

**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.

Information Sources: The workgroup members used internet search engines to retrieve documents from: provincial and local hemodialysis programs; provincial public health agencies; the Centres for Disease Control and Prevention, webinars and slides from other kidney agencies, and non-reviewed pre-prints. Pubmed was used to search for known peer-reviewed published articles and non-peer reviewed pre-prints. 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. Members of the Canadian Society of Nephrology (CSN) Board of Directors used snowballing to identify 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 two virtual meetings on April 7 and April 9. Disagreements were resolved by consensus. The document was reviewed by an ethicist, an infection control expert, a community nephrologist, and a patient representative. Content was presented during an interactive webinar attended by 265 kidney health professionals (knowledge users) as an additional form of peer review. The webinar was also posted online. Comments were documented and incorporated or addressed in the final manuscript submitted to the editors of the Canadian Journal of Kidney Health and Disease (CJKHD). CJKHD editors reviewed the parallel process peer review and edited the manuscript for clarity.

Key finds: Recommendations were made under the following themes: A. Identification of Patients with COVID-19 in the Dialysis Unit; B. Hemodialysis of Patients with Confirmed COVID-19; C. Hemodialysis of Patients Not Yet Known to Have COVID-19; D. Visitors; E. Testing for COVID-19 in the Dialysis Unit; F. Resuscitation; G. Routine Care; H. Dialysis Under Fixed Dialysis Resources.

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.

1.0 PURPOSE

Patients receiving in-center hemodialysis present are a unique and vulnerable population during a pandemic. The necessity of treatment at the dialysis center three times weekly means they cannot remain isolated in their homes. They must interact regularly with transport drivers, nurses, and members 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 2m distance between patients at all times in the treatment area and waiting room. These circumstances pose the perfect environment for the rapid spread of COVID-19 infection. Once infected, dialysis patients have substantial mortality risk due to high burden of comorbid disease and/or advanced age. Adequate implementation of measures to prevent the spread of COVID-19 in in-center hemodialysis units is therefore of paramount importance.

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

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, in order 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.

2.0 INFORMATION SOURCES

The workgroup members used internet search engines to retrieve documents from provincial and local hemodialysis programs; provincial public health agencies; the Centres for Disease Control and Prevention, other kidney agencies; as well as non-reviewed pre-prints. Finally we searched Pubmed for relevant peer-reviewed published articles using the search terms “COVID-19” AND “(dialysis OR chronic kidney disease)”.

3.0 METHODS

Challenges in the care of hemodialysis patients during the COVID-19 pandemic were highlighted in the discussion group of the Canadian Senior Renal Leaders Forum. Members of the Canadian Society of Nephrology (CSN) Board of Directors used snowballing to identify clinicians and administrators with expertise in hemodialysis to form the workgroup who reviewed information from available sources. One lead was chosen who drafted the initial document. Members of the workgroup reviewed and discussed all recommendations in detail during two virtual meetings on April 7 and April 9. Disagreements were resolved by consensus. Email conversations supplemented the virtual meetings. All recommendations were developed based on consideration of several principles based on ethical underpinnings (see below). The pre-final recommendations were reviewed by an ethicist, an infection control expert, and a community nephrologist. Content was presented during an interactive webinar attended by 265 kidney health professionals (knowledge users) as an additional form of peer review. The webinar was posted online to obtain further feedback. Comments were documented and addressed in the final manuscript submitted to the editors of the Canadian Journal of Kidney Health and Disease (CJKHD). CJKHD editors reviewed the parallel process peer review and edited the manuscript for clarity.

3.1 Basis of These Recommendations

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

3.2 Principles of ESRD Care in the COVID-19 Era

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

I. Identify and treat affected individuals safely

Fairness - ensure that patients continue to receive appropriate treatments regardless of their covid19 status and avoid outcomes that disproportionately impact those who are most vulnerable (e.g., 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 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 **as much as possible** 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.

3.3 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 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.

4.0 KEY FINDINGS

4.1 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 three times weekly. Many dialysis units report not have 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 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 dialysis, dialysis 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.**
- Renal programs should advocate governments to ensure:
 - access to drivers for dialysis patients with confirmed COVID-19
 - drivers of dialysis patients are deemed an essential service with access to personal protective equipment (PPE), cleaning supplies, +/- disposable plastic sheet seat covers
 - adequate instruction for drivers 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;
 - and expeditious processing of samples by the laboratory.

Maintenance of Droplet and Contact Precautions in the Dialysis Unit

- Ensuring protection of non-infected 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 pre-symptomatic transmission. The majority of 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; etc.
- Renal program leaders should also advocate that all new dialysis units (and any renovations of old dialysis units) are constructed with appropriate attention to infection control measures including:
 - an appropriate number of isolation rooms;
 - adequate spacing between dialysis stations that are not isolated;
 - adequate space in the waiting room.

4.2 RECOMMENDATIONS ON MANAGEMENT OF HEMODIALYSIS

A. IDENTIFICATION OF PATIENTS WITH COVID-19 IN THE DIALYSIS UNIT

A1. Screening in the Dialysis Unit	<i>All dialysis units should implement their own formalized screening process to detect individuals infected with SARS-CoV-2.</i>	Principles I, II, III
<ul style="list-style-type: none"> • 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 distance of >2 m between chairs. • Patients should be informed of their responsibility to self-report symptoms and be reassured that their dialysis 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. <p><u>Mandatory Screening Tools:</u></p> <ul style="list-style-type: none"> • Formal questionnaire that asks about the symptoms AND exposure history in last 14 days. <ul style="list-style-type: none"> -Symptoms compatible with COVID-19 include: fever, new cough, new or worsening difficulty breathing, new or worsening diarrhea, anosmia, dysguesia. -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. • Taking of temperature at ENTRY to the dialysis unit. <p><u>Recommended Screening Tools:</u></p> <ul style="list-style-type: none"> • Informal inquiry of atypical symptoms (especially in the elderly and immunocompromised patients) should be considered, including: change from previous well-being, altered neurological status. • Measurement of oxygen saturation only if readily available. <p><u>Who to Test for COVID-19:</u> Test all patients who:</p> <ul style="list-style-type: none"> • have one or more symptoms AND/OR • elevated temperature (definition is unclear but we suggest >37.3°C on two measurements at least 5 mins apart, OR >37.5°C) AND/OR • oxygen saturation <90% on room air. <p><u>How to Treat Asymptomatic Patients who Have Had a Potential Exposure:</u> See section C</p>		

EXAMPLES OF SCREENING QUESTIONNAIRES

1. BC Renal Agency - [Link](#)
2. McGill University Health Center - [Link](#)

A2. Call Ahead	<i>All dialysis patients should be advised that if they develop symptoms they should inform the dialysis unit BEFORE their scheduled treatment.</i>	Principles I, II, III, IV
<ul style="list-style-type: none"> 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 (egg. seek immediate medical attention, if, when, and where they should be tested, the timing and location of their next dialysis treatment to protect their safety and minimize exposing others). 		

A3. Categorization of Patients	<p><i>All dialysis patients should be categorized based on known SARS-Co-V test results, OR symptoms plus exposure history to determine optimal care pathway.</i></p> <ul style="list-style-type: none"> COVID-19+ Confirmed – see Section B P1 or P2 = Probable or Suspected COVID = patients with symptoms P3 = Asymptomatic, WITH known exposure P4 = Asymptomatic, NO known exposure 	Principles I-V
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Table 1:

	Symptoms +	Symptoms –
Exposure +	P1 = Probable COVID	P3 = High Risk
Exposure –	P2 = Suspected COVID	P4 = Low Risk

**exposure includes travel outside of Canada, close contact with a person known to have COVID-19, or contact with bodily fluids from a person with COVID-19.*

B. HEMODIALYSIS OF PATIENTS WITH CONFIRMED COVID-19

B1. Assessment of Stability	<i>All patients with COVID-19 should be assessed <u>at each treatment</u> for suitability to be dialyzed in the dialysis unit.</i>	Principles I-V
<ul style="list-style-type: none"> 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: <ul style="list-style-type: none"> -new requirement for oxygen -new onset of persistent hypotension -new altered level of consciousness. As such patients may require urgent resuscitation, 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. 		

B2. Treatment Location for Stable Patients	<i>All dialysis patients with COVID-19 who are stable should continue to dialyze in an outpatient dialysis unit. They should receive “protected dialysis” away from patients not known to have COVID-19.</i>	Principle I, II, III, IV, V
<ul style="list-style-type: none"> • Ideally this means dialysis in an isolation room with droplet/contact precautions. A negative pressure ventilation room is NOT required. • 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. 		

B3. Transportation	<i>Whenever possible, all dialysis patients with confirmed COVID-19 should be transported in a private vehicle without other patients.</i>	Principle I, II, IV
<ul style="list-style-type: none"> • Private transportation may include driving oneself, private taxi, or special transportation for disabled individuals provided by provincial health agencies. The most optimal method will consider the patient’s financial resources and physical/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 a mask. • When in a vehicle with other individuals (including the driver), all dialysis patients should wear a procedure mask. All patients should practice hand-hygiene before and after entering vehicles. 		

B4. Escort to the Dialysis Unit	<i>Whenever possible, all dialysis patients with confirmed COVID-19 should be escorted by security or other hospital/facility personnel from the entrance of the building to the dialysis unit.</i>	Principles I, II, III
<ul style="list-style-type: none"> • Patients with confirmed COVID-19 should <u>not</u> wait in the waiting room, whenever possible. If they must wait, they must wear a mask and maintain >2 m distance from others. • They should be discouraged from going to other areas within the hospital/ facility. 		

B5. Masks and Hand Hygiene	<i>All dialysis patients should wear a mask from the moment he/she leaves her house, until he/she returns home. This includes: in transport vehicle, in hospital/dialysis facility, and during treatment. All dialysis patients should wash their hands with hand-sanitizer upon entry to and exit from the dialysis unit.</i>	Principle II, III, IV
<ul style="list-style-type: none"> • 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. • There should hand sanitizer at the entry to the dialysis unit. 		

B6. Counselling on Home Isolation	<i>All dialysis patients should be counselled on how to safely isolate themselves from others who live in their household.</i>	Principle II
<ul style="list-style-type: none"> 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	<i>The above recommendations should be followed until the patient can be declared negative according to the provincial public health agency guidelines.</i>	Principles II, III
<ul style="list-style-type: none"> At the current time, one 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. Duration of isolation may be longer than 14 days for immunocompromised patients – consultation of local infectious disease experts on a case-by-case basis is suggested. 		
B8. Visitors	<i>Visitors should not be permitted at the bedside of patients with confirmed COVID-19.</i>	Principle II
B9. Contact Tracing	<i>The local infection control team should be notified of patients with confirmed COVID-19 in order to do contact tracing for all staff and patients who may have been exposed.</i>	Principle II, III
<ul style="list-style-type: none"> The local public health department should be notified by the local infection control team if there is a suspected outbreak in the dialysis unit. 		

C. HEMODIALYSIS OF PATIENTS NOT YET KNOWN TO HAVE COVID-19

C1. Assessment of Stability	<i>All patients with symptoms of COVID-19 (P1/P2) should be assessed at each treatment for suitability to be dialyzed in the dialysis unit.</i>	Principles I-V
<ul style="list-style-type: none"> 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. As such patients may require urgent resuscitation, 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	<i>All stable patients should continue to be dialyzed in the outpatient dialysis unit.</i> <i>Patients categorized as probable (P1), suspected (P2), asymptomatic and exposed (P3), or asymptomatic not exposed (P4) may be treated as per the care pathways outlined below.</i>	Principles I-V
<ul style="list-style-type: none"> Table 1: Low prevalence Table 2: High prevalence <p><i>*Definition of low and high prevalence determined by public health agency.</i></p>		
C3. Special Populations	<i>Certain populations require special consideration:</i> <i>-dialysis patients who reside in long-term care facilities</i> <i>-dialysis patients coming from another facility</i>	Principles I-V
<ul style="list-style-type: none"> 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 the home has been identified to have an outbreak or not. Patients from different long-term care facilities should NOT be cohorted together. Isolation should continue until at least 14 days AFTER OUTBREAKS HAVE CLEARED from facilities in the region. Dialysis patients coming from another facility should be categorized as P3 for 14 days. 		

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	YES	YES	YES	NO
“Protected Dialysis”^a (isolation room)	YES	YES	IF POSSIBLE	NO
Droplet/contact PPE^b	YES	YES	YES	NO
Test for SARS-CoV-2 ^c	YES	WHEN POSSIBLE	NO	NO
Shared transportation – see section B3	NO	NO	NO	YES
Wait in waiting room ^d	NO	NO	NO	OK
Wander in facility	NO	NO	NO	OK
Counsel on home isolation	YES	YES	YES	NO
Discontinue Isolation procedures ^e – also see C3 for special populations	<i>If COVID negative: when symptoms resolve AND >14 days from exposure</i> <i>If COVID positive: See Section B</i>	<i>If COVID negative: when symptoms resolve</i> <i>If COVID positive: See Section B</i>	14 days from exposure	n/a
Visitors ^f	NO	NO	One	One

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	YES	YES	YES	YES
“Protected Dialysis”^a (isolation room)	YES*	YES*	IF POSSIBLE	NO
Droplet/contact PPE^b	YES	YES	YES	Mask and Visor
Test for SARS-CoV-2 ^c	YES	YES	NO	NO
Shared transportation – see section B3	NO	NO	NO	Try to avoid
Wait in waiting room ^d	NO	NO	NO	Try to avoid
Wander in facility	NO	NO	NO	NO
Counsel on home isolation	YES	YES	YES	Only if recommended for population
Discontinue Isolation procedures ^e – also see C3 for special populations	<i>If COVID negative: when symptoms resolve AND >14 days from exposure</i> <i>If COVID positive: See Section B</i>	<i>If COVID negative: when symptoms resolve</i> <i>If COVID positive: See Section B</i>	14 days from exposure	n/a
Visitors ^f	NO	NO	NO	NO

Notes for Tables 2 and 3

a. Protected Dialysis (Isolation Rooms)

- **Ideally, P1, P2, and P3 patients should be dialyzed in separate isolation rooms.** If not possible, maintain droplet/contact precautions by keeping >2m 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** even with patients of the same category.
- Negative pressure ventilation rooms are NOT required for routine dialysis. Recommended ONLY if an AGMP anticipated such as high flow oxygen, intubation, or mechanical ventilation. For this reason, ensure sick 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.

b. PPE

- P1, P2, and P3 patients require droplet/contact precautions when providing treatment or care within 2m of patient. Airborne precautions (N95 mask) are NOT required except for AGMPs. Dialysis is NOT an AGMP.
- P4: Healthcare workers should always wear a mask and visor once there is a high prevalence of COVID-19 in the community, as determined by provincial health agencies.
- Whether or not and how to reuse PPE should follow provincial public health agency guidelines.

c. Repeat Testing for P1 and P2 Patients who Are Initially Negative

- If the test comes back negative and there remains a high index of suspicion for COVID-19, the test may be repeated as sensitivity of nasopharyngeal aspiration for COVID-19 is estimated to be ~70%. 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.

d. 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 ready in order to avoid the waiting room.
- If the patient must use the waiting room, practice distancing measures with patients separated by at >2m. This should include moving chairs the required distance, or taping chairs that are not to be used in order to respect the minimum space.

e. Discontinuation of Isolation

- P1 and P2 patients should remain isolated until the patients has NO symptoms AND the patient has definitively tested negative for COVID-19. See “repeat testing” below.
- Duration of isolation may be longer than 14 days for immunocompromised patients – consultation of local infectious disease experts on a case-by-case basis is suggested.
- ***P1 and P3 patients exposed to outbreaks in their living facility (eg. long-term care facility) should be isolated until at least 14 days AFTER THE OUTBREAK IS CLEARED from their living facility.**

f. Visitors - see section D

D. Visitors

D1. Visitors	<i>During periods of high community prevalence of COVID-19, visitors should not be permitted in the dialysis unit</i> <i>Exception: a visitor is needed to facilitate the dialysis treatment AND the patient is P3 or P4.</i>	Principles II, III, IV, V
<ul style="list-style-type: none"> • 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 social 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	<i>All patients presenting with symptoms compatible with COVID-19 (P1 and P2) should be tested for SARS-CoV-2, preferably in the hemodialysis unit after nurses have received proper training.</i>	Principles I, II, III, V
<ul style="list-style-type: none"> • Testing should be done in an isolation room. • RNs performing COVID-19 testing should use PPE for droplet/contact precautions as per provincial health agency guidelines. N95 masks are <u>not</u> required. • Renal programs should advocate for expedient results (ideally within 24 hours) to allow planning of future dialysis treatment location depending on COVID status. • CT scan is not required for diagnosis of COVID-19. 		

F. Resuscitation

F1. Level of Intervention	<i>All dialysis patients should have level of intervention (code status) and goals of care clearly documented in the dialysis AND hospital charts.</i>	Principles I, IV, V
<ul style="list-style-type: none"> • For patients who are unlikely to benefit from attempted resuscitation, a “Do Not Resuscitate” status should be considered. • A copy of the level of intervention form should be given to the patient to keep at home. 		
F2. Minimize risk of needing resuscitation in the dialysis unit	<i>See recommendations B1 and C1</i>	Principles I, II, III

F3. Early Assessment	Any patient with confirmed, probable, or suspected COVID-19 and signs of clinical deterioration during hemodialysis (such as hypoxemia and/or respiratory distress) should have rapid assessment for early controlled intubation by a specialized resuscitation team.	Principles I, II, III
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F3. Resuscitation Protocol	<i>All dialysis units should review their resuscitation procedures in detail with all staff.</i>	Principles I, II, III
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- Aspects that should be reviewed include:
 - is the proper equipment available in the dialysis unit or will it be brought by the code team?
 - are all personnel 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 for resuscitation. If one is not available, decisions on whether and how to modify the protected code blue protocol should be made with the local resuscitation / intensive care unit team.
- For satellite dialysis units outside a hospital with no code 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 / intensive care unit experts.
- The protected code blue protocol should contain detailed information on: resuscitation location, how will patient be moved, PPE to be used, who should enter the room, what type oxygen mask is to be used, whether an AED should be used, whether chest compressions should wait until after intubation, where and how the patient should be transferred after being resuscitated, and decontamination procedures.
- Consideration may also be given to assigning two nurses during each dialysis shift as the acting code leader and gopher until the resuscitation team arrives.

G. Routine Dialysis Care

G1. Bloodwork	<i>Consider reducing the frequency of routine bloodwork and access flow measurements for stable patients.</i>	Principles I, IV, V
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- Routine bloodwork should be no more frequent than every 6weeks unless clinically indicated.
- Ensure patients receiving less frequent dialysis are included in the routine bloodwork schedule.
- Consider a method to stagger bloodwork to distribute the lab’s work over different weeks.
- If possible, review blood work remotely and order appropriate changes through the electronic medical record to reduce exposure to paper charts.
- Prescriptions should be called in, faxed, or submitted electronically to the patient’s pharmacy.

G2. Physician Rounds	<i>During the COVID-19 pandemic, nephrologists and their teams should develop a plan to ensure continuous medical assessments of their dialysis patients, while maintaining strict and appropriate infection control precautions.</i>	Principle I, III, IV, V
<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> -Wearing mask and eye protection while in the patient care area -Maintaining >2m distance from patients unless physical examination is indicated, and from staff -Full droplet/contact precautions when performing 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. 		

H. Dialysis Under Fixed Dialysis Resources

H1. Communication with Patients	<i>Patients should be informed early in the pandemic that their dialysis schedules may change, but that these changes will only be temporary, and will only undertaken if safe.</i>	Principle I, V
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H2. Shortage of Isolation Rooms	<i>When there is a shortage of isolation rooms, several options may be considered.</i>	Principle I, IV
<p>Options:</p> <ol style="list-style-type: none"> 1) Cohort patients with confirmed COVID-19 on a separate shift. Cohorting should be avoided for P1 and P2. 2) Maintain >2 m between patients and use clear plexiglass screens which should be disinfected between treatments, or disposable plastic sheets to be removed after each treatment. These sheets can be used to create an isolation bubble with zipper for entry. 3) If resources and space allow, create temporary walls between the stations. 4) If resources allow, consider using some home dialysis training rooms as additional isolation rooms for P1/P2 patients under investigation. However, this should NOT be at the expense of reducing home dialysis training which facilitates transitioning people away from the hospital/dialysis unit. 5) If resources allow, consider converting other single rooms within the facility to “dialysis ready” rooms. 		

H3. Shortage of Nursing Staff	<p><i>Staff in local regional network who have experience in dialysis but are not currently working in the area should be identified, including retired hemodialysis nurses/staff.</i></p> <p>If there remains a severe shortage of hemodialysis nursing staff (ie from illness, quarantine or deployment to other units), then several additional options may be considered.</p>	Principle I, IV
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Options:

- 1) Maximize use of the dialysis unit open hours by allowing “staggered shifts” rather than 3 fixed shifts a day.
- 2) Open dialysis unit on Sundays to reduce the number of nurses required during a single shift
- 3) Decrease nurse to patient ratios (egg. from 1:3 to 1:4 or even less if non-dialysis nurses can assist with nursing care in the dialysis unit if within their scope of practice).
- 4) Increase overtime of existing nurse to allow a 4th dialysis shift per day. May entail shortening patient treatments by 30 mins for patients who can tolerate it and staggered shifts. May pose transport problems for 4th shift.
- 5) Open the dialysis unit overnight. May cause nursing fatigue, is disruptive to patients, and requires special transport arrangements. Also, many dialysis units already have night shifts.
- 6) Reduce treatments to 2 per week for patients who can safely tolerate it. Patients may be prioritized for dialysis based on residual renal function, average weight gains and pre-dialysis serum potassium with caveats:

***Patients should not miss two consecutive treatments, and no more than two treatments in 6 weeks.**

***Patients with serious dialysis access related issues with decreased blood flows and potential pre-existing underdialysis should NOT miss any treatments.**

***The treating physician has the discretion to override 2x/per week algorithms for individual patients.**

5.0 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.

6.0 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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Appendix – Rationale For Recommendations and Supplementary Materials

Rationale for Recommendations

Section A: Identification of Patients with COVID-19 in the Dialysis Unit

Dialysis patients have a high risk of infection as they are unable to remain isolated in their homes. Many also live 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 better identify potentially infected patients and inform precaution 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 and oxygen saturation 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 well informed of COVID-19 symptoms and assurances of continued dialysis care.

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 in order to minimize spread of infection and ensure patient safety. It also ensures that patients who are sick are identified and treated as soon as possible.

Categorizing patients according to probability of infection will inform precaution 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.

Section B: Hemodialysis of Patients with Confirmed COVID-19

Patients with severe symptomatic COVID-19 infection have a very high risk of transmitting infection to others and therefore should be dialyzed in an isolation room with airborne/ droplet/ contact precautions to minimize risk to nursing staff and other patients. This is not always possible in the main dialysis unit. Further, 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 (egg. CPR), which require expeditious access to an expert resuscitation team (see section F). For these reasons, 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 it is not medically needed and in order to reserve inpatients resources for those who need it.

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 or 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 space. 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 for 3-4 hours during dialysis treatment. Preventing infection transmission (principle II) supersedes patient-centered care and autonomy (principle V) in this case.

Section C: Hemodialysis of Patients Not Yet Known to Have COVID-19

Recommendations provided vary according to prevalence in order that principle V (patient-centered care) over can be respected over principles II and III during periods of low prevalence prior to and AFTER the peak of the pandemic. As prevalence increases, index of suspicion for COVID-19 infection increases in symptomatic patients even in the absence of identifiable exposure. Those who are symptomatic should ideally be treated with droplet/contact precautions as per provincial public health guidelines. Asymptomatic exposed patients may transmit infection to vulnerable populations and should wear mask and undergo protected dialysis accordingly. As prevalence increases in the community, all people should be considered exposed irrespective of identifiable exposure.

Rationale for care pathways for P1 and P2 are the same as that for confirmed COVID-19. Care pathway for P3 is based on the risk of transmission of infection by asymptomatic or pre-symptomatic individuals. Thus droplet and contact precautions should be used, when possible.

Section D: Visitors

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.

Section E: Testing for COVID-19 in the Dialysis Unit

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 in order to reduce the risk of exposing other people and ensure the swab is performed most expeditiously. There are significant differences between swabbing test kit availability and practices across provinces and different regions in Canada. As such, the above recommendations should be discussed with local Infection Prevention and Control authorities and adjusted as needed.

Section F: Resuscitation

The importance of respecting patient wishes, where possible (principle V), and to provide appropriate, beneficial medical interventions (principle I) were considered. However, with finite resources, it is appropriate to allocate resources (e.g., ICU, ventilation) to patients most likely to survive (principle 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.

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, and is in keeping with most provincial public health guidelines.

Section G: Routine Care

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 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 >2m physical distance is greatly outweighed by the benefits of physical presence in being able to detect patient problems and provide more optimal medical care. Both sides agreed that physical examination of patients should be limited to those in whom it was deemed absolutely necessary.

Section H: Dialysis Under Fixed Dialysis Resources

The majority of 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, asymptomatic exposed to COVID-19, non-COVID infections such as *C. difficile*, etc. Ensuring protection of non-infected 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 due to an explosion 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 in order that the greatest numbers of patients be allowed to receive an acceptable minimum amount of dialysis.

Some observational studies have shown that twice weekly dialysis can be utilized for a subset of patients with preserved residual function and minimal interdialytic weight gain and without hyperkalemia or marked comorbidity. In these selected populations, residual renal function is preserved and survival is comparable to 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 twice weekly hemodialysis). Alternatively, an algorithm may be used based on average weekly weight gains and potassium values (Tables 4, 5). 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.

Table 4: SCHEME FOR DIALYSIS PRIORITY using the NEPHROCARE electronic medical record

PRIORITY A	<ul style="list-style-type: none">• Average weight gain \geq 2 kg during the <u>last month</u> <p>OR</p> <ul style="list-style-type: none">• Cannot miss based on opinion of treating physician e.g. inability to tolerate small weight gains due to tenuous cardiac status, noncompliant with Kayexalate, etc.	Cannot miss any treatments safely
PRIORITY B	<ul style="list-style-type: none">• <u>2 or more K values >5.5 during the last 3 months</u>	Ideally should not miss any treatments If must miss one treatment, use Kayexalate 30 g daily until next treatment.

PRIORITY C	<ul style="list-style-type: none"> • one K value >5.5 in the <u>last 3 months</u> 	<ul style="list-style-type: none"> *Can temporarily miss one treatment in a week if absolutely necessary. Prescribe Kayexalate 15 g/d until next treatment
PRIORITY D	<ul style="list-style-type: none"> • All others 	<ul style="list-style-type: none"> *Can temporarily miss one treatment in a week if absolutely necessary The need for Kayexalate should be determined by the treating physician based on knowledge of the patient's average K, compliance, and residual renal function

*Patient should not miss two consecutive treatments, *and no more than two treatments in 6 weeks.*

*Patients with serious dialysis access related issues with decreased blood flows and potential pre-existing underdialysis should NOT miss any treatments.

*Treating physician has the discretion to override this algorithm for individual patients.

Table 5: CRITERIA for initiating and maintaining TWICE WEEKLY HEMODIALYSIS treatment^{1,2,3}

<ul style="list-style-type: none"> ▪ Adequate KRU of >3 ml/min/1.73m² (requires prior 24-hour urine collection available) ▪ Adequate residual urine output >600 ml/day ▪ Fluid gain <2.5kg between two consecutive HD treatments, or <5% of the ideal dry weight ▪ No clinically significant fluid overload ▪ Suitable body size relative to residual renal function and not in hypercatabolic state ▪ K <5.5 mEq/L ▪ Good nutritional status ▪ Infrequent hospitalization and easily manageable comorbid conditions including cardiovascular or pulmonary symptoms

¹ Kalantar-Zadeh K, Unruh M, Zager PG, et al. Twice-weekly and incremental hemodialysis treatment for initiation of kidney replacement therapy. *Am J Kidney Dis.* 2014;64(2):181–186. doi:10.1053/j.ajkd.2014.04.019

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