://orcid.org/0000-0002-2156-3553

## REFERENCES

1. Guan W, Ni Z, Hu Y, Liang W, Ou C, He J, et al. Clinical characteristics of coronavirus disease 2019 in China. N Engl J Med. 2020;382(18):1708–20. https://doi.org/10.1056/NEJMoa2002032.
2. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020 Feb 15;395(10223):497–506.
3. Luyckx VA, Tuttle KR, Garcia-Garcia G, Gharbi MB, Heerspink HJL, Johnson DW, et al. Reducing major risk factors for chronic kidney disease. Kidney Int Suppl. 2017;7(2):71–87.
4. Ikizler TA, Kliger AS. Minimizing the risk of COVID-19 among patients on dialysis. Nat Rev Nephrol. 2020;16(6):311–3.
5. Ikizler TA. COVID-19 and dialysis units: what do we know now and what should we do? Am J Kidney Dis. 2020;76:1–3.
6. OPS/OMS Rep. Dom.—Primer caso importado del nuevo coronavirus confirmado en República Dominicana https://www.paho.org/dor/index.php?option=com_content&view=article&id=3240:primer-caso-importado-del-nuevo-coronavirus-confirmado-en-republica-dominicana&Itemid=362 Accessed 6 Jul 2020
7. Chaudhary K, Sangha H, Khanna R. Peritoneal dialysis first: rationale [internet]. Vol. 6, Clinical Journal of the American Society of Nephrology. Clin J Am Soc Nephrol. 2011;6(2):447–56. https://pubmed.ncbi.nlm.nih.gov/21115629/ Accessed 3 Jul 2020.
8. Mehrotra R, Devuyst O, Davies SJ, Johnson DW. The current state of peritoneal dialysis. J Am Soc Nephrol. 2016;27(11):3238–52.
9. Yang Z, Dong J. Operational considerations for peritoneal dialysis management during the COVID-19 pandemic. Clin Kidney J. 2020;13(3):322–7.
10. Fernandez-Prado R, Gonzalez-Parra E, Ortiz A. Often forgotten, transport modality to dialysis may be life-saving. Clin Kidney J. 2020;13(4):510–2.
11. Rincón A, Moreso F, López-Herradón A, Fernández-Robres MA, Cidraque I, Nin J, et al. The keys to control a

coronavirus disease 2019 outbreak in a haemodialysis unit. Clin Kidney J. 2020;13(4):542–9.
12. Oficina Nacional de Estadística (ONE) https://www.one.gob.do/ Accessed 3 Jul 2020.
13. Weisbord SD, Fried LF, Arnold RM, Rotondi AJ, Fine MJ, Levenson DJ, et al. Development of a symptom assessment instrument for chronic hemodialysis patients: the dialysis symptom index. J Pain Symptom Manage. 2004;27(3):226–40.
14. WHO. Home care for patients with COVID-19 presenting with mild symptoms and management of their contacts https://www.who.int/publications/i/item/home-care-for-patients-with-suspected-novel-coronavirus-(ncov)-infection-presenting-with-mild-symptoms-and-management-of-contacts Accessed 1 Jul 2020.
15. Sánchez Cardenas Rafael, Neftali Vasquez Francisco, Quezada Ariza Hecto, Rosa Chupany Chanel, Herrera Brito Luz, Suriel Oscar, Mordan Jose D la RA. Directrices para la referaencia, Traslado y Recepción de Pacientes afectados por COID-19, República Dominicana. https://repositorio.msp.gob.do/bitstream/handle/123456789/1763/9789945621020.pdf?sequence=1&isAllowed=y. Accessed 1 Jul 2020.
16. CDC. Hand Hygiene Recommendations (Guidance for Healthcare Providers about Hand Hygiene and COVID-19) 2020 https://www.cdc.gov/coronavirus/2019-ncov/hcp/hand-hygiene.html Accessed 6 Jul 2020.
17. WHO. Five moments for hand hygiene. Clean Care is Safer Care. 2014 https://www.who.int/gpsc/tools/Five_moments/en/ Accessed 6 Jul 2020.
18. Agarwal R. The aftermath of coronavirus disease 2019: devastation or a new dawn for nephrology?. Nephrol Dial Transplant. 2020;35(6):904–907. https://doi.org/10.1093/ndt/gfaa094.
19. Li PKT, Szeto CC, Piraino B, de Arteaga J, Fan S, Figueiredo AE, et al. ISPD peritonitis recommendations: 2016 update on prevention and treatment. Peritoneal Dialysis International. 2016;36(5):481–508. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5033625/ Accessed 3 Jul 2020.
20. Campbell DJ, Johnson DW, Mudge DW, Gallagher MP, Craig JC. Prevention of peritoneal dialysis-related infections. Nephrol Dial Transplant. 2015;30(9):1461–72.
21. Cao F, Li L, Lin M, Lin Q, Ruan Y, Hong F. Application of instant messaging software in the follow-up of patients using peritoneal dialysis, a randomised controlled trial. J Clin Nurs. 2018;27(15–16):3001–7. https://doi.org/10.1111/jocn.14487 Accessed 3 Jul 2020.
22. Nayak A, Karopadi A, Antony S, Sreepada S, Nayak KS. Use of a peritoneal dialysis remote monitoring system in India. Perit Dial Int. 2012;32(2):200–15. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3525402/ Accessed 3 Jul 2020.
23. ISPD: Strategies regarding COVID-19 in PD patients precautionary measures for PD patients https://ispd.org/wp-content/uploads/ISPD-PD-management-in-COVID-19_ENG.pdf. Accessed 6 Jul 2020.
24. Kliger AS, Silberzweig J. Mitigating Risk of COVID-19 in Dialysis Facilities. Clin J Am Soc Nephrol. 2020;15(5):707–709. https://doi.org/10.2215/cjn.03340320.
25. Vischini G, D'Alonzo S, Grandaliano G, D'Ascenzo FM. SARS-CoV-2 in the peritoneal waste in a patient treated with peritoneal dialysis. Kidney International. 2020;98(1):237–238.
26. Candellier A, Goffin É. Letter regarding "SARS-CoV-2 in the peritoneal waste in a patient treated with peritoneal dialysis". Kidney International. 2020;98(2):512. https://doi.org/10.1016/j.kint.2020.05.034.
27. Kwan BCHBC-HBCH, Leung CBC-B, Szeto C-CCCC-C, Wong VW-SVWS, Cheng YLY-LYL, Yu AW-YAWYAW-Y, et al. Severe acute respiratory syndrome in dialysis patients. J Am Soc Nephrol. 2004;15(7):1883–8. https://www.scopus.com/inward/record.uri?eid=2-s2.0-3042579830&doi=10.1097%2F01.ASN.0000131522.16404.1F&partnerID=40&md5=68da6f08510f25d85c50841d6f5ebca9. Accessed 25 May 2020.
28. Macrotech. Protocolo Conexión- Desconexión DPCA. 2019.
29. Alfano G, Fontana F, Ferrari A, Guaraldi G, Mussini C, Magistroni R, et al. Peritoneal dialysis in the time of coronavirus disease 2019. Clin Kidney J. 2020;13(3):265–8.
30. Ma Y, Diao B, Lv X, Zhu J, Liang W, Liu L, et al. 2019 novel coronavirus disease in hemodialysis (HD) patients: Report from one HD center in Wuhan, China. medRxiv. 2020. in press. https://doi.org/10.1101/2020.02.24.20027201.

## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

**How to cite this article:** Polanco E, Aquey M, Collado J, et al. A COVID-19 pandemic-specific, structured care process for peritoneal dialysis patients facilitated by telemedicine: Therapy continuity, prevention, and complications management. *Ther Apher Dial*. 2021;25:970–978. https://doi.org/10.1111/1744-9987.13635