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Management of Outpatient Hemodialysis During the COVID-19 Pandemic: Recommendations From the Canadian Society of Nephrology COVID-19 Rapid Response Team

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Abstract

Purpose: To collate best practice recommendations on the management of patients receiving in-center hemodialysis during the COVID-19 pandemic, based on published reports and current public health advice, while considering ethical principles and the unique circumstances of Canadian hemodialysis units across the country.

Sources of information: The workgroup members used Internet search engines to retrieve documents from provincial and local hemodialysis programs; provincial public health agencies; the Centers for Disease Control and Prevention; webinars and slides from other kidney agencies; and nonreviewed preprints. PubMed was used to search for peer-reviewed published articles. Informal input was sought from knowledge users during a webinar.

Methods: Challenges in the care of hemodialysis patients during the COVID-19 pandemic were highlighted within the Canadian Senior Renal Leaders Forum discussion group. The Canadian Society of Nephrology (CSN) developed the COVID-19 rapid response team (RRT) to address these challenges. They identified a pan-Canadian team of clinicians and administrators with expertise in hemodialysis to form the workgroup. One lead was chosen who drafted the initial document. Members of the workgroup reviewed and discussed all recommendations in detail during 2 virtual meetings on April 7 and April 9. Disagreements were resolved by consensus. The document was reviewed by the CSN COVID-19 RRT, an ethicist, an infection control expert, a community nephrologist, and a patient partner. Content was presented during an interactive webinar on April 11, 2020 attended by 269 kidney health professionals, and the webinar and first draft of the document were posted online. Final revisions were made based on feedback received until April 13, 2020. CJKHD editors reviewed the parallel process peer review and edited the manuscript for clarity.

Key findings: Recommendations were made under the following themes: (1) Identification of patients with COVID-19 in the dialysis unit, (2) hemodialysis of patients with confirmed COVID-19, (3) hemodialysis of patients not yet known to have COVID-19, (4) visitors; (5) testing for COVID-19 in the dialysis unit; (6) resuscitation, (6) routine hemodialysis care, (7) hemodialysis care under fixed dialysis resources.

Limitations: Because of limitations of time and resources, and the large number of questions, formal systematic review was not undertaken. The recommendations are based on expert opinion and subject to bias. The parallel review process that was created may not be as robust as the standard peer review process.

Implications: We hope that these recommendations provide guidance for dialysis unit directors, clinicians, and administrators on how to limit risk from infection and adverse outcomes, while providing necessary dialysis care in a setting of finite resources. We also identify a number of resource allocation priorities, which we hope will inform decisions at provincial funding agencies.

Keywords
hemodialysis, infectious diseases, clinical guidelines

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Purpose

Patients receiving in-center hemodialysis are a unique and vulnerable population during a pandemic. The necessity for treatment at the dialysis center 3 times weekly means they cannot remain isolated in their homes. They must interact regularly with drivers, nurses, and members of the health care team. Most Canadian hemodialysis units are built with limited (if any) isolation rooms, and many units are too small to strictly observe the minimum 2 m distance between patients at all times in the waiting room and treatment areas. These circumstances pose the perfect environment for the rapid spread of COVID-19 infection. If infected, patients managed with maintenance dialysis have high risk of death because of their high burden of comorbid disease or advanced age.[1] Adequate implementation of measures to prevent the spread of COVID-19 in center hemodialysis units is therefore of paramount importance.

While provincial and federal public health agencies provide recommendations with respect to infection control practices on a daily basis, most of these recommendations, including those from the Centers of Disease Control,[2] provide minimal concrete and specific guidance on how to manage in-center hemodialysis units during the pandemic. Furthermore, advice from other countries is not necessarily applicable to the Canadian landscape.[3-7]

We convened a national workgroup of dialysis leaders to discuss key issues in the management of patients receiving in-center hemodialysis during the COVID-19 pandemic,[8] to collate concrete recommendations that can be easily translated into practice within the resource constraints of individual programs in Canada. We also sought to identify gaps in processes in care that were of *high priority* and *common* throughout the country so that these can be prioritized for resource allocation by provincial funding agencies.

Information Sources

The workgroup members used Internet search engines to retrieve documents from provincial and local hemodialysis programs,[9-13] provincial public health agencies,[14-19] the Centers for Disease Control and Prevention,[2] other kidney agencies,[20] as well as nonreviewed preprints. Finally, we searched PubMed for relevant peer-reviewed published articles using the search terms "COVID-19" AND "(dialysis OR chronic kidney disease)."

Methods

In the context of the pandemic, regional hemodialysis programs rapidly developed policy. Challenges in care were highlighted in the discussion group of the Canadian Senior Renal Leaders Forum, a group of medical and administrative leaders of kidney programs. The Canadian Society of Nephrology (CSN) developed the COVID-19 rapid response team (RRT) to address these challenges by recruiting volunteers within the CSN board who then identified

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other experts within the kidney community to form the workgroup. Available COVID-19 documents from programs across the country were collected. Other national and international kidney agency literature and webinars were viewed for recommendations that could be applied to the Canadian environment. In select circumstances, a review of the published literature was also undertaken. One lead was chosen who drafted the initial document. Members of the workgroup reviewed and discussed all recommendations in detail during 2 virtual meetings on April 7, 2020 and April 9, 2020. Disagreements were resolved by consensus. Recommendations were developed based on consideration of several principles based on ethical underpinnings. We use "we recommend" when we thought the evidence was strongest and the likelihood of benefit high. We use "we suggest" when we reached consensus but the evidence did not reach this standard. Once the document was thought to be complete, it was reviewed by an ethicist, an infection control expert, a community nephrologist, a patient partner, and the entire CSN COVID-19 RRT. Content was presented during an interactive webinar on April 11, 2020, attended by 269 kidney health professionals, after which the document was further revised. The webinar and revised document were posted online.[21] Final revisions were made based on feedback received until April 13, 2020. CJKHD editors reviewed the parallel process peer review and edited the manuscript for clarity.

Basis of These Recommendations

- They aligned with most provincial public health recommendations.
- They consdidered the different prevalence of COVID-19 within each community at different times (periods of low prevalence before and toward resolution of the pandemic).
- They consdidered that hemodialysis centers throughout the country are of varying size and have different access to resources.
- They were based on the best judgment of the workgroup after consideration of: known published peer-reviewed and non-peer-reviewed preprints, guidelines from other jurisdictions, input from infection control experts, and comments from knowledge users.
- They attempted to uphold ethical principles that balance the needs and rights of the individual patient against the public good in the setting of finite resources.

Ethical Principles

Each recommendation considered several principles of care and its underlying ethical tenets.

I. Identify and treat affected patients safely:

Fairness—ensure that patients continue to receive appropriate treatments regardless of their COVID-19 status and avoid adverse outcomes that disproportionately impact those who are most vulnerable (eg, lower socioeconomic status).

II. Prevent transmission to other patients:

Minimize net harm: limit the spread of disease and disruption to the health care system.

III. Ensure safety of dialysis unit staff:

Reciprocity

IV. Optimize use of resources:

Macro-allocation: optimize use of resources to maximize health outcomes for the greatest number, realizing that previous standards may need to be temporarily adjusted.

V. Maintain patient-centered care with respect to privacy, treatment location, rights to visit loved ones, and the provision of optimal medical and preventative care:

Respect for autonomy: Maintain patient-centered care as much as possible for all patients with respect to their preferences, granting that choices may be limited in a pandemic.
Fidelity: Maintain commitment to patients to provide necessary and optimal medical care, even through challenging times and when there is a degree of risk to providers.
Proportionality: Keep restrictions on staff and patients commensurate with level of risk to public health.

Scope of This Document

- This document pertains to the practice of *outpatient hemodialysis*. Inpatient hemodialysis, home dialysis, chronic kidney disease care, access considerations, and acute kidney injury are not in the scope of this document.
- This document pertains to infection control aspects related to the *unique circumstances* of in-center hemodialysis patient care. Other general infection control practices should follow the most current provincial public health recommendations and are referred to where appropriate throughout the document.

Key Findings

Items That Should Be Prioritized For Resource Allocation by Provinces

Personal Protective Equipment (PPE), Hand Sanitizer, and Cleaning in the Dialysis Unit

- Hemodialysis is a life-sustaining therapy that requires patients to interact with health care personnel 3 times weekly. Many dialysis units report not having enough PPE to meet their daily needs.
- For this reason, dialysis units should be considered a "front-line" health service during a pandemic, and provided with adequate allocation of PPE and hand sanitizer that allows them to adhere to the recommendations in this document.
- This includes provision of procedure masks, visors, gowns, and gloves for personnel; provision of procedure masks for dialysis patients; filling of hand sanitizer dispensers regularly; and appropriate cleaning of the waiting room and dialysis treatment area several times a day.

Transportation Services for Dialysis Patients

- Without transportation to and from the dialysis unit, patients who cannot drive themselves would be admitted to hospital, entailing inappropriate use of scarce resources.
- For this reason, drivers of dialysis patients should be considered an essential service during a pandemic.
- Kidney programs should advocate to government to ensure that
  - access to drivers for dialysis patients with confirmed COVID-19 is available
  - drivers of dialysis patients are deemed an essential service with access to personal protective equipment (PPE), cleaning supplies, ±disposable plastic sheet seat covers
  - drivers are instructed on how to use PPE and disinfect their vehicles properly

Testing for COVID-19 in the Dialysis Unit

- Patients receiving hemodialysis are a vulnerable patient population at high risk of acquiring infection due to their regular interactions with transport drivers and health care professionals, and their need to sit in the treatment area with other patients for prolonged periods of time. When testing is performed, knowledge of results is required to plan the safest manner and location of dialysis treatments.
- For these reasons, dialysis patients should be prioritized to have expeditious access to testing for COVID-19.
- This includes
  - adequate provision of test kits to perform nasopharyngeal swabs in the dialysis unit;
  - provision of PPE (see above);
  - adequate training of nurses;
  - expeditious processing of samples by the laboratory.

Maintenance of Droplet and Contact Precautions in the Dialysis Unit

- Ensuring protection of noninfected patients and staff is of paramount importance during a pandemic. It is thus of paramount importance that appropriate droplet and contact precautions be maintained for all patients who have symptoms compatible with COVID-19, as well as those who have been exposed to COVID-19 and may risk of asymptomatic or presymptomatic transmission. Most of the dialysis facilities in Canada do not have enough isolation rooms to accommodate this need during a pandemic.
- For this reason, institutions should work with dialysis unit directors to provide adequate and acceptable solutions to the problem of not having enough isolation rooms.
- This may include rapid water installation for hemodialysis in other areas of the hospital with private rooms, provision of plexiglass barriers between stations, running extra dialysis shifts in the current isolation rooms.
- Kidney program leaders should advocate that all new dialysis units (and any renovations of old dialysis units) are constructed with appropriate attention to infection control measures including
  - appropriate numbers of isolation rooms;
  - adequate spacing between dialysis stations that are not isolated;
  - adequate space in the waiting room.

Recommendations

A. Identification of Patients With COVID-19 in the Dialysis Unit.

A1. Screening in the Dialysis Unit — ***We recommend that all dialysis units implement their own formalized screening process to detect individuals infected with SARS-CoV-2.*** — **Principles I, II, III**

- All patients should be screened at the entry to the dialysis unit by health care workers with appropriate knowledge using a screening tool. See below.
- Whenever possible, patients should not be allowed to wait in the waiting room prior to screening. In situations where this is not possible, ensure a distance of >2 m between chairs.
- Patients should be informed of their responsibility to self-report symptoms and be reassured that their dialysis treatments will continue.
- If there is an outbreak in the dialysis unit, local public health officials should be consulted to determine necessary modifications to screening and testing procedures.
- Patients presenting with severe symptoms meeting admission criteria should be redirected to the appropriate location for medical care. Admission criteria should follow local standards.

Mandatory Screening Tools:

- Formal questionnaire that asks about the symptoms AND exposure history in last 14 days.[22,23]
  - *Symptoms* compatible with COVID-19 include fever, new cough, new or worsening difficulty breathing, new or worsening diarrhea, anosmia, dysgeusia.
  - *Exposure history* includes travel outside of Canada, OR close contact with a person infected with or suspected to have COVID-19, OR contact with bodily fluids from an individual with COVID-19, OR living in a nursing home, regardless of whether there is an outbreak.
- Taking of temperature at ENTRY to the dialysis unit.

Recommended Screening Tools:

- Informal inquiry of *atypical symptoms* (especially in the elderly and immunocompromised patients) should be considered, including change from previous well-being, altered neurological status.

Who to Test for COVID-19: Test all patients who

- have one or more symptoms OR
- elevated temperature (*definition is unclear* but we suggest >37.3°C)

How to Treat Asymptomatic Patients who Have Had a Potential Exposure:
See section C

A2. Call Ahead — ***We recommend that all dialysis patients be advised that if they develop symptoms they should inform the dialysis unit BEFORE their scheduled treatment.*** — **Principles I, II, III, IV**

- All patients should be informed of the signs and symptoms of COVID-19. Consider giving standardized pamphlets from the public health office, if available in the patient's language.
- Patients should be instructed to call the dialysis unit if they develop symptoms at home.
- If resources allow, consider requesting a nurse to call all HD patients a few hours before their upcoming treatment to inquire about symptoms.
- Patients who report symptoms should be directed to the most appropriate medical resources (eg, seek immediate medical attention, testing options [if, when, and where], adjusting the timing and location of their next dialysis treatment to permit appropriate evaluation and minimize exposing others).

A3. Categorization of Patients — ***We recommend that all dialysis patients be categorized based on known SARS-Co-V2 test results, symptoms, and exposure history to determine the optimal care pathway. (Table 1)*** — **Principles I-V**

- COVID-19+ Confirmed — see section B
- P1 = Symptomatic, WITH known exposure
- P2 = Symptomatic, NO known exposure
- P3 = Asymptomatic, WITH known exposure
- P4 = Asymptomatic, NO known exposure

Table 1. Summary of Risk Categories.

	Symptoms +	Symptoms −
Exposure +	P1 = Probable COVID-19	P3 = High-Risk COVID-19
Exposure −	P2 = Suspected COVID-19	P4 = Low-Risk COVID-19

Note. Exposure is defined as travel outside of Canada, close contact with a person infected with or suspected to have COVID-19, or contact with bodily fluids from a person with or suspected to have COVID-19, OR living in a nursing home, regardless of whether there is an outbreak. COVID = coronavirus disease.

Rationale. Dialysis patients have a high risk of infection because they are unable to remain isolated in their homes. Many also reside in community living settings, such as long-term care facilities, where the prevalence of COVID-19 may be high due to outbreaks. Therefore, a rigorous screening process at entry to the dialysis unit is needed to identify potentially infected patients and inform precautionary measures to prevent transmission and protect health care workers.

The presentation of COVID-19 may be atypical in dialysis patients, especially if they are elderly or immunocompromised. Security personnel–led screening at a hospital/facility entrance is rapid and standardized. These individuals may not be trained to identify probable cases as accurately as health care workers who know the patients and can detect changes in general status and symptoms.

Temperature may aid in the identification of infected patients who do not present with typical symptoms.

Patients may feel more confident and comfortable to report symptoms to health care workers if the patients are well informed about possible COVID-19 symptoms and the patients receive assurances that dialysis care will continue.

Patients who present with severe symptoms may decompensate quickly and should be directed to the emergency department or other suitable location for further assessment.

Allowing patients to call ahead allows the dialysis unit staff to best plan their treatment to minimize the spread of infection and ensure patient safety. It also ensures that patients who have severe symptoms or are unstable are identified and treated as soon as possible.

Categorizing patients according to probability of infection will inform precautionary measures to safely treat patients in the most appropriate location and in the most appropriate manner, to minimize transmission to other patients, and to protect health care workers.

B. Hemodialysis of Patients With Confirmed COVID-19.

B1. Assessment of Stability	***We recommend that all patients with COVID-19 be assessed at each treatment for suitability to be dialyzed in the dialysis unit.***	**Principles I-V**

- All patients with COVID-19 meeting admission criteria or deemed to be otherwise unstable should be dialyzed in a location that does not put them or others at risk.

These criteria include

  - new requirement for oxygen;
  - new onset of persistent hypotension;
  - new altered level of consciousness.

- Because unstable patients may require urgent resuscitation, the dialysis treatment should ideally be performed in a negative pressure ventilation room with rapid access to a specialized resuscitation team. This may require transfer to another facility, emergency room, or intensive care unit (ICU), as appropriate.

B2. Treatment Location for Stable Patients	***B2.1—We recommend all dialysis patients with COVID-19 who are stable continue to receive their dialysis treatments in an outpatient dialysis unit.*** ***B2.2—We recommend that all dialysis patients with COVID-19 be separated from other patients using droplet/contact precautions during their dialysis treatments.***	**Principles I-V**

- Ideally, separated means dialysis in an isolation room with droplet/contact precautions. A negative pressure ventilation room is NOT required. Droplet/contact precautions mean procedure mask, visor, gloves, and gown.
- If no isolation room is available, cohorting COVID-19+ patients on a separate dialysis shift may be considered, preferably during the last shift of the day to allow adequate time for disinfection.
- If even this is not possible, see section H.
- Although large regional programs may choose to designate a single dialysis unit in the region to which all patients with confirmed COVID-19 are transferred, this is not absolutely necessary if the above precautions are followed.

B3. Transportation	***We recommend that all dialysis patients with confirmed COVID-19 be transported in a private vehicle without other patients.***	**Principles I, II, IV**

- Private transportation may include driving oneself, private taxi, or special transportation for disabled individuals provided by provincial health agencies. The optimal method will consider the patient's financial resources and physical and cognitive function.
- If single-patient transportation cannot be provided, consider cohorting patients with confirmed COVID-19 in the same vehicle, provided all patients are wearing masks.
- When in a vehicle with a patient confirmed to have COVID-19, the driver should wear a procedure mask and visor. All patients and the driver, should perform hand-hygiene before and after entering vehicles.

B4. Escort to the Dialysis Unit	***We suggest that all dialysis patients with confirmed COVID-19 be escorted by security or other hospital/facility personnel from the entrance of the building to the dialysis unit.***	**Principles I, II, III**

- Patients with confirmed COVID-19 should *not* wait in the waiting room, whenever possible. If they must wait, they must wear a mask and maintain >2 m distance from others.
- Patients with confirmed COVID-19 should be discouraged from going to other areas within the hospital or facility.

B5. Masks and Hand Hygiene	***B.5.1—We recommend that all dialysis patients wear a mask from the moment they leave their house, until they return home. This includes in transport vehicle, in the hospital or facility, and during treatment.*** ***B.5.2—We recommend that all dialysis patients perform hand-hygiene with hand sanitizer upon entry to and exit from the dialysis unit.***	**Principles II, III, IV**

- All dialysis patients with confirmed COVID-19 should be provided with an extra procedure mask at the end of each treatment to wear in the vehicle on the way to the next dialysis session.
- If the dialysis unit does not have enough masks, then the patient should wear a cloth mask.
- Hand sanitizer should be located at the entry to the dialysis unit.

B6. Counseling on Home Isolation	***We recommend that all dialysis patients be counseled on how to safely isolate themselves from others who live in their household.***	**Principle II**

- Dialysis patients should be provided with a standardized pamphlet from the provincial public health agency on how to practice home isolation, if such a pamphlet exists in their own language.

B7. Discontinuation of Isolation Procedures	***We recommend that the above recommendations be followed until the patient can be declared negative according to provincial public health agency guidelines.***	**Principles II, III**

- At the current time, one such recommendation is that isolation should be continued until the patient is asymptomatic, AND a minimum of 14 days, AND until the patient has 2 negative tests separated by at least 24 hours ("recovery"). This recommendation may change depending on the local availability of tests.
- The duration of isolation may be longer than 14 days for immunocompromised patients—consultation with local infectious disease experts on a case-by-case basis is suggested.
- Given that the risk of reinfection is not known, patients who have recovered from COVID-19 should be screened as described in section A and treated by the algorithm in section C.

B8. Visitors	***We suggest that visitors not be permitted for patients with confirmed COVID-19.***	**Principle II**

B9. Contact Tracing	***We recommend that the local infection prevention and control team be notified of patients with probable and confirmed COVID-19 to ensure consistent processes for contact tracing for all staff and patients, and to ensure that public health is notified if the current interim case definition is met.***	**Principles II, III**

- The local public health department should be notified by the local infection control team if there is a suspected outbreak in the dialysis unit.
- The interim case definition is defined nationally but reported provincially. It is available at: https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection/health-professionals/national-case-definition.html

Rationale. Patients with *severe symptomatic* COVID-19 infection requiring high-flow oxygen have a very high risk of transmitting infection to others and therefore should be admitted, and dialyzed in an isolation room with airborne/droplet/contact precautions to minimize risk to nursing staff and other patients. Furthermore, such unstable patients usually require intensive nursing care which is difficult to provide in a busy outpatient unit, as every time the nurse enters the isolation room, PPE with N95 must be donned. Finally, unstable patients are at high risk of needing advanced resuscitation efforts (eg, CPR), which require expeditious access to an expert resuscitation team (see section F). For these reasons, such unstable patients should ideally not be dialyzed in the main outpatient dialysis unit.

Stable patients with COVID-19 should not be admitted to hospital as this is not likely to improve outcomes and allows inpatient resources to be reserved for those who are likely to benefit.

Isolation of stable confirmed COVID-19 patients using droplet/contact precautions while they are in hospital or treatment facility follows recommendations of provincial public health agencies. It is recognized that not all dialysis facilities have this capability. In this case, COVID-19-positive patients may be cohorted together on a single dialysis shift, accepting the small risk of cross-infection with a different COVID-19 strain. Finally, it is recognized that some dialysis units already at capacity may not have the ability to reserve an entire shift for just a few patients with confirmed COVID-19. For such units, a protocol of dialysis under fixed dialysis resources would need to be considered (section H).

Airborne precautions (N95 masks) are only required for patients who are undergoing aerosol-generating medical procedures (AGMP); these should NOT be done in the dialysis unit (including high-flow oxygen). Please see provincial health agency website for latest recommendations on what is classified as an AGMP.

In keeping with public health recommendations, confirmed COVID-19 patients should not circulate freely in public spaces. An escort will help adherence to this recommendation, especially for those who have cognitive deficits or misunderstand the recommendations.

It is not safe for visitors to be at the bedside of a patient infected with COVID-19 during dialysis treatment. Preventing infection transmission (principle II) supersedes patient-centered care and autonomy (principle V) in this case.

C. Hemodialysis of Patients Not Yet Known To Have COVID-19.

C1. Assessment of Stability	***We recommend that all patients with symptoms of COVID-19 (P1 or P2) be assessed at each treatment for suitability to be dialyzed in the dialysis unit.***	**Principles I-V**

- All patients with symptoms of COVID-19 meeting admission criteria or deemed to be otherwise unstable should be dialyzed in a location that does not put them or others at risk. These criteria include new requirement for oxygen, new onset of persistent hypotension, and new altered level of consciousness.
- Unstable patients may require urgent resuscitation; therefore, dialysis should ideally be performed in a negative pressure ventilation room with rapid access to a specialized resuscitation team. This may require transfer to another facility, emergency room, or ICU, as appropriate.

C2. Dialysis of Stable Patients	***C.2.1—We recommend that all dialysis patients whose COVID-19 status is unknown and who are stable continue to receive their dialysis treatments in an outpatient dialysis unit.*** ***C.2.2—We recommend that all patients whose COVID-19 status is not known (P1, P2, P3, P4) be treated according to the pathways outlined in the tables below that account for the prevalence of disease within the community.***	**Principles I-V**

- Table 2: Low prevalence
- Table 3: High prevalence

**Definition of low and high prevalence is determined by the provincial public health agency.*

C3. Special Populations	***We recommend that patients on dialysis (a) residing in a long-term care facility or (b) coming from another facility the following precautions be observed in addition to those in Table 2 or 3.***	**Principles I-V**

- In regions where there are identified outbreaks in long-term care facilities, all dialysis patients residing in long-term care facilities should be considered as P3 (exposed) whether or not the home has been identified to have an outbreak.
- P3 recommendations in Table 2 or 3 should continue until at least 14 days AFTER OUTBREAKS HAVE CLEARED from facilities in the region.
- Patients from different long-term care facilities should NOT be cohorted together unless full droplet/contact precautions can be respected (see below), as this practice increases the risk of spread between long-term care facilities.
- Patients on dialysis coming from another dialysis facility should be categorized and treated as P3 for 14 days.

Rationale. This guidance varies according to prevalence. At times of low prevalence, before and after the peak(s) of the pandemic, principle V (patient-centered care) can be respected over principles II and III. As prevalence increases, the index of suspicion for COVID-19 infection increases in symptomatic patients, even in the absence of identifiable exposure. The rationale for the care pathways for P1 and P2 is therefore the same as that for confirmed COVID-19. Those who are symptomatic (P1/P2) should be treated with droplet/contact precautions in keeping with provincial public health guidelines. The care pathway for P3 is based on the risk of transmission of infection by asymptomatic or presymptomatic individuals. Asymptomatic identifiably exposed patients (P3) may transmit infection to vulnerable populations and should wear masks and undergo dialysis with droplet and contact precautions accordingly. As prevalence increases in

the community, all people should be considered exposed irrespective of identifiable exposure, and wear a mask during dialysis, and health care personnel should wear mask and visor when within 2 m of patients.

Rationale. We recognize that not allowing visitors into the dialysis unit may be very distressing for dialysis patients and their families. The recommendations required consideration of principles II and III over principle V.

Table 2. Care Pathway for ***Low Prevalence*** of COVID-19 in Community.

	P1 Symptoms + Exposure + **PROBABLE**	**P2** Symptoms + Exposure − **SUSPECTED**	**P3** Symptoms − Exposure + **EXPOSED**	**P4** Symptoms − Exposure − **MAY BE EXPOSED**
Patient wears mask on entry, *during dialysis*, and in transport vehicle[a]	YES	YES	YES	NO
"Separated dialysis"[b] (isolation room)	YES	YES	IF POSSIBLE	NO
Droplet/contact PPE[c]	YES	YES	YES	NO
Test for SARS-CoV-2[d]	YES	WHEN POSSIBLE	NO	NO
Shared transportation[e]	NO	NO	NO	YES
Wait in waiting room[f]	NO	NO	NO	OK
Wander in facility	NO	NO	NO	OK
Counsel on home isolation	YES	YES	YES	NO
Discontinue isolation procedures[g]—also see C3 for special populations	*If COVID-19 negative*: when symptoms resolve AND >14 days from exposure *If COVID-19 positive*: See Section B	*If COVID-19 negative*: when symptoms resolve *If COVID-19 positive*: See Section B	14 days from exposure	N/A
Visitors[h]	NO	NO	One	One

Note. Colours indicate risk (green to red).

Table 3. Care Pathway for ***High Prevalence*** of COVID-19 in Community.

	P1 Symptoms + Exposure + **PROBABLE**	**P2** Symptoms + Exposure − **SUSPECTED**	**P3** Symptoms − Exposure + **EXPOSED**	**P4** Symptoms − Exposure − **MAY BE EXPOSED**
Patient wears mask on entry, *during dialysis*, and in transport vehicle[a]	YES	YES	YES	YES
"Separated dialysis"[b] (isolation room)	YES	YES	IF POSSIBLE	NO
Droplet/contact PPE[c]	YES	YES	YES	Mask and Visor
Test for SARS-CoV-2[d]	YES	YES	NO	NO
Shared transportation[e]	NO	NO	NO	Try to avoid
Wait in waiting room[f]	NO	NO	NO	Try to avoid
Wander in facility	NO	NO	NO	NO
Counsel on home isolation	YES	YES	YES	Only if recommended for general population
Discontinue isolation procedures[g]—also see C3 for special populations	*If COVID-19 negative*: when symptoms resolve AND >14 days from exposure *If COVID-19 positive*: See Section B	*If COVID-19 negative*: when symptoms resolve *If COVID-19 positive*: See Section B	14 days from exposure	N/A
Visitors[h]	NO	NO	NO	NO

Note. Notes for Tables 2 and 3.

(continued)

Table 3. (continued)

a. Masks for Patients:
- When the prevalence of COVID-19 in the community is high (as determined by public health), all patients should wear masks throughout the treatment, including P4. When prevalence is low, patients who are asymptomatic with no known exposures do not need masks.

b. Separated Dialysis (Isolation Rooms):
- *Ideally*, P1, P2, and P3 patients should be dialyzed in separate isolation rooms. If this is not possible, maintain droplet/contact precautions by keeping >2 m distance between patients AND using a physical barrier to separate treatment stations, such as plexiglass screens, washable curtains, or disposable plastic sheets. See section H.
- P1, P2, and P3 patients should *NOT* be cohorted together, even with patients of the same category. This is to avoid transmission from positive (but not yet confirmed) patients to those who are negative.
- Negative pressure ventilation rooms are NOT required for routine dialysis. They are recommended ONLY if an aerosol-generating medical procedure (AGMP) is anticipated, such as high-flow oxygen, intubation, or mechanical ventilation. For this reason, we recommend unstable patients are dialyzed in an appropriate location (see C1).
- Cleaning of the treatment area, machines, and isolation rooms should follow provincial public health agency guidelines.

c. PPE (Personal Protective Equipment):
- Health care workers who care for patients in categories P1, P2, and P3 (ie, exposed or symptomatic) require appropriate PPE for droplet/contact precautions when providing treatment or care within 2 m of the patient. This means procedure mask, visor, gloves, and gown. Airborne precautions (N95 masks) are NOT required, except for AGMPs. Dialysis is NOT an AGMP.
- For patients in category P4 (ie, no exposure, asymptomatic): Public health agencies determine whether COVID-19 is highly prevalent in the community. When this is the care, we recommend that health care workers wear a mask and visor for all patients, without changing between patients (ie, they are supplied with 1 or 2 masks for each shift and wear them continuously except for breaks).
- Whether to reuse PPE, and how to process PPE for reuse, should follow provincial public health agency guidelines.

d. Repeat Testing for P1 and P2 Patients who are Initially Negative:
- When there is a high clinical suspicion for COVID-19 and negative nasopharyngeal swab, the test may be repeated. The sensitivity of nasopharyngeal swab for COVID-19 may be less than 100%. Whether to do more than 2 tests for a single patient should be determined on an individual basis in consultation with local infectious disease specialists.

e. Transportation:
- The recommendations in section B3 apply here, except that patients who are P1, P2, or P3 should NOT be cohorted together in the same vehicle.

f. Waiting Room:
- If feasible, medically stable patients can opt to wait in their car or transport vehicle and be contacted by cellphone when their treatment spot is ready, to avoid the waiting room.
- If the patient must use the waiting room, practice distancing measures with patients separated by at least 2 m. This includes moving chairs to the required separation, or taping chairs that are not to be used, to maintain separation.

g. Discontinuation of Isolation Procedures:
- Patients in categories P1 and P2 should remain isolated until they have NO symptoms AND the patient has definitively tested negative for COVID-19.
- The duration of isolation may be longer than 14 days for immunocompromised patients—consultation with local infectious disease experts on a case-by-case basis is suggested.
- Patients in categories P1 and P3 who have been exposed to outbreaks in a group facility (eg, long-term care facility) should be isolated until at least 14 days AFTER THE OUTBREAK IS CLEARED from their group facility.

h. Visitors—see section D

Colours indicate level of risk (green to red).

D. Visitors.

D1. Visitors	***We suggest that during periods of high prevalence of COVID-19 as determined by the local public health agency, visitors not be permitted in the dialysis unit, unless the visitor is needed to facilitate the dialysis treatment AND the patient is P3 or P4.***	**Principles II, III, IV, V**

- All visitors who enter the unit should be screened with the screening questionnaire. Only asymptomatic visitors with no known exposure should be permitted to enter the unit. All visitors should be required to wear a mask and practice physical distancing.
- All visitors should be provided with reassurance that their loved one will continue to receive the best possible and safest hemodialysis care.

E. COVID-19 Testing in the Dialysis Unit.

E1. Testing	***E.1.1—We suggest that all patients presenting with symptoms compatible with COVID-19 (P1 and P2) be tested for SARS-CoV-2 in the hemodialysis unit.*** **E.1.2—We recommend that testing in the dialysis unit should only be performed in the dialysis unit after the dialysis nurses have been properly trained to do so, and an isolation room is available.**	**Principles I, II, III, V**

- Nurses performing COVID-19 testing should use PPE for droplet/contact precautions as per provincial health agency guidelines. N95 masks are *not* required.
- Kidney programs should advocate for expedient results, ideally within 24 hours, for patients treated with maintenance dialysis, to allow planning of future dialysis treatment location depending on COVID-19 status.
- Chest X-ray may be performed if clinically indicated. Computed tomographic scan is not required for diagnosis of COVID-19, but may be ordered in individual cases if deemed clinically appropriate.

Rationale. Swabbing for COVID-19 is rapid and may be easily performed by trained nurses. Ideally, it should be done in the hemodialysis unit rather than sending patients to another facility, to reduce the risk of exposing other people and to ensure the swab is performed expeditiously. There are significant differences between swabbing test kit availability and practices across provinces and different regions in Canada: the above recommendations should be discussed with local Infection Prevention and Control authorities and adjusted as needed.

F. Resuscitation.

F1. Level of Intervention	***F.1.1—We recommend that all dialysis patients have level of intervention (code status) clearly documented in the dialysis AND hospital charts.*** ***F.2.1—We suggest updating the code status for all dialysis patients whose documentation is more than 12 months old.***	**Principles I, IV, V**

- For patients who are unlikely to benefit from attempted resuscitation, a "Do Not Resuscitate" (DNR) status should be considered.
- It is important to ensure open, early, unambiguous communication between health care workers, patients, and their caregivers regarding goals of care and prognosis, as well as the implications of the COVID-19 pandemic on the individual. Patients and caregivers should be encouraged to discuss options with the physician.
- Consider providing a copy of the completed official provincial "level of intervention form*" to the patient to keep at home as instruction to health care workers and paramedics in the event of an emergency. **This legally binding form is available in certain provinces, including Ontario and Quebec.*

F2. Minimize risk of needing resuscitation in the dialysis unit	***See recommendations B1 and C1***	**Principles I, II, III**

F3. Early Assessment	***We suggest that any patient with confirmed, probable, or suspected COVID-19 and signs of respiratory deterioration during hemodialysis (such as hypoxemia or respiratory distress) has rapid assessment for transfer to the emergency room, and/or early controlled intubation by a specialized resuscitation team, as appropriate.***	**Principles I, II, III**

- For patients who become unstable and have indicated they do not wish to be intubated or resuscitated, transfer to the emergency room is suggested to avoid further deterioration in the dialysis unit which may pose a risk of physical and emotional distress to others.
- For patients who become unstable and who have specified they wish to be fully resuscitated, rapid assessment for transfer to the emergency room or intensive care unit for early controlled intubation is suggested to avoid risks associated with aerosolized transmission during "crash intubation."

F4. Resuscitation Protocol	***We recommend that all dialysis units review their resuscitation procedures in detail with all staff.***	**Principles I, II, III**

- Aspects that should be reviewed include
  - determining whether the proper equipment is available in the dialysis unit or if it will be brought by the code team;
  - ensuring that all staff are aware of the local resuscitation protocols that should be followed, including *when*, for *whom*, and *how* a "protected code blue" is to be used.
- A protected code blue includes using a designated (preferably negative pressure ventilation) isolation room, with a closed door, that is left vacant in case of need for resuscitation. If one is not available, decisions on whether and how to modify the protected code blue protocol should be made in advance with the local resuscitation/intensive care unit team.
- For satellite dialysis units that operate outside a hospital, with no resuscitation team within the building, decisions as to whether and how the protected code blue procedure will be modified should be made in conjunction with local resuscitation experts and stakeholders, including intensive care unit physicians, paramedics, and ambulance services.
- The protected code blue protocol should contain detailed information on: resuscitation location, how the patient will be moved to the designated resuscitation room (including how patient will be disconnected from dialysis machine and whether blood will be returned or not), PPE to be used, who should enter the room, what type oxygen mask is to be used, whether an automated external defibrillator (AED) should be used, whether chest compressions should wait until after intubation, where and how the patient should be transferred after resuscitation, whether successful or unsuccessful, and decontamination procedures.
- Consideration may also be given to assigning 2 nurses during each dialysis shift as the acting code leader and "runner" until the resuscitation team arrives.

Rationale. The importance of respecting patient wishes, where possible (principle V), and of providing appropriate, beneficial medical interventions (principle I) were considered. However, with finite resources, it is appropriate to allocate resources (eg, ICU, ventilation) to patients most likely to survive (principal IV). Patients should have these forms in their home so that if they deteriorate at home, paramedics and other health care workers may be informed of the code status and patients' wishes respected.

The decision to implement protected codes blue during the pandemic considers the need to protect against the risk of aerosolized transmission of the virus to other patients and health care workers[24,25] and is in keeping with most provincial public health guidelines.

G. Routine Dialysis Care.

G1. Bloodwork	***We suggest reducing the frequency of routine bloodwork and access flow measurements for stable patients.***	**Principles I, IV, V**

- We suggest that routine bloodwork should be no more frequent than every 6 weeks unless clinically indicated.
- Ensure that patients receiving less frequent dialysis are included in the routine bloodwork schedule.
- Consider a method to stagger bloodwork to distribute the work of the laboratory over different weeks and shifts (eg, alphabetically by patient's last name).
- If possible, review blood work remotely and order appropriate changes through the electronic medical record to reduce exposure to paper charts.
- Prescriptions should be faxed or submitted electronically to the patient's pharmacy.

G2. Physician Rounds	***G.2.1 We recommend that during the COVID-19 pandemic, nephrologists and their teams develop a plan to provide regular medical assessments of their dialysis patients, while maintaining strict and appropriate infection control precautions.*** ***G.2.2 We suggest patients be regularly assessed for suitability to transition to home dialysis therapies.***	**Principles I, III, IV, V**

- Nephrologists and nurse practitioners caring for hemodialysis patients should be available for in-person assessment of patients where patient safety and care planning demands face-to-face assessment.
- When in the hemodialysis unit patient care area, strict and appropriate infection prevention and control procedures should be followed. These include
- Wearing mask and visor while in the patient care area.
- Maintaining a distance of at least 2 m from patients except during necessary physical examination, and from staff.
- Using full droplet/contact precautions when performing necessary physical examination.
- In certain circumstances, the nephrologist may provide care virtually by phone, video, or other communication when in the interests of patient and staff protection.
- Other health care workers (eg, dieticians, pharmacists, physiotherapists) should follow their local hospital guidelines. We suggest that these professionals may minimize in-person visits and provide care virtually whenever possible without reducing the quality of care provided.
- Home dialysis therapies may be considered to limit ongoing exposure to patients and staff in the in-center hemodialysis unit.

Rationale. Whether to continue in-person rounds or switch to a type of virtual rounds was a matter of considerable controversy among the workgroup members and was discussed at length. Pros and cons of each method were duly considered and discussed during the webinar. The need to minimize the risk of infection transmission by nephrologists rounding physically in the unit on large numbers of patients was recognized. Conversely, others were of the strong opinion that the very small (albeit nonzero) risk of infection transmission while wearing appropriate PPE and respecting >2 m physical distance is greatly outweighed by the benefits of physical presence in being able to detect patient problems and provide more optimal medical care. All workgroup members agreed that physical examination of patients should be limited to those in whom it was deemed absolutely necessary.

H. Dialysis Under Fixed Dialysis Resources.

H1. Communication with Patients	***We suggest that dialysis patients be informed early in the pandemic that their dialysis schedules may change, but that these changes will only be temporary, and will be only undertaken if safe.***	**Principles I, V**

H2. Shortage of Isolation Rooms	***H.2.1—When there is a shortage of isolation rooms, we suggest that patients with confirmed COVID-19 be cohorted on a separate shift.*** ***H.2.2—When there is shortage of isolation rooms, we recommend that cohorting symptomatic patients with probable or suspected COVID-19 (P1 and P2) be avoided, but rather several other options be considered as outlined below.*** ***H.2.3—When there is a shortage of isolation rooms, we recommend that cohorting asymptomatic exposed (P3) patients be avoided, but several options may be considered as outlined below.***	**Principles I, IV**

- *Note: no matter which option is chosen, all health care workers should use droplet/contact PPE for all patients confirmed to have COVID-19, or who are P1, P2, or P3.*

Options:

1. Maintain at least 2 m between patients AND separate patients using (a) clear plexiglass screens, disinfected between treatments, or (b) disposable plastic sheets, which can be used to create an isolation bubble with zipper for entry and washed or changed after each treatment; or, if none of these are available, (c) cloth curtains, washed between treatments.
2. If resources and space allow, create temporary walls between the stations.
3. If resources allow, consider using some home dialysis training rooms as additional isolation rooms for patients in categories P1 and P2 who are under investigation. However, this should NOT be at the expense of reducing capacity in the home dialysis training unit, because this facilitates transitioning people away from the hospital and in-center dialysis unit.
4. If resources allow, consider converting other single rooms within the facility to "dialysis ready" rooms.

H3. Shortage of Nursing Staff	***H.3.1—We suggest identifying staff in the local regional network who have experience in dialysis, but are not currently working in the area, including retired hemodialysis staff.*** ***H.3.2—If there remains a shortage of hemodialysis nursing staff (from illness, quarantine, or deployment to other units), we suggest several options be considered to increase dialysis capacity before reducing dialysis frequency for individual patients. These options are outlined below.*** ***H.3.3—For patients currently receiving 3 times weekly hemodialysis, we recommend that twice-weekly dialysis be avoided until all other options have been exhausted, and that its use be limited to temporary periods and to patients who can safely tolerate it, with close monitoring of potassium, fluid gains, and adequacy parameters.***	**Principles I, IV**

Options:

1. Maximize use of the dialysis unit's open hours by allowing "staggered shifts" rather than 3 fixed shifts a day.
2. Open the dialysis unit on Sundays to reduce the number of nurses required during a single shift.
3. Decrease nurse to patient ratios (eg, to 1:4 or even lower, by employing nondialysis nurses or assistants to assist with care that is not directly related to the dialysis procedure).
4. Increase overtime of existing nurses to allow a fourth dialysis shift per day. This may entail shortening treatments by 30 minutes for patients who can tolerate it and staggered shifts. Work with patients, their families, social workers, volunteer drivers, and providers of local accessible transportation to solve transport problems for patients assigned to the fourth shift.
5. Open the dialysis unit overnight. Be aware that this option may cause nursing fatigue, is disruptive to patients, and requires special transport arrangements. This option is also not applicable to dialysis units that already have night shifts.
6. Reduce treatments to 2 per week, only for patients who can safely tolerate it (see Tables 4 and 5 for suggested criteria, Supplementary Material). Patients may be prioritized for dialysis based on residual kidney function, average weight gains, and predialysis serum potassium with the following *suggested* caveats:
   - Patients should not miss 2 consecutive treatments, and if possible, no more than 2 treatments in 6 weeks.
   - Patients with serious dialysis-access issues with decreased blood flows and the potential for underdialysis, and those with recognized underdialysis, should NOT miss any treatments.
   - Patients' potassium, weight gains, and blood volume processed should be monitored weekly to determine if their dialysis frequency should be increased back to 3 times per week.

Rationale. Most of the hemodialysis facilities do not have enough isolation rooms to be able to accommodate large numbers of patients requiring droplet/contact isolation precautions (confirmed COVID-19, probable or suspected COVID-19, asymptomatic exposed to COVID-19, non-COVID-19 infections such as *Clostridium difficile*, etc). Ensuring protection of noninfected patients and staff is paramount and may require modifications to dialysis treatment schedules, but this should be duly balanced with the need to ensure adequate dialysis treatment for the individual patient requiring isolation.

Similarly, if a severe shortage of hemodialysis nursing staff during the pandemic (eg, from illness, quarantine, deployment to other units, or because of markedly increased

numbers of patients needing acute dialysis for acute kidney injury), multiple options may need to be considered to change nursing-to-patient ratios, or to temporarily change dialysis schedules so that the greatest number of patients be allowed to receive an acceptable minimum amount of dialysis.

Some observational studies have shown that twice-weekly dialysis can be used for a subset of patients with preserved residual kidney function and minimal interdialytic weight gain, who do not have hyperkalemia or marked comorbidity.[26-28] In these selected patients, residual kidney function is preserved and survival is comparable to that of patients receiving thrice-weekly hemodialysis. If residual renal urea clearance cannot be measured, reliance on urine volume is an option (using a threshold of >600 mL to identify those that can switch to a twice-weekly hemodialysis schedule). Alternatively, an algorithm may be used based on average weekly weight gains and potassium values (Tables 4 and 5, Supplementary Material). The period of twice-weekly dialysis should be limited, with careful monitoring of symptoms, blood work, hemodialysis ultrafiltration, and residual urine output on a routine basis.

Limitations

To expedite timely publication of these recommendations to aid decision-making during the pandemic, a systematic review was not undertaken. The recommendations are based on expert opinion and subject to bias. The parallel review process that was created may not be as robust as the standard peer review process.

Implications

These recommendations may provide guidance for dialysis unit directors, clinicians, and administrators on how to limit infection and risk while providing necessary dialysis care in a setting of finite resources. Items requiring prioritization of resource allocation by provincial funding agencies are also identified.

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Supplemental Material

Supplemental material for this article is available online.

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