REVIEW ARTICLE

REVISTA ENFERMAGEM ATUAL IN DERME

ADAPTATIONS IN HEMODIALYSIS CENTERS TO PREVENT INFECTION WITH THE NEW CORONAVIRUS: A INTEGRATIVE REVIEW

ADAPTAÇÕES NOS CENTROS DE HEMODIÁLISE PARA PREVENÇÃO DA INFECÇÃO PELO NOVO CORONAVÍRUS: UMA REVISÃO INTEGRATIVA

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ABSTRACT

Objective: To identify the adaptations made in hemodialysis centers to prevent infection by the new coronavirus. Method: Integrative review with 15 studies chosen for analysis, based on the Latin American and Caribbean Literature in Health Sciences (LILACS), the Medical Literature Analysis and Retrievel System Online (MEDLINE) and the Bibliographic Index Español en Ciencias de la Salud (IBECS). Results: The main adjustments implemented were the intensification of hand washing guidelines, use of masks by patients during transportation and in the waiting room, use of Personal Protective Equipment for professionals who are in direct contact with patients, rotation in shifts dialysis and equipment distancing. Conclusion: The study addressed a range of relevant adaptations in hemodialysis centers, with an emphasis on intensifying standard and specific biosafety measures for the prevention of the new coronavirus. Adjustments in the routines of services are essential for the continuity of treatment safely.

Keywords: Covid-19; Renal Dialysis; Hemodialysis Hospital Units; Biosafety.

RESUMO

Objetivo: Identificar as adaptações realizadas nos centros de hemodiálise para prevenção da infecção pelo novo coronavírus. Método: revisão integrativa com 15 estudos eleitos para análise, levantados nas bases da Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS), na Medical Literature Analysis and Retrievel System Online (MEDLINE) e no Índice Bibliográfico Español en Ciencias de la Salud (IBECS). Resultados: As principais adequações implantadas foram a intensificação das orientações da lavagem das mãos, uso de máscara pelos pacientes durante transporte e na sala de espera, uso de Equipamentos de Proteção Individual para os profissionais que estão em contato direto com os pacientes, rodízio nos turnos de diálise e distanciamento dos equipamentos. Conclusão: O estudo abordou um leque de adequações relevantes nos centros de hemodiálise, com ênfase na intensificação das medidas de biossegurança padrão e específicas para a prevenção do novo coronavírus. As adequações nas rotinas dos serviços são imprescindíveis para a continuidade do tratamento com segurança.

Palavras-chave: Covid-19; Diálise Renal; Unidades Hospitalares de Hemodiálise; Biossegurança

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INTRODUCTION

Chronic Kidney Disease (CKD) is characterized by the irreversible reduction of the number of nephrons, functional units of the kidneys. In this way, the organ becomes unable to perform its multiples and essential homeostatic activities[1]. For its magnitude, for affecting so many individuals and having lasting consequences, CKD is considered a public health problem[2]. In Brazil, the prevalence of people with kidney failure is increasing, the disease has an unfavorable prognosis and costs costly dialysis treatment[3].

The numbers of people undergoing hemodialysis are growing, as well as a high mortality rate, which is alarming the scientific community in both last decades[3]. In July 2018, the estimated total number of dialysis patients in the country was 133,464, while the annual rate of gross mortality was 9.5%. Of these, 92.3% were on hemodialysis, 7.7% in peritoneal dialysis and 22.1% on the waiting list for transplant[4].

Patients undergoing hemodialysis treatment face many challenges and health-related complications. In addition to this problem, the current pandemic for the new coronavirus (or Covid-19) as a possible aggravating factor to the health of this group. That disease can compromise several tissues and organs of the body, the impairment of kidney function can occur at any moment during the course of the disease, being more described as late. The pathogenesis of kidney injury in Covid-19 has not yet been defined, but it was observed that the presence of comorbidities can favor a more serious course of the disease[5].

SARS-CoV-2 is the etiologic agent of the disease called new coronavirus or Covid-19. The first cases were registered at the end of 2019 in China, featuring worldwide dissemination months later[6]. Covid-19 can cause the Severe Acute Respiratory Syndrome (SARS), a condition that compromises the lungs, causing inflammatory cell infiltration, fluid accumulation (edema) and pulmonary destruction, making it difficult to perform gas exchange[7].

Until December 7, 2020, the Covid-19 infection reached 67,940,946 people in the world and 6,623,911 in Brazil. Among the most vulnerable people and considered as a risk group for the worsening of the disease are the carriers of chronic diseases such as diabetes and hypertension, asthma, kidney disease, among others[8].

It is important to address the hemodialysis services and precautions related to infection. Logistic factors such as transport and the functioning of hemodialysis centers in closed places,

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allied to the clinical vulnerabilities of the patients with kidney disease, hemodialysis patients in Crema, in Italy, a risk of coronavirus infection 12.7 times greater than in the local population[9]. In a hemodialysis center in Spain that attends ninety patients, the prevalence of disease was 41% and mortality was around 16.2% in the first half of 2020[10].

Even with the imminent risk of infection, dialysis treatment could not be interrupted, as it is essential for the survival of these patients, who maintain an average frequency of going to these places three times a week. Given this context, the hemodialysis centers of the world adapted their routines following the health protocols recommended by the Ministries of Health, World Organization of Health and Specialist Societies, to minimize the risk of infection in these services[11-12].

In Brazil, the first recommendation concerning the care of dialysis patients was published on March 1, 2020 by Brazilian Society of Nephrology (SBN). As it is a new virus, the recommendations walked along with the evolution of knowledge about the disease and followed the recommendations and determinations of the Federal Council of Medicine (CFM) and the Ministry of Health[13]. Several countries also issued recommendations that were applied in the context of its services, taking into account regional specificities.

Given this reality and the new challenges imposed in dialysis centers to ensure the continuity of the treatment of patients safely, it was necessary to adapt service routines to adopt these recommendations. The professionals of health faced the enormous challenge of dealing with an unknown scenario and fear of death, at the same time, they had to remain active to ensure survival of these patients[14].

Development is necessary for scientific studies that explore the reality of hemodialysis centers in context of the pandemic. This work has as a goal to identify the adaptations occurring in hemodialysis centers for the prevention of new coronavirus infection. The study was guided by the following research question: what adaptations have been made in hemodialysis centers for prevention of the new coronavirus infection?

METHOD

The present study consists of an integrative review, a method that provides the synthesis of knowledge and the incorporation of applicability of study results significantly[15]. This type of study allows the combination of primary and secondary studies, evaluating the

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methodological quality in order to propose new results according to the objective intended[16].

The Integrative Review (IR) is consisting of six distinct phases: 1) identification of the theme and selection of the hypothesis or research question for the elaboration of the integrative review; 2) establishment of criteria for inclusion and exclusion of studies/sampling or literature search; 3) definition of the information to be extracted from the studies, selecting the categorization of studies; 4) evaluation of studies included in the integrative review; 5) interpretation of results; 6) presentation review/synthesis of knowledge[17].

In the first stage, the research question was: what adaptations performed in hemodialysis centers for the prevention of infection by the new coronavirus? Later, in the second stage, the strategies for searches were defined, in which the following Health Sciences Descriptors (DeCS) combined with operators Booleans AND and OR: "infections by coronavirus", "hospital units of hemodialysis", "hemodialysis centers", “renal dialysis”, hemodialysis, “failure chronic kidney disease", "peritoneal dialysis", "disease by the new coronavirus" and "measures of security”, as shown in Figure 1.

The data collection step was held in December 2020, through electronic searches in Latino Literature-American and Caribbean in Health Sciences (LILACS), in Medical Literature Analysis and Retrieval System Online (MEDLINE) and in the Bibliographic Index Español en Ciencias de la Salud (IBECS). Studies were included when published from December 2019 to November 2020, available in Portuguese, English or Spanish and that dealt with adjustments made in the centers of hemodialysis due to the new coronavirus pandemic. Studies of review, technical notes, manuals or other recommendations for prevention of Covid-19 in hemodialysis centers were excluded.

In the selection step, initially 486 studies were found, then with the application of the filter from the year 2019 to 2020, remained 421. After reading all titles, 41 studies continued. The reading of the abstracts continued, with the permanence of 30 studies. At the end, after reading the articles in full, 16 studies were selected, which two of them got eliminated, because they were duplicated in more than one database. Therefore, the final study sample consisted of 14 articles, as shown in Figure 1. After the careful reading of the studies in the sample, data were extracted on its characterization, as well as those who answered the question of research.

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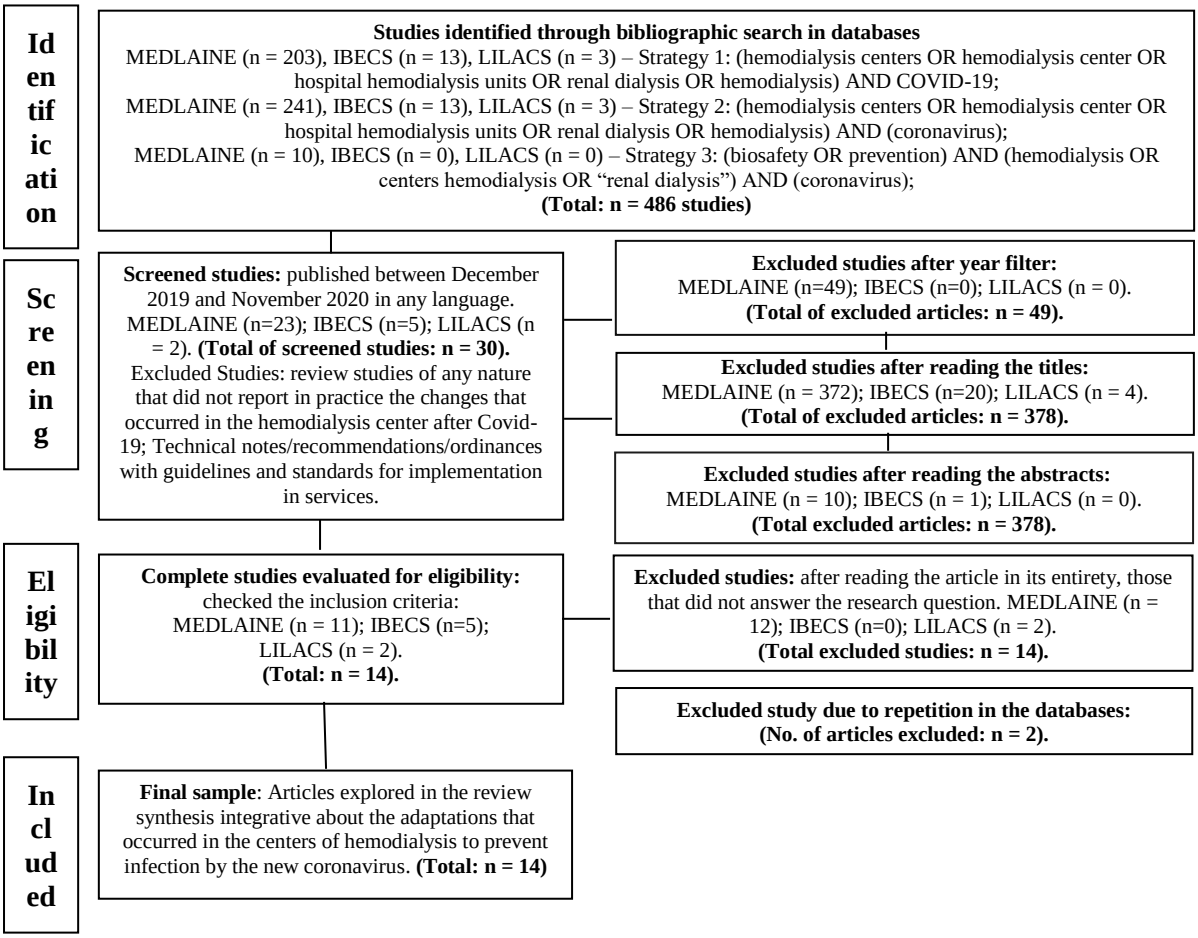
Figure 1 - Selection of articles Flowchart on the adaptations made in the centers of hemodialysis for the prevention of new coronavirus infection, Maceió, Brazil, 2020.



Source: Authors (2020).

RESULTS

Among the 14 studies that compose the final sample, 50% were published in the first half of 2020 and 50% in the second; 78.6% are of the experience report type, 35.33% were carried out in Spain, 100% had hospital units as a scenario of hemodialysis, 71.4% were indexed in the MEDLINE and 28.6% were published in the Journal of Nephrology, as it turns out in table 1.

The adaptations that took place in the centers of hemodialysis due to the Covid pandemic-19 were classified into three categories for better contextualization, as shown in table 2: I) Recommendations for homecare and transport; II) New routines in hemodialysis centers; III) Adaptations in hemodialysis centers related to human and material resources.

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Table 1- Characterization of selected studies regarding authors' names, month and year of publication, type of study, country and study setting, indexed databases and journal of Publication, Maceió, Brazil, 2020.

AUTHORS/ MONTH/ YEAR OF PUBLICATION	TYPE OF STUDY / LEVEL OF EVIDENCE	SCENARIO/ COUNTRY	BASES/ JOURNAL
[18] Sánchez - Pérez et al., 08- 09/2020	Report of experience/VI	Tertiary hospital/ Spain	IBECS/ MEDLINE/ Journal of Nephrology
[19] Arribas – Cobo et al., 07/2020	Report of experience/VI	Hospital Unit/ Spain	IBECS/ Enfermería Nefrológica
[20] Andreu-Periz et al., 10/2020	Phenomenological Qualitative/ IV	Hemodialysis Hospital Units/ Spain	IBECS/ Journal of Nephrology
[10] Albalate et al., 05- 06/ 2020	Report of experience/VI	Hospital Unit/ Spain	IBECS/ Journal of Nephrology
[9] Depetri et al., 05/2020.	Report of experience	Dialysis Center of Crema, Italy	MEDLINE/ G Ital Nefrol
[21] Bharati et al., 07/ 2020	Report of experience/VI	Reference Center tertiary hemodialysis/ South and Southeast Asia	MEDLINE/ Journal of Nephrology
[22] Ippolito et al., 06/2020	Report of experience/VI	Dialysis unit/ Italy	MEDLIN/ Giornale Italiano di Nefrologia
[23] Yau et al., 11/2020	Cohort Study/IV	Hospital Unit/ Toronto, Canada	MEDLINE/ American Journal of Kidney
[24] Cho et al., 12/2020	Cohort Study/IV	Hemodialysis Units/ Korea	MEDLINE/ Journal of the American
[25] Li e Xu, 05/2020	Report of experience/VI	Dialysis Centers / Wuhan in China	MEDLINE/ Clinical Journal of American Society of Nephrology
[26] Arenas et al., 04/ 2020	Report of experience/VI	Hemodialysis unit/ Spain	IBECS/ J. Nefrol
[27] Ossareh et al., 09/2020	Report of experience/VI	Hospital Unit/ Wuhan China	MEDLINE/ Iranian Journal of kidney Diseases
[28] Ulrich et al., 03- 04/ 2020	Report of experience/VI	Hemodialysis unit/ U.S	MEDLINE/ Nephrol Nurs J.
[29] Wei et al. 06/2020	Report of experience/VI	Dialysis Center / Wuhan, China	MEDLINE/ Renal Failure

Source: Authors (2020).

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Table 2 – Main adjustments adopted in hemodialysis centers of the studies analyzed after the Covid-19 pandemic, Maceió, Brazil – 2020.

I) HOMECARE AND TRANSPORT	II) NEW ROUTINES IN HEMODIALYSIS CENTERS		III) CHANGES IN HUMAN/MATERIALS RESOURCES
General: ✓ Washing hands before the exit from home[19, 26]; ✓ Avoid contact with sick people/ symptomatic[23,26]; ✓ Keep up at home in eminence of symptoms of Covid and call to the center of dialysis for guidelines[26]. **Transport**: ✓ Sanitize the hands before enter the ambulance[26] and wear mask during the transport[18, 19]; ✓ Offer of written instructions to the operators and patients about the measures to be followed at home and on travels from/to the center dialysis[9, 27]; ✓ The transport in	**Screening:** ✓ Hand wash with hydroalcoholic solution[19,20,10,26,27] and in a continuous way[23, 27, 29]; ✓ Washing the fistula with hydroalcoholic solution[19, 20,27]; ✓ Mandatory use of mask including by escorts in the waiting room[18,19] and constant use of surgical mask by patients[19, 20, 10, 22, 23, 27, 29]; ✓ Patient screenings: 1st) by phone on the prior day to the dialysis session; 2nd) upon arrival in the waiting area for the unit of dialysis[23]; ✓ Protocol implementation screening for patients and professionals of health [18,10,22,23,24] which included the monitoring of vital signs [18,19,23,24] and questions about the	**Dialysis:** ✓ Access prohibition to the dialysis room by escorts and shift changes of dialysis[19,20,29,24] with distance between the machines[19, 20, 23] of two meters[21]; **Common:** ✓ Correct use of PPE [18,19,22,24,26,27,28,21] and dispensers of disinfectant[9] were installed; ✓ Creation of a care protocol with patients in dialysis[24] **Health education:** ✓ Implementation of protocols with guidelines on the disease/prevention[10,23,25]; ✓ Guidelines for patients about infection, prevention and measures in the face of symptoms[10,21] and every turn on the care for the disease[29];	**Precautions/biosafety:** ✓ Constant use of surgical mask[19,20,10,27,29] and strict hand hygiene[21, 25, 27, 28, 21] before, during and after each procedure[24]; creation of an exchange area adequate[21]; ✓ Adoption of effective protective measures and precautions, including the use of masks, hats and aprons that meet to requirements[25] and standard precautions: pre-examination, invasive operations, vascular access connection, injections, collection of blood and other operations through contact with blood and patient's bodily fluids[25]; ✓ Professionals are always well protected with all PPE[28], including personal goggles, closed shoes, suitable clothes and mask N95[27]. Assiduous use whenever they are in dialysis rooms and especially in patient contact[28]; **Training/continuing education/motivation:** ✓ Training professionals in the hemodialysis unit on the use of PPE, with an emphasis on proper removal[29] and contamination prevention[24] and identification of signs of Covid-19 symptoms[26]; ✓ Correct handling of surgical masks and N95[28] and guidance on patient care[18,29]; ✓ Strategies to deal with the new scenario and the practice of clinical look[28,29], leading and examining patients with the discussion of cases and reduction of fear with the intensification of prevention measures[21] **Resource and routine management:** ✓ Expansion of human resources and awareness of interpersonal relationships for nurses in order to facilitate adaptation to tasks[20]; ✓ High availability of personal protect equipment (PPE) and encouragement for the adoption of surgical masks, coveralls, gowns,

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collective ambulance was discouraged; oriented to use own vehicle[10, 18].	symptoms or contact with confirmed cases or suspects[18, 23, 24]; ✓ Creating a clinic triage for patients with suggestive diagnosis with blood tests immunoglobulin (IgG/IgM) and computed chest tomography (CCT)[27]; ✓ Implementation of physical distance in the waiting room[23].	✓ Social distancing within the rooms of dialysis and out[29]; ✓ Vaccination for seasonal flu (*Haemophilus influenzae*)[26] and implantation of biosecurity protocol [10, 19];	water repellents, glasses, shoe protectors, gloves and harness for the assistance of the patients[9] and availability of kits with goggles, N95 mask and plastic apron, in addition to the cotton smock, gloves, cap and usual shoe protectors[21]. The gaps of supply were managed with the internal production of 3D printing visors[21]; ✓ Cluster medical activities with large groups such as study groups and discussion with the patient were carried out by phone or internet[25].

Source: Authors (2020).

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DISCUSSION

The hemodialysis centers had to adapt to Covid-19's pandemic scenario to ensure continuity of treatment of patients safely[19]. They deepened their knowledge and sought to transform the scenario with the implementation of new routines and incentives for patients and professionals, in order to ensure the continuity of hemodialysis[20].

Among the measures cited for the prevention of Covid-19 in studies, highlights are hand washing[19, 26, 20, 10, 27], recommended to patients and professionals of continuous form[23, 27, 29]. It is a low cost and high effectiveness measure, because the hands are the main vehicle of cross contamination[30], becoming a fundamental measure of Sanitary protocols. Its correct execution removes transient skin flora and desquamated cells, reducing the risk of infection. Hand hygiene can be performed with soap and water or alcoholic and antiseptic solution[31].

Another measure adopted in the centers of hemodialysis consists of the mandatory use of masks by patients since leaving house[18-19], as well as by professionals and escorts, when present[10,19,20,22,23,27,29]. The masks are mechanical barriers for the prevention of droplet dispersion with the purpose of self-protection against diseases, and also to prevent the transmission of pathogens between sick and healthy individuals, masks have been used as a popular public health intervention[32].

The studies also highlighted important recommendations aimed at patients and professionals involved in the transport of patients to hemodialysis centers. In addition to the guidelines on the washing hands before entering the ambulance[26] and the use of a mask[18, 19], there was also the distribution of instructions written about the measures to be followed at home and during the journey[9,27]. In two centers of Spain, transport in collective ambulances were discouraged, being recommended the use of own vehicles[10, 18]. This aspect represents a critical point, especially in Brazil, since many patients reside in cities far from services and are not able to afford the expenses of private transport.

The hemodialysis centers modified the service flow with the implementation of mandatory routines in screening the patient before entering the room dialysis, which included: hygiene of hands[19,20,10,26,27,23,27,29], use of masks[18,19, 20, 10, 22, 23, 27, 29], operationalization of a screening protocol for the identification of

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healthcare professionals or symptomatic patients through the investigation of symptoms and check vitals sign[18,10,22,23,24]. In addition, a hemodialysis center in Wuhan has implemented a clinical screening with the provision of immunoglobulin and tomography tests for patients with diagnoses suggestive of Covid-19.

In addition to patient screening after the entrance to the dialysis unit, a center in Canada inserted a telephone triage, performed the day before dialysis, with the objective of evaluating the patient and providing the necessary guidance and support[23]. In this sense, the importance of initial evaluation/screening done by health professionals to the patient on dialysis, because this allows the detection of flu symptoms and the targeting of suspect patients to a more detailed evaluation, following a different service flow to guarantee your safety and of other patients and professionals[33].

The measurement of vital signs during the screening of patients, professionals and family members who arrive at the center of hemodialysis is crucial to reduce the risks of Covid-19 infection as it allows the comparison with patterns and bodily trends and directs the conduct of professionals[34]. The washing of the arm of the arteriovenous fistula in patient screening was implemented in two centers in Spain and of China[19, 20, 27] and there is also a purpose to reduce the risk of infection, being performed by prior cleaning of the puncture site using mild soap and antiseptic[35].

Dialysis services changed routines inside the dialysis rooms too. Between identified measurements, the prohibition of access to room by companions, being allowed only in strictly necessary situations[9]. Changes in shifts of dialysis were implemented in two centers of dialysis from Spain, one from Korea and one from China[19,20,24], to minimize agglomeration of patients. The distance between the stations of hemodialysis were also observed[19,20,23], two meters between them[21]. These conducts are aligned with the main recommendations of the World Organization of Health[36].

Some common measures were implemented in all sectors of the units of dialysis, such as the use of individual protection of form correct[18,19,22,24,26,27,28,21], implantation of biosafety protocol[19,10] and the creation of a patient care protocol on dialysis[24]. There was also the implementation of alcohol gel dispensers[9] for patients, escorts and professionals. Due to its

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antiseptic properties, the alcohol use in gel became indispensable in the fight against the pandemic, with wide availability in various spaces and at the main entrances to buildings, public transport and health services[37].

Some dialysis centers carried out various educational actions aimed at self-care of patients, with emphasis on preventive measures to minimize risks of infection by the new coronavirus[10,21]. At the dialysis center in Wuhan, China[25], educational actions were promoted on the Covid-19 on all shifts, with the purpose of promoting a greater availability of information and to solve doubts about the infection. They also included guidelines on social distancing inside and outside the rooms. In a center of dialysis from Spain[26], the patients too were instructed to receive the seasonal flu vaccine, because although this one doesn't check protection against Covid-19, it prevents the seasonal flu, which can be an aggravating factor to the clinical picture of these patients.

There were significant changes regarding human resources and availability of materials in the services of hemodialysis in the face of the pandemic. One of adaptations that should be highlighted are the intensification of strategies for biosafety, such as the constant use of masks[19,20,10,27,29], strict sanitation of the hands[21,25,27,28,21] before and after each procedure[24], protective measures and effective standard precautions, including use of masks, hats and aprons that meet the requirements by the workers[25]. The glasses of personal protection, closed shoes, appropriate clothing and N95 masks also became more rigorously used[27]. In one dialysis unit[28], health professionals were instructed to stay assiduously with all PPE whenever they were inside the rooms and mainly in direct contact with the patients. These strategies are paramount to give greater security to the performance professional[38].

Hemodialysis services organized to ensure the greatest supply of PPE, as with the changes in routines and the intensification of biosafety actions, the consumption of these inputs was increasing. Beyond the standard precautionary equipment already used, were added some high protection, such as overalls, repellent coats of water, harness[9], N95 mask and cap[21].

The management of gaps in supply was a problem experienced by all countries and in all health services. To deal with these gaps, a tertiary referral center of Asian hemodialysis[21] produced

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visors by 3D printing, using plastic sheets of protection. A study also pointed out that there was an increase in the availability of human resources in the service, given the overload of work that professionals have been and are being exposed to during the pandemic[20]. The same center also cited the insertion of team training in order to foster a better relationship between nurses, enabling greater adaptation to new challenges imposed by the pandemic[20]. Covid-19 imposes a work routine on the professional which requires greater dedication, responsibility, skill and emotional balance[39].

There was also investment by some centers in training/qualification for the teams on the use of PPE, patient management, as well as personal motivation to reduce insecurity in acting in this context[21]. These professional empowerment/training moments were fundamental for the planning of care, to discuss cases and create service flowcharts/strategies[40].

A study at a center in Crema, Italy, reported the experience of 13 patients on peritoneal dialysis at home. At the beginning of the pandemic, they received guidance and participated in online consultations through chats with doctors. These patients had no additional risks and specific aspects of hemodialysis subjects (home-hospital displacement) regarding the exposure to infection by the new coronavirus, since they were isolated in the home. Only one of the patients on peritoneal dialysis tested positive for Covid-19. Peritoneal dialysis is a viable alternative in the midst of the pandemic, in addition to requiring lower costs in the treatment of the patient[9].

CONCLUSION

The study achieved its objective, since it identified the adaptations performed in hemodialysis services of several countries for the prevention of the infection of the new coronavirus for chronic kidney patients.

The articles addressed a range of adjustments; one of the main ones was the reinforcements to the guidelines on washing the hands. Were also implemented guidance on mask use by patients during transport and in the room of waiting, the importance of PPE for the professionals who are directly counting with the patients, the rotation in the shifts of dialysis and the distance of equipment.

The implementation of these measures was crucial for patients to continue their treatment and minimize the risks of exposure. It is important to emphasize that all these changes that have

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taken place in the centers of hemodialysis reinforce the importance of more intensive implementation of standards and biosafety routines, because often, in the daily lives of professionals, they are neglected, and should be applied regardless of the context of the pandemic. The adjustments that occurred also lead to reflection on peritoneal dialysis as a possible treatment to be further explored and investable both in the pandemic as in the daily lives of patients, as it can be performed at home, reducing costs and wear and tear with the displacement.

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