

# CANNT JOURNAL JOURNAL ACITN

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home dialysis programs in  
Canada: A literature review**

**CONTINUING EDUCATION SERIES  
Calciphylaxis in patients with  
end-stage kidney disease**



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Canadian Association of Nephrology Nurses and Technologists  
l'Association canadienne des infirmières et infirmiers et des technologues de néphrologie



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# CANNT JOURNAL JOURNAL ACITN

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#### Editor-in-Chief

Jovina Bachynski, MN, RN(EC), CNeph(C), PhD(Student)

Email: [cannt.journal1@gmail.com](mailto:cannt.journal1@gmail.com)

#### Co-Editor

Rosa M. Marticorena, BScN, RN, CNS, CNeph(C), DClInEpi, PhD

Email: [cannt.journal1@gmail.com](mailto:cannt.journal1@gmail.com)

#### Managing Editor

Heather Coughlin, Pembroke, Ontario

#### Layout and Design

Sherri Keller, Pembroke, Ontario

#### Advertising Sales

Heather Coughlin, Pappin Communications

T: (613) 633-1938

Email: [heather@pappin.com](mailto:heather@pappin.com)

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## Letter from the Editors

It has become a tradition to start the year reflecting on the theme for World Kidney Day. The theme this year is **Kidney health for all – Advancing equitable access to care and optimal medication practice**. This theme is particularly resonant in its call for an interdisciplinary approach to not just advance equitable access, but *secure* vital equitable care including optimal medication practices from clinicians within the patient's circle of care. We draw inspiration from this year's theme as we present our lead article, *A look within: Program-level barriers and strategies to growing home dialysis programs in Canada: A literature review*, by Shawna Khan. Home dialysis represents an important option, particularly for people living in remote areas of the country for whom leaving their way of life to receive dialysis in distant dialysis centres would represent a significant change in their quality of life. Knowledge through research is empowering us to improve access to equitable care for our patients, and this literature review indicates a paucity of Canadian studies, thus underscoring the need for additional research, particularly for those who may not initially fulfill the criteria for home dialysis and are, thus, considered marginal. There clearly is much more work to be done on this front. Similarly, in our continuing education offering, Tabassum and Battistella note there are no Canadian data available on the incidence of calciphylaxis, a complication that has devastating consequences for those afflicted. Much of how we manage and care for our patients is based on best practice guidelines. Inasmuch as

nursing practice encompasses different types of knowledge, we cannot escape how research informs our practice as a starting point. To this end, we exhort our nurse and technologist members to engage in research or quality initiative projects about an aspect in their respective practice for which the question "How can we improve on this to advance quality patient care?" applies. At *CANNT Journal*, we publish observational studies, reviews, clinical trials, case reports, solutions to clinical bedside issues, and quality improvement projects to disseminate important findings that could be relevant to you and your practice. Over the years, our membership has diminished proportionally, but our collective voice has not lost its impact. We can make a difference in nephrology nursing and technological practice through different ways, chief among them is sharing knowledge with our peers.

Sincerely from your *CANNT Journal* co-editors,



**Jovina Bachynski**  
MN-NP Adult, RN(EC),  
CNephC, PhD Student



**Rosa M. Marticorena**  
CNS, CNeph(C),  
DClInEpi, PhD

# Message des rédactrices

La tradition veut que nous commençons l'année par une réflexion sur le thème de la Journée mondiale du rein. Cette année, le thème retenu est *La santé rénale pour tous – Promouvoir un accès équitable aux soins et une utilisation optimale des médicaments*. Il s'agit d'un thème particulièrement évocateur qui exige une démarche interdisciplinaire pour non seulement promouvoir un accès équitable, mais aussi *garantir* des soins équitables vitaux, notamment au moyen de démarches pharmacologiques optimales par les cliniciens au sein du cercle de soins aux patients. Notre inspiration pour le thème de cette année se fonde sur notre article vedette intitulé *A look within: Program-level barriers and strategies to growing home dialysis programs in Canada: A literature review (Coup d'œil : Obstacles et stratégies pour la création de programmes d'hémodialyse à domicile au Canada – une revue de la documentation)*, rédigé par Shawna Khan. La dialyse à domicile représente une option importante, en particulier pour les personnes des régions éloignées qui verraient leur qualité de vie grandement touchée si elles devaient tout quitter pour recevoir des traitements d'hémodialyse dans des centres loin de chez elles. Les connaissances acquises grâce à la recherche nous permettent d'améliorer l'accès à des soins équitables pour nos patients, et cet examen de la documentation souligne un manque d'études canadiennes et la nécessité d'accélérer la recherche, en particulier pour les personnes qui ne répondent initialement pas aux critères d'admissibilité à l'hémodialyse à domicile et sont donc considérées comme marginales. De toute évidence, il reste beaucoup de travail à faire à cet égard. Parallèlement, dans le cadre de notre offre de formation continue, Tabassum et Battistella font remarquer qu'il n'existe pas de données canadiennes sur l'incidence de la calciphylaxie, une complication dont les conséquences peuvent être dévastatrices pour les personnes touchées. Une grande part de notre gestion

des soins aux patients est fondée sur les lignes directrices de pratiques exemplaires. Comme la pratique infirmière regroupe divers types de connaissances, nous ne pouvons nier à quel point la recherche façonne cette pratique à sa base. À cette fin, nous exhortons les infirmiers et infirmières ainsi que les technologues parmi nos membres à s'engager dans la recherche ou dans des projets de qualité touchant l'un des aspects de leur pratique respective où s'applique le principe d'optimisation des soins aux patients. La revue de l'ACITN propose des études d'observation, des critiques, des essais cliniques, des rapports de cas, des solutions à des problèmes cliniques de contact avec les patients et des projets d'amélioration de la qualité visant à disséminer des découvertes importantes qui pourraient s'appliquer à vous et à votre pratique. Au fil des ans, le nombre de nos membres a diminué, mais notre voix collective continue de retentir bien fort. Nous sommes en mesure de changer les choses dans la pratique infirmière et technologique de la néphrologie, et ce, par divers moyens, dont le partage des connaissances avec nos pairs.

Vos rédactrices de la *Revue de l'ACITM*.



**Jovina Bachynski**  
Sc. Inf., IP (adulte) inf.  
aut. (catégorie  
spécialisée) clinique,  
CNeph(C), doctorante



**Rosa M. Marticorena**  
ICS, CNeph(C), D.E.S.  
Épidémiologie, Ph. D.

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Téléphone : 613-507-6053  
Télécopieur : 1-866-303-0626  
Courriel : [cannt@cannt.ca](mailto:cannt@cannt.ca)

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**Rédactrice en chef**  
Jovina Bachynski, MN, RN(EC), CNeph(C), PhD(Student)  
Courriel : [cannt.journal1@gmail.com](mailto:cannt.journal1@gmail.com)  
Co-rédactrice  
Rosa M. Marticorena, BScN, RN, CNS, CNeph(C), DClínEpi, PhD  
Courriel : [cannt.journal1@gmail.com](mailto:cannt.journal1@gmail.com)

**Éditeur**  
Heather Coughlin, Pembroke (Ontario)

**Conception et design**  
Sherri Keller, Pembroke (Ontario)

**Publicité**  
Heather Coughlin, Pappin Communications,  
T : 613-633-1938  
Courriel : [heather@pappin.com](mailto:heather@pappin.com)  
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PhD(Student)  
[cannt.journal1@gmail.com](mailto:cannt.journal1@gmail.com)

**CANNT Journal Co-Editor/  
Coéditrice:**  
Rosa Marticorena, BScN, RN, CNS, CNeph(C),  
DClinEpi, PhD  
[cannt.journal1@gmail.com](mailto:cannt.journal1@gmail.com)

**CANNT Administrative Office/  
Bureau National de l'ACITN:**  
4 Cataraqui St., Suite 310  
Kingston, ON K7K 1Z7  
Phone: 613-507-6053  
Same Toll Free: 1-877-720-2819  
Fax: 1-866-303-0626  
General email: [cannt@cannt.ca](mailto:cannt@cannt.ca)

## President's Message

It is a pleasure to write to you as your CANNT-ACITN President. I begin this message with appreciation to all CANNT-ACITN members and nephrology colleagues for your efforts and unrelenting perseverance and dedication. It is no secret that this remains a very challenging time for healthcare, and, together, our collective influence, resiliency, and impact continue to find creative ways to be a shining light within nephrology care.

Canada is home to large diaspora communities, and we have seen how events surrounding armed international conflict can lead to division. I know that many are heavily impacted by the ongoing violence, displacement, and humanitarian crises globally that limit access to healthcare and life-saving treatments like dialysis. My heartfelt sympathy and prayers go out to all, and we must not lose sight of our shared responsibilities to one another and our community.

We celebrated World Kidney Day (WKD) on March 14, 2024. The theme this year is **Kidney health for all – Advancing equitable access to care and optimal medication practice**. Professionals in nephrology are in a unique position to raise awareness of the importance of our kidneys to our overall health and to reduce the frequency and impact of kidney disease and its associated health problems globally. As a collective group, we must continue to advocate for chronic kidney disease (CKD) awareness and capacity building of the health care workforce. It is critical to address the shortage of nurses, technologists, and other health care providers, and build capacity among health care workers. Safeguarding education on appropriate CKD screening and adherence to practice guidelines are paramount

to the successful implementation of effective and safe treatment strategies. Adopting and utilizing pharmacologic and non-pharmacologic tools for CKD management and fostering effective communication and empathy among colleagues greatly impact patient care. I hope you were able to join CANNT and Can-SOLVE for the special webinar on STOP Med-HD: Safety deprescribing medications for people on hemodialysis held on March 14.

We are also excited to announce the CANNT-ACITN National Conference 2024 will be held in Ottawa. Stay tuned—more details to follow. Additionally, please continue to take advantage of our open-access *CANNT Journal*, nephrology guidelines, webinars, networking opportunities, CANNT awards, bursaries, and research grants. For more information, visit us at <https://cannt-acitn.ca/>

I am immensely grateful for your commitment to patient care and CANNT-ACITN. Remember you have a unique opportunity to enhance the quality of care provided to individuals with kidney disease. I cannot wait to see, hear, and experience all the wonderful things we'll be able to accomplish together. God bless you all!

Eleanor Roosevelt said: “The future belongs to those who believe in the beauty of their dreams.” I believe profoundly in CANNT-ACITN members and the remarkable things we can accomplish together.

Regards,

*Alicia Moonesar*



**Alicia Moonesar, DNP,  
MScN, BScN, NP-PHC (she/  
her)  
President – CANNT-ACITN**

# Message de la présidente

C'est avec grand plaisir que je m'adresse à vous à titre de présidente de l'ACITN. Laissez-moi d'abord remercier tous les membres de l'association et les collègues du milieu de la néphrologie pour leurs efforts soutenus, leur persévérance et leur dévouement. Nous savons tous que le milieu de la santé traverse une période difficile. Malgré cela, nous parvenons, grâce à notre unité, notre influence collective et notre résilience, à trouver sans cesse des moyens de faire valoir les soins en néphrologie.

Le Canada rassemble une importante diaspora de collectivités, et nous avons pu constater à quel point les événements touchant les conflits armés internationaux peuvent contribuer à nous diviser. Je sais que beaucoup de personnes subissent les contrecoups de la violence, des déplacements et des crises humanitaires sévissant de par le monde, qui limitent l'accès aux soins de santé et aux traitements vitaux comme la dialyse. Mon cœur est avec toutes ces personnes, et nous ne devons jamais perdre de vue nos responsabilités les uns envers les autres et envers notre communauté.

Le 14 mars, nous avons célébré la Journée mondiale du rein. Cette année, le thème retenu est **La santé rénale pour tous – Promouvoir un accès équitable aux soins et une utilisation optimale des médicaments**. Les professionnels de la néphrologie se trouvent dans une position unique

pour sensibiliser à l'importance des reins dans l'état de santé global et pour contribuer à réduire la fréquence et les effets de la maladie rénale et des problèmes de santé connexes dans le monde. En tant que groupe, nous devons poursuivre notre effort de sensibilisation aux maladies rénales chroniques et à la nécessité d'améliorer les capacités des effectifs en santé. Il est crucial de contrer la pénurie de personnel infirmier, de technologues et d'autres fournisseurs de soins de santé et d'accroître le nombre de travailleurs de la santé. Il est d'une importance capitale de disséminer l'information sur le dépistage approprié des maladies rénales chroniques et d'adhérer aux lignes directrices de pratique clinique pour réussir la mise en œuvre de stratégies thérapeutiques efficaces et sécuritaires. L'adoption et l'utilisation d'outils pharmacologiques et non pharmacologiques pour la prise en charge des maladies rénales chroniques, de même que la promotion de la communication efficace et de l'empathie entre collègues, ont des répercussions positives notables sur les soins aux patients. J'espère que vous avez pu assister au webinar spécial de l'ACITN et de Can-SOLVE intitulé STOP Med-HD: Safety de-prescribing medications for people on hemodialysis (en anglais), le 14 mars dernier.

Nous sommes aussi heureux d'annoncer que le Congrès national de 2024 de l'ACITN se tiendra à Ottawa. Les

détails vous seront communiqués bientôt. Nous vous encourageons également à vous prévaloir de nos ressources grand public, soit la Revue de l'ACITN, les lignes directrices en néphrologie, nos webinaires, nos occasions de réseautage, et les prix, bourses et subventions de recherche. Pour obtenir de plus amples renseignements, visitez le site <https://cannt-acitn.ca/>.

Je vous suis immensément reconnaissante pour votre dévouement à l'égard des soins aux patients et l'ACITN. N'oubliez pas que vous avez une occasion unique d'améliorer la qualité des soins prodigués aux personnes atteintes de maladies du rein. Je suis impatiente de voir, d'entendre et de vivre toutes les merveilleuses choses que nous arriverons à accomplir ensemble. Merci!

Eleanor Roosevelt a dit : « L'avenir appartient aux personnes qui croient en la beauté de leurs rêves ». J'ai une confiance profonde envers les membres de l'ACITN et toutes les choses remarquables que nous sommes en mesure de faire ensemble.

Cordialement,

*Alicia Moonesar*



D<sup>re</sup> Alicia Moonesar, DPI,  
M. Sc. Inf., B. Sc. Inf.,  
IPSP (elle)  
Présidente, CANNT-ACITN

# CANNT in Action

**H**appy New Year! The Canadian Association of Nephrology Nurses and Technologists (CANNT) is excited about the opportunities and experiences that 2024 will bring for the CANNT community. As we embark on this new year, we have several updates and initiatives to share with you.

We are pleased to announce the launch of the 2023 update to the *Vascular Access Guidelines*, now available online on the CANNT website for all nephrology professionals. A dedicated CANNT working group, comprised of appointed nursing experts in vascular access, ensured the validity, reliability, and utility of the revised recommendations.

Additionally, we are excited to introduce the patient pamphlet on Kidney Organ Trafficking, with factual information to patients, particularly in nephrology care. It is meant to bring awareness of organ trafficking. This resource is now accessible on the CANNT website in downloadable format, and has been distributed to institutions nationwide. We encourage our members to share this information and make the pamphlet readily available to patients. As we continue our reach, sharing more information on transplant and organ trafficking, CANNT is planning to launch a similar pamphlet with information directed towards health care professionals later this year.

Looking ahead, the 2024 CANNT Conference Planning Committee has been established and will soon begin

planning for the upcoming conference in Ottawa. The conference is scheduled to take place from October 24-26, 2024, at the Ottawa Conference and Event Centre. Abstract proposals are currently being accepted online through the CANNT website.

In the spring, CANNT President, Alicia Moonesar, will be attending this year's American Nephrology Nurses Association (ANNA) national conference in April, as part of our longstanding reciprocal relationship. This is a special year for ANNA as they celebrate their 55<sup>th</sup> anniversary. We look forward to hearing about the insights and knowledge Alicia brings back from this event.

World Kidney Day was on March 14 and this year's theme is **Kidney health for all – Advancing equitable access to care and optimal medication practice**. CANNT teamed up with Can-SOLVE to provide a free webinar that aligns with the theme, *STOP Med-HD: Safely deprescribing medications for people on hemodialysis*. Can-SOLVE CKD Network is Canada's largest-ever kidney research initiative. It is a national partnership of patients, researchers, healthcare providers, and policy makers working to transform treatment and care for Canadians affected by chronic kidney disease. The network coordinates and conducts innovative research using a patient-oriented approach. Hemodialysis patients have a very high pill burden (averaging 12 medications a day) and research suggests many of

these medications may not be necessary, potentially leading to unnecessary hospitalizations and adverse drug reactions. To help reduce this burden, Canadian researchers have developed a new tool to help care teams identify and reduce unnecessary medications being taken by patients receiving hemodialysis. The webinar provided information on the STOP Med-HD project and how this new tool is being used at sites across Canada.

As CANNT looks forward to the rest of the year, members can expect more webinar opportunities in the spring. CANNT will also be focusing on more resources for technologists, including an FAQ section that will answer questions about the technologist role, opportunities, and certifications available in Canada. CANNT is also working on an exciting project to bring more resources for the CNA nephrology certification exam training to CANNT members.

We want to thank our members for their continued support and engagement. Your ideas and suggestions are invaluable to us, so please do not hesitate to contact CANNT with any feedback or suggestions that would benefit you.



**Megan Howes, CAE, CMP**  
**Executive Director,**  
**CANNT**

## JOIN THE CANNT COMMUNITY

The Canadian Association of Nephrology Nurses and Technologists (CANNT) provides leadership and promotes the best nephrology care and practice through education, research, and communication. Join today and receive:

- discount of the annual conference registration fee
- educational opportunities at a reduced cost or free to members
- connections to the latest information and resources related to nephrology, technology or nursing
- networking opportunities with colleagues practising in your nephrology specialty on a national level
- opportunities for collaborative networking and problem solving through participation in a Refined Clinical Practice Group
- CANNT awards and research grants offered to individuals in recognition of their excellence in the workplace and/or to further their studies in Nephrology

Learn more at [cannt-acitn.ca](https://cannt-acitn.ca)



# L'ACITN en action

**B**onne et heureuse année! L'Association canadienne des infirmières et infirmiers et des technologues en néphrologie (ACITN) se réjouit des possibilités et des expériences que 2024 réserve à ses membres. À l'aube de cette nouvelle année, nous vous présentons plusieurs nouvelles et projets.

C'est avec plaisir que nous annonçons le lancement de la version mise à jour en 2023 des *Directives pour l'accès vasculaire* (en anglais) à l'intention de tous les professionnels de la néphrologie, maintenant accessible en ligne sur le site de l'ACITN. Un groupe de travail dédié de l'ACITN rassemblant des infirmières et infirmiers experts de l'accès vasculaire a assuré la validité, la fiabilité et l'utilité des recommandations mises à jour.

Par ailleurs, nous sommes heureux de présenter le dépliant sur le trafic de reins, lequel présente des renseignements factuels à l'intention des patients en matière de soins en santé rénale (en anglais). Il s'agit d'un document de sensibilisation au trafic d'organes. Cette ressource est maintenant accessible sur le site de l'ACITN en format téléchargeable et a été distribuée à des établissements aux quatre coins du pays. Nous encourageons nos membres à disséminer cette information et à mettre le dépliant à la disposition des patients. Dans le but de publier plus de renseignements sur la transplantation et le trafic d'organes, l'ACITN prévoit lancer, plus tard cette année, un dépliant semblable à l'intention des professionnels de la santé.

Le comité de planification du congrès 2024 de l'ACITN a été formé et

commencera bientôt à planifier le prochain congrès qui se tiendra à Ottawa, du 24 au 26 octobre 2024, au Centre de congrès et d'événements d'Ottawa. Les propositions de conférences peuvent être soumises par l'intermédiaire du site Web de l'ACITN.

Au printemps, Alicia Moonesar, présidente de l'ACITN, participera au congrès national de l'American Nephrology Nurses Association (ANNA) en avril prochain dans le cadre de notre partenariat réciproque de longue date. Il s'agit d'une année spéciale qui marquera le 55<sup>e</sup> anniversaire de l'ANNA. Nous avons hâte d'entendre ce qu'Alicia aura à dire à propos de l'événement.

Le 14 mars était la *Journée mondiale du rein* et elle avait pour thème cette année *La santé rénale pour tous – Promouvoir un accès équitable aux soins et une utilisation optimale des médicaments*. L'ACITN s'est associée à Can-SOLVE pour offrir un webinaire gratuit sur un thème connexe, intitulé *STOP Med-HD: Safely deprescribing medications for people on hemodialysis (Arrêt sécuritaire des médicaments pour les patients en hémodialyse)*. Le réseau Can-SOLVE CKD est le plus grand projet de recherche en néphrologie jamais mis sur pied. Il s'agit d'un partenariat national regroupant des patients, des chercheurs, des fournisseurs de soins de santé et des décideurs et visant à transformer le traitement et les soins aux patients touchés par les maladies rénales chroniques. Le réseau coordonne et dirige des travaux de recherche novateurs selon une démarche axée sur le patient. Les patients en hémodialyse doivent prendre beaucoup de médicaments (en

moyenne, 12 par jour) et la recherche laisse penser que nombre de ceux-ci ne seraient pas nécessaires, voire même qu'ils peuvent entraîner des effets indésirables pouvant aller jusqu'à nécessiter une hospitalisation. Dans le but de réduire ce fardeau, des chercheurs canadiens ont créé un nouvel outil permettant aux équipes de soins de reconnaître et de réduire les médicaments superflus que prennent les patients d'hémodialyse. Le webinaire expliquait le projet STOP Med-HD et l'utilisation de ce nouvel outil dans divers centres au Canada.

L'ACITN est prête pour le reste de l'année, et les membres peuvent s'attendre à se voir offrir d'autres webinaires au printemps. L'ACITN compte également se pencher sur les ressources à l'intention des technologues, notamment une FAQ qui expliquera le rôle des technologues, les possibilités et les programmes de certification offerts au Canada. L'ACITN s'affaire aussi à un projet prometteur visant à offrir à ses membres plus de ressources de formation en vue de l'examen de certification en néphrologie de l'AIIC.

Nous tenons à remercier nos membres pour leur participation et leur appui soutenus. Vos idées et suggestions sont importantes. N'hésitez donc pas à faire part à l'ACITN de tout commentaire qui pourrait contribuer à améliorer les services et ressources qui vous sont offerts.



**Megan Howes, CAE CMP**  
**Directrice générale,**  
**ACITN**

# A look within: Program-level barriers and strategies to growing home dialysis programs in Canada: A literature review

By Shawna Khan

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## ABSTRACT

*Home dialysis, which includes home hemodialysis and peritoneal dialysis, is cost-effective and equally efficacious or superior to in-centre hemodialysis. A growing number of Canadian and international government organizations and nephrology organizations are advocating for an increase in the number of patients on a home dialysis modality. Despite this, home dialysis uptake in Canada has been slow. This literature review analyzes barriers to home dialysis at a renal-program level in Canada and suggests strategies to overcome these barriers. The initial search of published peer-reviewed articles from 2012 to 2023 yielded 847 articles; 11 were retained for review. Three prominent recurring themes were identified as program-level barriers to increasing the prevalence of patients on a home dialysis modality: (a) nephrologist fellowship training and self-reported preparedness; (b) in-centre hemodialysis (ICHD) staff knowledge and comfort level; and (c) lack of objective and consistent exclusion criteria for recruitment to a home dialysis modality. Recommendations to overcome these barriers are (a) promoting a home-dialysis-first culture; (b) enhancing education and peer mentorship; and (c) optimizing patient recruitment.*

**Keywords:** home dialysis, home hemodialysis, peritoneal dialysis, barriers, challenges

Every year, the rate of Canadians who start renal replacement therapy because of kidney failure rises by 1.1%, and the number of Canadians receiving chronic dialysis has nearly doubled in the past 20 years (Canadian Institute for Health Information [CIHI], 2021b). In Canada and worldwide, in-centre hemodialysis (ICHD) is the most commonly used renal replacement therapy for end-stage renal disease (ESRD), despite research showing home dialysis modalities, including peritoneal dialysis (PD) and home hemodialysis (HHD), are equally efficacious or superior to conventional ICHD, and have similar or improved impacts on the quality of life for patients (Diebel et al., 2020; Hager et al., 2019).

## AUTHOR NOTE

Shawna Khan, MN, RN, Renal Program, William Osler Health System, Brampton Civic Hospital, Brampton, Ontario

Address for correspondence to: Shawna Khan, Renal Program, Brampton Civic Hospital, 2100 Bovaird Drive E., Brampton, ON L6R 6J7.

Email: [shawna.khan@williamoslerhs.ca](mailto:shawna.khan@williamoslerhs.ca)

Governments and global kidney disease organizations are rallying renal programs to expand home dialysis programs to meet the ever-growing dialysis needs (Chan et al., 2020; Mendu et al., 2021). In Canada (excluding Quebec), 18.9% and 4.7% of patients on renal replacement therapy are receiving PD and HHD, respectively (Hager et al., 2019). In 2015, the Ontario Renal Network (ORN), the provincial government agency responsible for managing and delivering chronic kidney disease services in Ontario, set a provincial target of having 28% of all dialysis patients on a home dialysis modality by 2019. Although gains were made, the prevalence rates of home modalities in Ontario have plateaued, with rates at 25.5% in 2019 and 24.9% at the end of fiscal year 2022/2023 (ORN, n.d., 2019, 2023). Low rates of home dialysis are evident in other provinces in Canada as well, with Saskatchewan having 22% of patients receiving PD and 2.5% receiving HHD (Diebel et al., 2020; Prasad et al., 2020). Home care screening and assessments declined substantially during the COVID-19 pandemic, potentially adding barriers to assisted home dialysis (CIHI, 2021a).

The cost differences between providing ICHD and home dialysis are well documented in the literature. Kidney failure uses a disproportionate amount of healthcare spending, with the Canadian health system spending 1.2% of its annual budget on kidney failure (Hager et al., 2019). ICHD costs significantly more to the health care system compared to home dialysis, and renal programs face challenges related to space and staffing to accommodate increased ICHD needs (Hager et al., 2019). Compared with ICHD, PD and HHD are associated with decreased lifetime costs to the health care system, with savings of greater than \$36,000 and \$75,000 per patient, respectively (Poinen et al., 2021). In British Columbia, home modalities are estimated to cost between \$45,000 and \$50,000 per patient/year, with ICHD costs between \$65,000 to \$90,000 per patient/year (Poinen et al., 2021). Despite growing evidence that home dialysis is more cost-effective than ICHD, uptake has been slow in Canada. The slowed growth suggests persistent barriers to implementation (Hager et al., 2019).

Despite resource challenges, renal programs continue to be tasked with increasing the number of patients on a home dialysis modality. Understanding barriers to home dialysis is multifaceted and complex. Previous studies have explored barriers to home dialysis therapies from the perspective of patients and caregivers, identifying several common

themes around patient support, burden of care, technology limitations, infrastructure needs, negative body image, and patient fears (Sauvé et al., 2016; Walker et al., 2015). However, knowledge and expertise on program-level barriers are scattered. Identifying barriers within renal programs can empower nephrology teams to look within and generate practical solutions to optimize their processes and policies to increase the number of patients on a home modality.

This article discusses barriers to home dialysis within renal programs and suggests strategies for overcoming these barriers. Understanding and overcoming program-level barriers to home dialysis will increase the prevalence of dialysis patients on a home modality and support local practice improvements in renal programs in Canada. The aim of this review is to

1. identify the program-level barriers to increasing the prevalence of patients on a home dialysis modality
2. uncover organizational strategies to overcome these barriers and increase the prevalence of patients on a home modality.

In this article, the term ‘in-centre hemodialysis’ refers to hemodialysis provided by a nurse in a hospital or community-based dialysis unit. The term ‘home dialysis’ refers to either peritoneal dialysis or home hemodialysis that is self-administered by the patient at home.

## METHODS

The research questions guiding this review were: (a) What are the program-level barriers to increasing the prevalence of patients of a home dialysis modality? and (b) what organizational strategies are suggested to overcome barriers to ensure renal programs can establish a successful home dialysis program? A bibliographic search of the Cumulative Index for Nursing and Allied Health (CINAHL), PubMed, and Google Scholar databases was completed using the keywords “hemodialysis,” “peritoneal dialysis,” “home hemodialysis,” “barriers,” and “challenges.” The keywords were searched for both title and abstract using the Boolean operators AND and OR. The search was limited to peer-reviewed articles in English published between 2012 and 2023 to ensure studies were relevant to the current healthcare climate. Additional searches involved reviewing the selected articles’ reference list. Initially, the articles were screened for relevance according to their title and abstract against the inclusion and exclusion criteria. The full text of the remaining articles was then reviewed, and pertinent articles were selected based on the inclusion and exclusion criteria. Inclusion criteria are: adults (18 years of age and older); international publications; and barriers and strategies related to health care providers and renal-program practices or policies. The criteria focus on examining factors that directly stem from the care team and renal program practices or policies. Publications were excluded if they were not in English, investigated patient-reported or patient-specific barriers and strategies, and studies involving children.

## Data Analysis Method

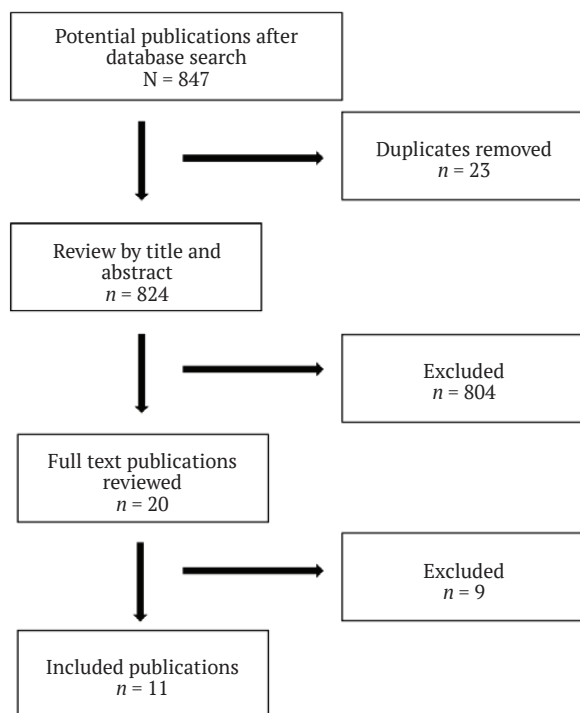
A careful and considered approach was used in selecting studies that met the inclusion and exclusion criteria. A thematic analysis was done to identify recurrent concepts that emerged from the reviewed literature based on the research questions. The recurrent concepts were then aggregated into the themes identified in this article.

## FINDINGS

A total of 847 publications were retrieved during the initial search, leaving 824 unique records after duplicates were removed. Screening of titles and abstracts resulted in 20 publications requiring further review. After further review, nine publications were removed based on the exclusion criteria. Eleven publications met the inclusion criteria. Of the 11 studies, only three were conducted in Canada. Figure 1 illustrates a flow diagram of the screening process and results. The results yielded two mixed methods studies, seven cross-sectional surveys, and two retrospective studies. The results of the included studies are summarized in Table 1. Based on the results of the analysis, three prominent recurring themes were identified as contributing factors to program-level barriers to increasing the prevalence of patients on a home dialysis modality. The themes included nephrologist fellowship training and self-reported preparedness, ICHD staff knowledge and comfort level, and the lack of objective and consistent exclusion criteria for recruitment to home dialysis.

**Figure 1**

*Flowchart Illustrating the Screening Process and Results*



**Table 1***Summary of the Included Articles*

<b>Author, Date, Country</b>	<b>Methodology and Methods Used</b>	<b>Aim</b>	<b>Key Findings</b>
Combes et al. (2015), England	Mixed methods study: 1. Quantitative analysis of home dialysis uptake rates at seven hospitals 2. Qualitative interviews of 96 clinical and managerial staff and 93 dialysis patients to explore the factors that influence or impede home dialysis uptake	1. Study the impact policy changes in England had on home dialysis prevalence 2. Examine barriers and facilitators to home dialysis uptake	Facilitators: 1. Commissioner's target and financial penalty 2. New funding for specialist staff and dialysis machines 3. Clinical leadership and wider staff support 4. Training and support systems for home dialysis patients  Barriers: 1. Lack of training for non-specialist staff 2. Pre-dialysis education 3. Lack of recognition by staff of the patient's emotional and psychological needs
Desmet et al. (2013), Belgium	Quantitative: Cross-sectional survey <i>n</i> = 113	1. Evaluate the nephrologists' perception of PD and its use 2. Identify barriers to PD implementation perceived by nephrologists	Facilitators 1. 88% of respondents claim PD is underused and should reach 20%–25%. 2. Clear preference to choose a home modality for themselves if faced with ESRD. 3. Necessity for active nursing team dedicated to a pre-dialysis promotion.  Barriers: 1. Easy access to HD 2. Patient's refusal to the technique 3. No consensus on contraindications to PD 4. Lack of motivation of nephrologists
Firaneck et al. (2016), United States	Quantitative: Cross-sectional survey <i>n</i> = 273	To understand better why PD and HHD are not more widely used	Barriers: 1. HCP Knowledge Gaps 2. Lack of support from ICHD staff 3. 90% of respondents indicated that if they had ESRD, they would choose PD or HHD for themselves.
Gupta et al. (2021), United States	Quantitative: Cross-sectional survey <i>n</i> = 110	Identify strengths and limitations in US nephrology fellowship home dialysis training	1. Trainees overall felt moderately prepared for managing PD after graduation. 2. Only 26% had initiated and supervised training in a HHD patient. 3. Overall self-reported preparedness for managing HHD was low with most respondents reporting being minimally prepared or not prepared at all. 4. 99% of fellows wanted more home dialysis-focused teaching in their program.
Jayanti et al. (2014), Europe, Middle East, Asia, North America, South America, Central America, Africa	Quantitative: Cross-sectional survey <i>n</i> = 272	Understand the beliefs and attitudes of individuals with regards to adopting HHD	Facilitators: 1. Physicians have a great deal of interest in HHD and view home as the ideal location. 2. Respondents had a view that a significantly higher proportion of patients could be on HHD.  Barriers: 1. The quality and quantity of pre-dialysis education and the level of support, in the form of specialized nurses, influenced the number of patients selecting a home modality. 2. Majority of participants attribute factors, such as patient complexity and comorbidities, fear of self-cannulation, fear of isolation, lack of support, and lack of space within patient's home as barriers to HHD. Many of these factors have been overcome in larger programs with longer experience and greater expertise.
Lloyd et al., 2023, United Kingdom	Quantitative: Retrospective single-centre analysis of electronic medical records <i>n</i> = 116	Study how many patients who chose HHD as their preferred mode of renal replacement therapy (RRT) went on to receive this treatment and the barriers to starting this treatment	Barriers: 1. Breakdown of communication between clinics and dialysis units. 2. Absence of documentation on clinical suitability for HHD. 3. Delays in training or establishing vascular access. 4. 9 patients changed their mind after starting ICHD. 5. 6 patients had an unsuitable home environment.

*continued...*

Merighi et al. (2012), United States	Quantitative: Cross-sectional survey <i>n</i> = 629	Determine nephrologists' self-assessment of preparedness for providing care to dialysis patients and their need for additional dialysis-specific training after completing their nephrology fellowship	Facilitators: 1. When nephrologists were asked what dialysis modality they would choose for themselves, 94% chose some form of home dialysis. 2. Higher self-assessment of preparedness and additional post-fellowship training was associated with a higher likelihood of providing treatment to PD patients.  Barriers: 1. 38% of respondents did not feel well prepared to care for dialysis patients at the time of their nephrology certification examination. 2. After fellowship training, 16% sought additional dialysis-specific training.
Morita et al. (2019), Canada	Mixed methods approach: 1. Quantitative metrics (surveys) 2. Qualitative data collection (semi-structured interviews and open-ended survey questions)	1. Assess the effectiveness of UHNs Explore Home Dialysis [EHD] program 2. Evaluate the need for an educational program to train individuals on how to deploy home dialysis programs 3. Evidence Evaluate that the educational program is beneficial to participants and for the deployment of new home dialysis programs	Facilitators: 1. Clinicians are likely the main enablers for the success of home dialysis programs.  Barriers: 1. Financial 2. Infrastructural barriers 3. Institutional and cultural barriers  EHD Program: Participants wanted the following: 1. Materials that could be used to train their staff back in their home institution 2. Access to UHN protocols and training materials 3. Opportunities to connect with their peers and EHD mentors after their tenure in the EHD program 4. Support material to demonstrate the financial viability and benefit of home dialysis programs.
Phillips et al. (2015), Canada	Quantitative: Cross-sectional survey <i>n</i> = 1845	Determine if an education initiative modified the perceptions of ICHD nurses toward home dialysis	1. After the education initiative, perceptions were more positive toward PD and HHD for all characteristics studied. 2. After initiative, nurses were more in favour of home dialysis for most patients and system factors. 3. Although baseline attitudes toward home dialysis were positive, there were statistically significant improvements in most areas after the initiative. 4. Although baseline perceptions were generally in favour of home dialysis, ICHD nurses did not feel well informed about the benefits of home therapies, or comfortable explaining home dialysis to patients prior to the intervention.
Poinen et al. (2021), Canada	Quantitative: Retrospective observational case control study <i>n</i> = 1845	Quantify missed opportunities to recruit patients to home therapies and explore where in the modality selection process this occurs	1. Out of 1845 patients, a total of 320 (17.3%) missed opportunities were identified, with 165 (8.9%) having initially chosen a home therapy and 155 (8.4%) being undecided about their preferred modality. 2. A contraindication to both PD and HHD was documented in 8 "missed opportunity" cases. 3. Mismatch between patients who did not have a clear contraindication to both PD and HHD and the number of patients who received dedicated education on home therapies.
Rope et al. (2017), United States	Quantitative: Cross-sectional survey <i>n</i> = 266	Determine current nephrology fellows' educational needs and evaluate their interest in potential education interventions	1. 51% desired additional instruction in their fellowship on HHD. 2. 45% desired additional instruction in their fellowship on PD.

## **Theme One: Nephrologist Fellowship Training and Self-Reported Preparedness**

In five of the included studies, the authors found training and self-reported preparedness for nephrologists were key barriers to increasing the uptake of patients on a home modality (Desmet et al., 2013; Gupta et al., 2021; Merighi et al., 2012; Morita et al., 2019; Rope et al., 2017). The included studies highlight a deficit in nephrologist fellowship training in home dialysis, including limited experience and a lack of self-reported preparedness among graduating nephrologists.

In a study conducted in the French-speaking part of Belgium, Desmet et al. (2013) revealed the importance of PD exposure and training for nephrologists. In this study, a 33-item questionnaire was sent to nephrologists to record their opinions concerning the limited use of PD; the results indicated nephrologists' training and experience were significant barriers to the uptake of PD. Almost 30% of respondents had personally followed less than five patients or had no PD experience, and 39% reported no specific training on PD management. Despite this educational gap, 88% of respondents believed PD is underutilized and should reach a prevalence of 20% to 25% (Desmet et al., 2013). This finding is similar to other studies in this review and suggests the gap between nephrologists' knowledge and experience, and their desire to prescribe more home dialysis, impede increasing home dialysis prevalence (Desmet et al., 2013; Gupta et al., 2021; Merighi et al., 2012; Rope et al., 2017).

Gupta et al. (2021) developed a survey to assess training and educational patterns in home dialysis in nephrology fellowship programs in the United States. In the survey, it was found that only 44% of respondents had initiated and managed patients on PD during their training, and overall, trainees felt moderately prepared to manage PD after graduation. Not surprisingly, the self-reported level of preparedness for PD was higher among trainees who had initiated and trained patients on PD than trainees without this experience. The study found overall self-reported preparedness for managing HHD was low, with most respondents reporting being minimally prepared or not prepared at all. An educational gap was identified, with 99% of respondents wanting more home dialysis-focused teaching in their program (Gupta et al., 2021). A desire for more focused education on home dialysis was also found in the survey conducted by Rope et al. (2017). Results from a survey to conduct an educational needs assessment for nephrology fellows in the United States indicated a desire for more education on home dialysis by the trainees (Rope et al., 2017). In this survey, HHD and PD were the top two most desired topics, with 51% and 41% of trainees desiring additional instruction in HHD and PD in their fellowship, respectively (Rope et al., 2017).

To meet national and international targets of increasing the prevalence of home dialysis, it is imperative nephrology training programs ensure trainees are prepared to care for patients on a home modality (Merighi et al., 2012). In a US nationwide survey of 629 clinical nephrologists, Merighi et al. (2012) found 38% of respondents did not feel well prepared to care for dialysis patients at the time of their nephrology certification examination, and after fellowship training, 16%

sought additional home dialysis-specific training. A higher self-assessment of preparedness and additional post-fellowship training were associated with a higher likelihood of prescribing home dialysis. It is reasonable to surmise a lack of training and experience may, in part, be responsible for the low uptake of home dialysis.

## **Theme Two: In-Centre Hemodialysis Staff Knowledge and Comfort Level**

In five of the included studies, the authors found a lack of knowledge and comfort among ICHD staff, including nurses, allied health, personal support workers, and renal technologists, explaining or engaging in casual conversations with patients about home dialysis options (Combes et al., 2015; Firanek et al., 2016; Morita et al., 2019; Phillips et al., 2015; Lloyd et al., 2023). In a mixed methods study in England, Combes et al. (2015) used quantitative analysis of home dialysis uptake rates at seven hospitals and qualitative interviews of 96 clinical and managerial staff and 93 dialysis patients to explore the factors that influence or impede home dialysis uptake. The researchers found renal staff, including nurses, allied health, personal support workers, and renal technologists working on the wards and in hemodialysis units, lacked confidence in talking with patients about home dialysis, even on a casual basis (Combes et al., 2015). The importance of training for all staff, not just specialized staff, was reinforced by the patient interview results. Patients expressed in their casual conversations with staff that their questions were not answered, and that staff failed to portray the benefits of home dialysis in a positive light and had missed opportunities to encourage patients to consider home dialysis (Combes et al., 2015).

The impact of ICHD staff on a patient's future dialysis decisions cannot be over-emphasized. ICHD staff provide ongoing day-to-day interactions with patients and may intentionally or unintentionally influence a patient's perceptions of home dialysis (Combes et al., 2015; Firanek et al., 2016). Firanek et al. (2016) conducted an 85-question survey sent to health care providers in outpatient dialysis units in the United States. Researchers found a lack of support from ICHD staff, with fewer ICHD nurses and technical staff acknowledging the benefits of home dialysis and more readily identified potential contraindications and drawbacks to home modalities (Firanek et al., 2016). Additionally, Lloyd et al. (2023) found 8% of patients who initially chose HHD changed their mind during the transition period on ICHD, indicating the patient experience of ICHD during the early transition phase could potentially positively or negatively influence a patient's view of undertaking HHD.

Recognizing the impact ICHD staff can have on patients' future modality decisions, a Canadian dialysis centre evaluated the effect of offering additional home dialysis training to ICHD nurses (Phillips et al., 2015). Nurses in the study were given surveys prior to and following a three-hour Canadian nursing education initiative on home dialysis. This study found that, although perceptions of home modalities were positive overall, providing additional education resulted in a significant shift in preference away from ICHD and toward home modalities. Respondents also saw fewer patient characteristics as barriers to home modalities after training (Phillips et al., 2015).

### **Theme Three: Lack of Objective and Consistent Exclusion Criteria for Recruitment to Home Dialysis**

Patient exclusion criteria and nephrologist opinions on modifiable and non-modifiable factors varied across the included studies, indicating an inconsistency among health-care providers in selecting patients for a home modality (Desmet et al., 2013; Jayanti et al., 2014; Lloyd et al., 2023; Poinen et al., 2021). Desmet et al.'s (2013) study on Belgian nephrologists' opinions found over 60% of nephrologists thought anuria, bad patient hygiene, chronic respiratory insufficiency, body mass index between 30 and 35, and malnutrition with hypoalbuminemia were at least relative contraindications to PD. Researchers also found 44% thought the practitioner's negative opinion of PD was a relative contraindication to the modality. These findings are significant in the context of this study because 50% of respondents declared they do not present PD as an alternative modality to conventional ICHD if they are convinced the patient is not a good candidate. In a survey of dialysis health care professionals, Jayanti et al. (2014) found the majority of participants attribute factors, such as patient complexity and comorbidities, fear of self-cannulation, and lack of space as barriers to HHD. These perceived barriers limit the provider offering home dialysis, even though many of these factors have been overcome in larger programs with longer experience and greater expertise (Jayanti et al., 2014).

Poinen et al. (2021) conducted a retrospective observational study of patients started on chronic dialysis in British Columbia, Canada, between January 1, 2015, and December 31, 2017, to quantify missed opportunities to recruit patients to home therapies. Cases were defined as a missed opportunity if a patient had chosen a home modality or remained undecided and, ultimately, received ICHD. Out of 1,845 patients, a total of 320 (17.3%) missed opportunities were identified, with 165 (8.9%) having initially chosen a home modality and 155 (8.4%) being undecided. Of the 320 missed opportunities, eight patients (2.5%) had a documented contraindication to PD and HHD. However, the specific nature of the contraindication was not included in the study.

Lloyd et al. (2023) conducted a retrospective single-centre analysis of electronic medical records for all patients who chose HHD as their preferred mode of renal replacement therapy and went on to receive this therapy. During the period studied, 116 patients chose HHD during their modality education. Of these, 93 required renal replacement therapy, and within that group, only 28 patients started on HHD. In nine cases, there was no documented reason why the patient did not receive HHD. Further, the clinical condition of eight patients had deteriorated after suffering major vascular events, such as acute coronary syndrome, cerebral vascular accidents, or amputations. However, there was no documentation for six of the eight patients, and clinical deterioration was only identified as a barrier to HHD after discussion with the responsible clinician. Although it is possible to receive HHD after such illnesses, the patient's most responsible clinician felt they would no longer be able to perform the tasks required.

Patients being appropriately recruited into home modalities impacts the type of modality education they receive.

Poinen et al. (2021) found a mismatch between patients who did not have a clear contraindication to home dialysis and the number of patients who received dedicated education on home therapies, indicating a need for programs to re-evaluate their current process for recruitment to home modalities (Poinen et al., 2021). Further, Desmet et al. (2013) found half of the respondents declared they would not discuss PD as an option if they considered the patient a bad candidate (e.g., poor understanding and collaboration).

## **DISCUSSION AND RECOMMENDATIONS**

Based on the findings of this analysis, the following recommendations represent the practical next steps to overcoming the barriers presented in this article and increasing the prevalence of patients on a home dialysis modality.

### **Home-Dialysis-First Culture**

A *home-dialysis-first* culture is the belief among nephrologists and staff that every patient with ESRD is a potential candidate for home dialysis and positions home dialysis as the default modality. In this culture, all patients are assumed to be appropriate for home dialysis, and then any exclusion criteria, such as unstable medical or behavioural conditions, or unsuitable housing, are applied (Agency for Clinical Innovation, 2014; ORN, 2019). Renal programs in Ontario with high home dialysis rates were identified as having a strong home-dialysis-first culture with institutional buy-in and a belief that every patient should be considered for a home modality unless there is a non-modifiable contraindication (ORN, 2019). Consistent staff support and belief in the home-dialysis-first culture enable overall uptake of home modalities. All staff, including specialized home dialysis staff and the ICHD staff, supporting home dialysis is a key success factor in home dialysis programs (Combes et al., 2015; ORN 2019; Phillips et al., 2015).

A key factor determining the success of a home-dialysis-first culture is the presence of home dialysis champions across all teams in the renal program (ORN, 2019). Combes et al. (2015) found strong clinical leadership was seen as a key to success in increasing home dialysis uptake rates, with particular individuals being highlighted as champions. This support was seen as essential to creating the right climate for change (Combes et al., 2015). A home-dialysis-first culture paves the way for changing staff attitudes and increasing comfort with home modalities through staff education and preventing missed opportunities for patients to be recruited to a home modality (Firanek et al., 2016; ORN, 2019; Phillips et al., 2015; Poinen et al., 2021).

### **Education and Peer Program Mentorship**

The findings of this review suggest that education, experience, knowledge, and comfort among nephrologists and ICHD staff are barriers to home dialysis uptake. The importance of clinician support and buy-in were widely demonstrated in this literature review revealing that clinicians are likely the main enablers for the success of home dialysis programs (Combes et al., 2015; Desmet et al., 2013; Firanek et al., 2016; Gupta et al., 2021; Merighi et al., 2012; Morita et al., 2019; Phillips et al., 2015). A successful home dialysis

program is reliant on the nephrologists and ICHD staff being engaged, competent, and well educated about home dialysis therapies (Ahmad et al., 2020). Practical solutions to this barrier include regular staff education targeting all renal teams, including ICHD staff, and standardizing learning materials for staff education to support consistent messaging from staff to patients throughout the patient journey (Ahmad et al., 2020; Morita et al., 2019; ORN, 2019; Phillips et al., 2015).

Peer program mentorship can address knowledge gaps among nephrologists and dialysis staff. Morita et al. (2019) evaluated the effectiveness of the University Health Network's (UHN) Explore Home Dialysis (EHD) Program in Toronto, Canada. The EHD program was created as an immersive education program to train clinicians and administrators to develop new home dialysis programs. The researchers found participants in the EHD program provided positive feedback and indicated an overall perceived benefit of the program, with clear opportunities for improvement. Participants were interested in concrete training materials, access to UHN protocols, and opportunities to connect with their peers and EHD mentors after they completed the program. Renal program leaders should take the initiative to collaborate with peer programs and disseminate organizational strategies through conferences, publications, and peer-to-peer mentorship.

### **Optimizing Patient Recruitment**

A challenge in comparing studies is the heterogeneity in what constitutes an exclusion or contraindication to home dialysis. Depending on the experience and culture of a renal program, a barrier may or may not be perceived as insurmountable. This literature review identified a mismatch between patients with a clear contraindication to a home modality and those who received dedicated home dialysis education (Poinen et al., 2021). The literature review also identified varying beliefs among nephrologists and ICHD staff on what is considered a contraindication, indicating a need for renal programs to evaluate their current process for recruitment to home therapies with the aim of identifying a standardized recruitment and pathway to home dialysis that is not restricted by modifiable risk factors, such as the fear of self-cannulation (Desmet et al., 2013; Phillips et al., 2015; Poinen et al., 2021). Programs can improve home dialysis recruitment by developing formalized patient selection criteria with broad acceptance criteria to allow marginal patients to explore home dialysis. A home dialysis first culture supports flexible selection criteria for home dialysis patients, as even marginal candidates can be successful on a home modality if they are educated and trained effectively (ORN, 2019).

### **DIRECTIONS FOR FUTURE RESEARCH**

The findings in this literature review suggest a strong need to find solutions that can be easily disseminated to renal programs within Canada. Recommendations include the development of evidence-based clinical practice guidelines that can be adapted and used by renal programs across the country to implement and grow home dialysis

programs. Standardized materials in the form of a clinical practice guideline will fill the gaps within renal programs to overcome the barriers of health care provider training and knowledge gaps, and the lack of objective exclusion criteria for the recruitment to home dialysis (National Centre for Complementary and Integrative Health, 2023).

The literature did not delineate absolute and relative exclusion criteria for recruiting patients to a home modality. Future research dedicated to streamlining definitions of absolute and relative exclusion criteria would facilitate more meaningful comparisons between renal programs and provide support for renal programs to develop standardized recruitment and pathways to home dialysis that are not restricted by modifiable risk factors.

### **STRENGTHS AND LIMITATIONS**

The strength of this study is the identification of program-level barriers to growing home dialysis and providing targeted, program-specific strategies to a complex issue. Identifying barriers within control of the renal program empowers health care providers to make improvements to their program policies and processes.

This review aimed to uncover program-level barriers to increasing the prevalence of home dialysis in Canada. Of the eleven studies, only three were conducted in Canada (Morita et al., 2019; Phillips et al., 2015; Poinen et al., 2021). Additionally, none of the studies on nephrology fellowships were completed in Canada, which is a considerable limitation (Desmet et al., 2013; Gupta et al., 2021; Merighi et al., 2012; Rope et al., 2017). Although the data within these studies can be adapted to the Canadian context, the Canadian medical education and healthcare system have significant differences from the United States and Europe, such as existing funding models, resources, and cultural, institutional, and political characteristics. Recommendations for future research include conducting additional studies in Canada to ensure barriers and solutions target challenges encountered in the Canadian context.

Another limitation of this review is the small number of articles examined; a more exhaustive and critical appraisal of the articles could be beneficial in a future review. Finally, a single, independent author selected and reviewed the articles for inclusion, resulting in the potential exclusion of articles that may have been pertinent to this review.

### **CONCLUSION**

Within Canada and worldwide, there is a sense of urgency and reignited interest from governments and renal authorities in increasing the use of home dialysis modalities (Ahmad et al., 2020; Chan et al., 2020; ORN, 2019). Despite a growing interest in home dialysis, prevalence rates within Canada have been slow to increase, suggesting persistent barriers to implementation. Complex systems-level issues, such as healthcare resources in a post-pandemic landscape and a plethora of patient barriers continue to challenge renal programs in growing home dialysis. This literature review adds to the growing evidence of barriers faced by renal programs and provides practical solutions to overcome these



barriers. The results of this review suggest that program-level barriers include nephrologist fellowship training and self-reported preparedness, ICHD staff knowledge and comfort level, and a lack of objective and consistent exclusion criteria for recruitment to home dialysis. Implications for practice

and future considerations emphasize a home-dialysis-first culture to support education, peer mentorship, optimizing patient recruitment, and developing and disseminating clinical practice guidelines.

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# Calciophylaxis in patients with end-stage kidney disease

By Nashita Tabassum and Marisa Battistella

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## LEARNING OBJECTIVES

1. Describe the pathophysiology of calciophylaxis
2. List the risk factors and medications associated with development of calciophylaxis
3. Compare the therapeutic alternatives for treatment of calciophylaxis
4. Outline common complications/sequelae associated with calciophylaxis and their management

## INTRODUCTION

Calciophylaxis, also known as calcific uremic arteriopathy, is a syndrome of vascular calcification and thrombosis of arterioles and capillaries of the subcutaneous adipose tissue and dermis, resulting in painful, ischemic, and necrotic skin lesions (Nigwekar et al., 2018). Though rare, the disease is under-recognized and is primarily seen in patients with end-stage kidney disease (ESKD) on dialysis (this is called uremic calciophylaxis). However, it may occur in those without ESKD (non-uremic calciophylaxis). The purpose of this article is to review the diagnosis, pathophysiology, and current management of calciophylaxis.

## AUTHOR NOTE

Nashita Tabassum, PharmD, ACPR, Pharmacy Resident, University Health Network, Toronto, Ontario

Marisa Battistella, PharmD, ACPR, Clinician Scientist, Assistant Professor, Leslie Dan Faculty of Pharmacy, University of Toronto, Pharmacy Clinician Scientist, Clinical Pharmacist – Nephrology, University Health Network, Toronto, Ontario

Address for correspondence: to Marisa Battistella, University Health Network, 200 Elizabeth Street, EB 214, Toronto, ON M5G 2C4

Email: [marisa.battistella@uhn.ca](mailto:marisa.battistella@uhn.ca)

## CLINICAL PRESENTATION AND DIAGNOSIS

Calciophylaxis presents most commonly as painful ischemic necrotic skin lesions that may cover a varying surface area of the body. Some patients experience pain prior to the development of skin lesions. This pain is somatic (caused by infarction) and is generally severe throughout the course of the disease. Initial skin manifestations may include induration, plaques, nodules, livedo, or purpura, which rapidly progress to stellate, malodorous ulcers with black eschars. The lesions are typically bilateral, and the surrounding skin may have a “leather-like” structure. The lesions may have a central distribution (focused in areas with abundant adipose tissue, such as the abdomen or thighs) or a peripheral distribution (focused in areas with minimal adipose tissue, such as the digits). Central distribution is more common in those with ESKD (70%–80% of patients) compared to those without ESKD (50% of patients). These lesions may also be non-ulcerated or ulcerated depending on the stage of disease (Nigwekar et al., 2018). The most common sites of skin lesions include distal lower extremities (55%), proximal lower extremities (39%), trunk (31%), distal upper extremities (7%), and proximal upper extremities (3%; Udomkarnjananun et al., 2018). Penile lesions may also occur (occurring in approximately 6% of patients) and are associated with a higher risk of mortality (Gabel et al., 2021). Extraskelatal calcification is a less common presentation that requires imaging studies for detection. These extraskelatal calcifications rarely may lead to skeletal myopathy, intestinal bleeding, or visual impairment (Nigwekar et al., 2018).

Differential diagnoses should be excluded (see Table 1), using careful assessment of lab findings, imaging, and histopathologic features. Skin biopsy is the gold standard for diagnosis of calciophylaxis. However, biopsy itself can produce new, non-healing ulcers, infection, and induction of necrosis. As a result, if a patient has ESKD and has the classic presentation of a painful necrotic ulcer covered with a black eschar, a biopsy is not necessary and can be reserved for patients with atypical presentation. Furthermore, in the case of an acral, penile, or infected lesion, biopsy is contraindicated (Nigwekar et al., 2018).

**Table 1***Differential Diagnoses for Calciphylaxis*


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Warfarin-induced skin necrosis  
 Atherosclerotic vascular disease  
 Venous stasis ulcer  
 Endarteritis obliterans  
 Cellulitis  
 Cholesterol embolization  
 Dystrophic calcinosis cutis  
 Livedoid vasculopathy  
 Nephrogenic systemic fibrosis  
 Oxalosis  
 Antiphospholipid antibody syndrome  
 Cardiac myxoma  
 Pyoderma gangrenosum  
 Purpura fulminans  
 Necrotizing vasculitis  
 Radiation arteritis  
 Martorell's ulcer

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**PATHOPHYSIOLOGY**

Histologic analysis reveals that calcification, fibrosis, and thrombus formation result in reduced blood flow and ischemia, which manifest as cutaneous lesions (Nigwekar & Thadani, 2023). Abnormalities caused by chronic kidney disease—bone mineral disease (CKD-BMD) likely have a role in this. Retrospective studies have shown an association between calciphylaxis and primary hyperparathyroidism, active vitamin D administration, and elevated plasma calcium and phosphate. The benefits of parathyroidectomy have also been seen; this is thought to reduce calciphylaxis risk by correcting the hypercalcemia and hyperphosphatemia associated with hyperparathyroidism (Nigwekar & Thadani, 2023). However, analysis of a German calciphylaxis registry revealed that less than 6% of patients had parathyroid hormone (PTH) levels above the range recommended by the Kidney Disease Improving Global Outcomes (KDIGO) guidelines (Brandenburg et al., 2017; Ketteler et al., 2017). Elevated serum calcium and phosphorus levels also are not universally seen in patients with calciphylaxis (Brandenburg et al., 2017). It is hypothesized that the development of calciphylaxis, despite this lack of elevation, may paradoxically be attributed to overuse of calcium and vitamin D supplementation, leading to oversuppression of hyperparathyroidism, and resultant low bone turnover (adynamic bone disease; Brandenburg et al., 2017). Adynamic bone has an impaired ability to regulate circulating minerals, and it is thought that these circulating minerals are involved in the formation of extraskeletal calcium depositions. The mixed evidence suggests that CKD-BMD is only one of many factors involved in the development of calciphylaxis (Nigwekar & Thadani, 2013).

Additionally, patients with calciphylaxis have reduced levels of inhibitors of vascular calcifications, such as fetuin-A (2-Heremans-Schmid glycoprotein) and matrix Gla protein (MGP). Carboxylated MGP (CGMP) – the active form of MGP – is a potent inhibitor of calcification, and its carboxylation requires vitamin K. CGMP inhibits the pro-calcifying factors: bone morphogenetic protein 2 (BMP-2) and bone morphogenetic protein 4 (BMP-4). In the absence of vitamin K (as would be seen in patients receiving warfarin) and this inhibition,

expression of BMP-2 and BMP-4 is increased, leading to vascular smooth muscle with more osteogenic physiology. Additionally, fetuin-A is a serum glycoprotein that binds calcium and phosphate in the circulation; it is notably deficient in CKD, leading to soft-tissue calcification and vascular calcium deposition (Nigwekar et al., 2018; Rick et al., 2022).

**EPIDEMIOLOGY AND RISK FACTORS**

Although rare, calciphylaxis has been reported worldwide. In the United States, its prevalence ranges from one to four percent for patients with ESKD receiving dialysis (Rogers et al., 2008). These rates are much lower in other countries, such as Japan, with a reported prevalence rate of less than three cases per 10,000 hemodialysis patients per year (Hayashi et al., 2012). There are no Canadian data available. In the United States, the prevalence is increasing, although this may be related to greater awareness of the disease. The mean age of disease onset is between 50 to 70 years, and patients receiving peritoneal dialysis (PD) are known to have a higher incidence than those receiving hemodialysis (HD; Nigwekar et al., 2018). Table 2 lists risk factors for the development of calciphylaxis. Among them are hypercalcemia, hyperphosphatemia, and hyperparathyroidism—as discussed above, these likely play some role in the pathophysiology of calciphylaxis. Some more general risk factors include obesity, diabetes mellitus, female sex, and dependence on dialysis for more than two years. Medications that have been associated with the development of calciphylaxis include warfarin, calcium, vitamin D, iron, recombinant PTH and systemic corticosteroids (Weenig et al., 2007). The role of iron and its mechanism is not well understood, but several studies have reported its association

**Table 2***Risk Factors for Calciphylaxis*


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End-stage renal disease  
 Female sex  
 Obesity  
 Diabetes mellitus  
 Hypercalcemia  
 Hyperphosphatemia  
 Hyperparathyroidism (primary and secondary)  
 Over-suppressed PTH with adynamic bone disease (low bone turnover)  
 Elevated alkaline phosphatase  
 Vitamin K deficiency  
 Hepatobiliary disease  
 Thrombophilia (e.g., antithrombin deficiency, protein C deficiency, or lupus anticoagulant)  
 Autoimmune disorders (e.g., systemic lupus erythematosus)  
 Hypoalbuminemia  
 Metastatic cancers  
 POEMS syndrome  
 Genetic polymorphisms (e.g., rs4431401 and rs9444348)  
 Skin trauma (e.g., from subcutaneous injections)  
 Recurrent hypotension  
 Rapid weight loss  
 Exposure to ultraviolet light  
 Exposure to aluminum  
 Medications (e.g., warfarin, calcium, vitamin D, iron, recombinant PTH, systemic corticosteroids)

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*Note.* PTH = parathyroid hormone; POEMS = polyneuropathy, organomegaly, endocrinopathy, monoclonal plasma cell disorder, skin changes.

with calciphylaxis (Wickens et al., 2022). Warfarin, a vitamin K antagonist, increases risk by inhibiting vitamin K, which plays an important role in the conversion of MGP to its active form of CMGP. Of note, calciphylaxis associated with skin trauma from subcutaneous insulin or heparin administration has also been reported. This may be of particular importance in selecting therapy for these patients. If an injectable agent is needed, rotating injection sites and avoiding trauma at lesion sites is recommended (Nigwekar et al., 2015).

## TREATMENT

Management of calciphylaxis should be multifactorial and interdisciplinary. Generally, treatment can involve multiple services including, but not limited to, dermatology, wound care, nephrology, urology, infectious diseases, pain and palliative medicine, plastic surgery, and hyperbaric medicine. There are no approved treatments for calciphylaxis. Furthermore, the majority of evidence comes from retrospective and observational studies.

### Supportive Management

Patients with calciphylaxis require analgesia for symptomatic management of severe pain associated with skin lesions. A multimodal pain management strategy should be used. These patients often require very high doses of opioids such as hydromorphone or fentanyl. In addition to opioids, pain management with gabapentin, ketamine, intravenous ketorolac, or spinal anesthetic agents, is an option, especially if the patient is showing signs of pain refractory to opioids or of opioid toxicity (Polizzotto et al., 2006). Ketorolac is generally reserved for patients in whom preservation of renal function is not a priority. The role of wound care involves selection of appropriate dressings, debridement of necrotic tissue, and prevention of infection. However, collaboration with a pain specialist and plastic surgery is often required as the severity of pain makes debridement difficult. If surgical debridement is done appropriately, retrospective studies have shown that this can result in significantly better overall survival (McCarthy et al., 2016; Weenig et al., 2017).

### Risk Factor Modulation

For treatment of calciphylaxis beyond supportive care, first-line therapy is modification of risk factors, including treatment of calcium, phosphorus, and parathyroid hormone abnormalities. If abnormalities in serum calcium and phosphorus levels are present in a patient, these should be corrected to be within the normal range. Vitamin D and its analogues should be avoided as these may increase serum calcium and phosphorus. Calcimimetic agents such as cinacalcet should be used in patients with secondary hyperparathyroidism with PTH greater than KDIGO target levels. Finally, if PTH is refractory to other therapies, surgical parathyroidectomy should be explored as an option for correction of PTH levels (Nigwekar et al., 2015).

In terms of other modifiable risk factors, medications that can increase risk of calciphylaxis such as warfarin, systemic corticosteroids, calcium, vitamin D, and iron supplementation, should be discontinued. Although vitamin K theoretically may be used to treat calciphylaxis, this has not been well-studied and is not routinely done (Nigwekar & Thadani, 2023).

## Dialysis

Most patients will also require intensification of their dialysis regimen. If the patient is receiving PD, this may mean increased frequency of dialysis or transition to HD. In a patient already undergoing HD, this will mean increased frequency or duration of treatment, for example, going from thrice weekly to daily dialysis (Brandenburg et al., 2017).

## Sodium Thiosulfate

In terms of pharmacotherapeutic agents, sodium thiosulfate (STS) is trialed in all patients unless contraindicated. STS is an inorganic salt that is theorized to have antioxidant and vasodilatory properties, as well as the ability to chelate calcium to form calcium thiosulfate, a far more soluble salt (Baker et al., 2007). The majority of evidence comes from retrospective studies and case series, and at least three recent attempts at conducting randomized clinical trials (RCTs) have been terminated due to failure of patients to meet the inclusion criteria or lack of patient enrolment (Sinha et al., 2021). In fact, two meta-analyses of retrospective studies did not find any improvement in skin lesions or mortality. For example, Wen et al. (2023) looked at 422 patients across 19 retrospective cohort studies and found no difference in skin lesion improvement (RR, 1.23; 95% CI, 0.70–1.10) or survival (HR, 0.82; 95% CI, 0.57–1.18). Despite the lack of conclusive evidence, anecdotal evidence has shown efficacy of this agent, and many clinicians will use it as a first-line agent. STS is given at a dose of 25 g intravenously over 30 to 60 minutes during the last hour of each HD session or over 60 minutes, three times weekly for patients receiving PD. Adverse effects include transient mild rhinorrhea, sinus congestion, nausea, vomiting, as well as high anion gap metabolic acidosis (Baker et al., 2007). Of note, the optimal duration of STS therapy is not known; on average, patients will receive 12 weeks of therapy, but this ranges between 8 to 24 weeks (Udomkarnjananun et al., 2018).

## Hyperbaric Oxygen Therapy

In recent years, evidence from case reports, case series, and a narrative review have suggested that hyperbaric oxygen therapy (HBOT) can improve survival and the proportion of patients with complete wound healing, and lead to greater response even in those who only experience partial wound healing (An et al., 2015; Charaghvandi et al., 2020; Lipinski & Sahu, 2020). HBOT involves breathing 100% oxygen at pressures higher than ambient pressure (one atmosphere absolute [ATA]) while the patient is situated inside a sealed treatment chamber. Exposure to greater amounts of oxygen in the air allows improved oxygenation to hypoxic tissues, resulting in greater wound healing through fibroblast proliferation and angiogenesis, as well as improved oxygen-dependent neutrophil bactericidal activity (Lipinski & Sahu, 2020). As a result, HBOT is often used as a second-line or as an add-on therapy to STS. Potential complications of HBOT include middle ear barotrauma, claustrophobia, and pulmonary/central nervous system oxygen toxicity; in general, these are quite uncommon in practice (Kranke et al, 2015). Untreated pneumothorax is considered an absolute contraindication, while relative contraindications include concurrent chemotherapy (if the agent impedes wound healing),

the presence of an implantable device such as a pacemaker, pregnancy, as well as underlying respiratory diseases, such as chronic obstructive pulmonary disease (COPD) or asthma (Ortega et al., 2021).

### Other Therapies

Bisphosphonates, such as IV pamidronate and oral alendronate, have been used to treat calciphylaxis patients who have hypercalcemia. However, a meta-analysis showed that bisphosphonate treatment did not lead to improved clinical outcomes (Udomkarnjananun et al., 2018). Newer therapies are also being explored in this area. Myo-inositol hexaphosphate, also known as phytate, is an antinutrient (referring to its ability to decrease the bioavailability of important minerals such as calcium) found in seeds, legumes, nuts, and whole cereals (Grases & Costa-Bauza, 2019). It inhibits the formation and growth of hydroxyapatite crystals, the final common pathway in the pathophysiology of vascular calcification (Brandenburg et al., 2019).

A recent open-label, single-arm, repeat-dose phase two clinical study of SNF472 (an intravenous formulation of myo-inositol hexaphosphate) assessed the efficacy of intravenous administration of 7 mg/kg SNF472 three times per week for 12 weeks in 14 patients with calciphylaxis (undergoing thrice-weekly hemodialysis and standard care). Results showed a statistically significant improvement in wound healing (mean score reduction  $8.1 \pm 8.5$ , measured using Bates-Jensen Wound Assessment Tool), non-significant improvement in pain (mean 33% score reduction, measured using Visual Analogue Scale) and non-significant improvement in wound-related quality of life (Brandenburg et al., 2019). Currently, the CALCIPHYX study—a randomized, double-blind, placebo-controlled, phase three clinical trial of SNF472 for the treatment of calciphylaxis—is undergoing patient recruitment. Its eventual results will add important information to the body of evidence regarding myo-inositol hexaphosphate and its usability for calciphylaxis (Sinha et al., 2021). Other experimental therapies that are not routinely used to treat calciphylaxis include tissue plasminogen activator, LDL-apheresis, sterile maggot therapy, and recombinant platelet-derived growth factor (Nigwekar et al., 2018).

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## COMPLICATIONS AND PROGNOSIS

Mortality is very common. One study reported an estimated mortality of 40% at six months, whereas another reported 44% at one year (Gabel et al., 2021; McCarthy et al., 2016). Patients with kidney failure have a worse prognosis than those without (one-year mortality of 45%–80% versus 25%–45%), likely caused by the differences in comorbidities and the distribution of lesions (Nigwekar et al., 2018). Patients with a central distribution of lesions tend to be women with higher body mass index (BMI) and have a higher risk of death.

Infection is an extremely common complication of wounds caused by calciphylaxis. Infected wounds may present with additional pain and swelling with or without purulent discharge. These wounds should be debrided, and antimicrobial therapy should be administered. In terms of antimicrobial coverage, wound swabs are not reliable for identifying a specific organism. As such, empiric antibiotics should cover against streptococci, methicillin-resistant *Staphylococcus aureus*, aerobic gram-negative bacilli, and anaerobes (Nigwekar & Thadhani, 2023). The wounds caused by cutaneous calciphylaxis also often lead to recurrent sepsis in patients, making sepsis the most common cause of death among this population (Nigwekar et al., 2018).

## SUMMARY

Calciphylaxis is a rare, debilitating disease that manifests commonly as painful, necrotic skin lesions. Theorized to be caused by CKD-BMD abnormalities and deficiencies in inhibitors of vascular calcification, many medications, such as warfarin, calcium, vitamin D, iron, recombinant PTH, and systemic corticosteroids, can also increase the risk of a patient developing calciphylaxis. Although evidence is sparse, patients are treated with pain management, wound care, modification of risk factors, and sodium thiosulfate with or without hyperbaric oxygen therapy. Other potential therapeutic options include bisphosphonates and vitamin K, as well as myo-inositol hexaphosphate, which is currently being studied in a phase three RCT. Future research in this area should be a priority to improve outcomes in this patient population.

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# Calciophylaxis in patients with end-stage kidney disease

By Nashita Tabassum and Marisa Battistella

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- In the United States, what is the incidence of calciophylaxis in patients with ESKD on dialysis?
  - <1%
  - 1 to 4%
  - 7 to 8%
  - >10%
- Which of the following is the most common site of calciophylaxis skin lesions?
  - Trunk
  - Proximal upper extremities
  - Distal lower extremities
  - Penile area
- A patient with more advanced, severe skin lesions is most likely to present with
  - Non-ulcerated skin lesions with mild erythema
  - Non-ulcerated skin lesions with induration, plaques, nodules, or purpura
  - Stellate ulcerated skin lesions with black eschars
  - Stellate non-ulcerated skin lesions with black eschars
- Carboxylated MGP inhibits which of the following, leading to inhibition of vascular calcification?
  - BMP-2 and BMP-4
  - Vitamin K
  - NT-proBNP
  - Fetuin-A
- Which of the following is not considered a risk factor for developing calciophylaxis?
  - Warfarin therapy
  - Obesity
  - Skin trauma from subcutaneous injections
  - End stage liver disease
- Which of the following agents are not routinely discontinued should a patient develop calciophylaxis?
  - Calcium carbonate
  - Lanthanum carbonate
  - Calcitriol
  - Warfarin
- A patient on nocturnal peritoneal dialysis develops calciophylaxis. Which of the following is the least appropriate dialysis regimen change for them?
  - Increase frequency of PD to include daytime dialysis, in addition to nocturnal dialysis
  - Transition patient to 3 times a week intermittent hemodialysis
  - Transition patient to 6 times a week intermittent hemodialysis
  - Retain the same PD regimen
- Sodium thiosulfate can cause which of the adverse effects?
  - Hyperosmolar hyperglycemic state
  - High anion gap metabolic acidosis
  - Aortic dissection
  - Hypothyroidism
- Hyperbaric oxygen therapy improves oxygenation to hypoxic tissues leading to all of the following except:
  - Fibroblast proliferation
  - Angiogenesis
  - Inhibition of calcium deposition in vasculature
  - Neutrophil bactericidal activity
- What is the estimated mortality for calciophylaxis patients at 1 year?
  - 25%
  - 10%
  - 44%
  - 65%

# Calciophylaxis in patients with end-stage kidney disease

By Nashita Tabassum and Marisa Battistella

Volume 34, Number 1

## Post-test instructions:

### CANNT members:

This quiz is complementary to CANNT members. Complete this test on your Course Dashboard on the CANNT website <https://cannt-acitn.ca/course-dashboard/>. You must be logged in to access. Please contact [info@cannt-acitn.ca](mailto:info@cannt-acitn.ca) if you have issues accessing your Course Dashboard.

### Non-Members:

- Select the best answer and circle the appropriate letter on the answer grid below.
- Complete the evaluation.
- Send a copy of the answer form by email only to [info@cannt-acitn.ca](mailto:info@cannt-acitn.ca)
- Post-tests must be emailed by March 30, 2025.
- You will receive a credit card invoice for \$15.00 + HST
- If you receive a passing score of 80% or better, a certificate for 2.0 contact hours will be awarded by CANNT.
- Please allow six to eight weeks for processing. You may submit multiple answer forms in one email and will be invoiced for each, however, you may not receive all certificates at one time.

## POST-TEST ANSWER GRID

Please circle your answer choice:

- a   b   c   d
- a   b   c   d
- a   b   c   d
- a   b   c   d
- a   b   c   d
- a   b   c   d
- a   b   c   d
- a   b   c   d
- a   b   c   d
- a   b   c   d

## EVALUATION

	Strongly disagree				Strongly agree
1. The offering met the stated objectives.	1	2	3	4	5
2. The content was related to the objectives.	1	2	3	4	5
3. This study format was effective for the content.	1	2	3	4	5
4. Minutes required to read and complete:	50	75	100	125	150

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## COMPLETE THE FOLLOWING:

Name: \_\_\_\_\_

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CANNT member?  Yes  No





# CALL FOR ABSTRACTS

CANNT-ACITN invites you to join us in Ottawa October 24–26, 2024!

Abstracts are currently being accepted for ORAL and POSTER presentations for CANNT-ACITN 2024. Abstract submissions should share our knowledge and experience and be appropriate for the novice through to the advanced practice professional.

Topics of interest may include clinical research, innovative projects and solutions, ethics, case presentations, and clinical reviews. All abstract submissions must be evidence-based.

## ABSTRACT SUBMISSION GUIDELINES:

**Deadline: April 30, 2024**

All abstracts must be submitted online ([www.cannt-acitn.ca](http://www.cannt-acitn.ca)) through the online submission form.

### Submissions must include the following:

1. Abstract Title
  - must accurately reflect the content of the presentation
  - must be formatted in sentence case (capitalize first word and remaining words begin in lower case)

2. Authors and Affiliations

- must be included under the title and formatted as follows:  
Anne L. Smith<sup>a</sup>, RN, CNeph(C), Robert G. Jones<sup>a,b</sup>, RN

<sup>a</sup>Department of Nephrology, University of Toronto, Toronto, ON; <sup>b</sup>Department of Nephrology, University of Alberta Hospital, Edmonton, AB.

*Underline the name and initials of the presenter(s).*

3. Abstract Text

- should be no longer than 300 words including headings (do not include pictures, tables or references)
- should be as informative as possible
- define all abbreviations the first time they appear in the abstract
- use only the generic names of drugs
- do not identify companies and/or products in the body or title of the abstract

### If research-based, must include below headings:

- background
- purpose of study
- methods
- results
- conclusions
- implications for nephrology care

### If practice/education/narrative-based, must include below headings:

- background
- purpose of the project
- description
- evaluation/outcome
- implications for nephrology practice/education

## LEADING EDGE TOPICS INCLUDE

- Transplant
- Mental Health and CKD
- Cardiovascular Disease and CKD
- Future Directions of CKD and Treatment
- Pregnancy with Renal Disease
- Pediatrics
- Ethics and Elderly Care
- Medical Assistance in Dying
- Technical Advances in Dialysis Equipment
- Home Therapies

## IMPORTANT NOTES:

Only COMPLETE submissions received by April 14, 2024 will be considered.

- All correspondence will be with the first author only.
- Acceptance of abstract does not waive attendance fees (registration).
- Notification regarding selection decisions will be provided by June 15\*.
- Should the abstract be selected for presentation, the author(s) authorize(s) the publication of the abstract submitted for publication in the CANNT-ACITN Journal.
- The presentation shall not make comparison to companies or products for any purposes of product marketing, nor will topics or materials used discredit companies or products.
- The abstract, and associated authors, should make full disclosure of corporate employment and/or funding sources.
- Abstracts not in the required format will be returned to the author for revision.
- The language of abstract submission will be the language of presentation, if selected.

## SUBMIT ABSTRACTS TO:

Online: [www.cannt-acitn.ca](http://www.cannt-acitn.ca)

## QUESTIONS:

Email: [cannt@cannt.ca](mailto:cannt@cannt.ca)

*\*Based on preliminary timeline*

# CANNT Journal Manuscript Submission Guidelines

## DESCRIPTION

*CANNT Journal* is a quarterly publication that showcases excellence in nephrology nursing and technological writing through peer-reviewed articles that examine current issues and trends in nephrology nursing and technological practice, education, and research. *CANNT Journal* is the official journal of the Canadian Association of Nephrology Nurses and Technologists and supports the association's mission to serve its membership by advancing the development of nephrology nursing and technological knowledge. The journal is indexed in MEDLINE and CINAHL.

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*CANNT Journal* welcomes manuscripts related to nephrology nursing and technological education, practice, research, or health policy. The manuscript must be the sole intellectual property of the authors. Once accepted, manuscripts become the permanent property of *CANNT Journal*, and may not be reproduced elsewhere without written permission from the publisher.

We prefer manuscripts that present new clinical information or address issues of special interest to nephrology nurses and technologists. In particular, we are looking for

- original research reports
- relevant clinical articles
- innovative quality improvement reports
- narratives that describe the nursing experience
- interdisciplinary practice questions and answers
- literature or systematic reviews

We also encourage letters to the editor as a way to promote dialogue and alternative perspectives to articles published in *CANNT Journal*. Choose "Letters to the Editor" from the Section dropdown on the submissions page.

## SUBMISSION DECLARATION

Submission of the article implies that the work described has not been published elsewhere (except in the form of an abstract or a published lecture), that it is not under consideration for publication elsewhere, that its publication is approved by all authors and responsible authorities where the research was carried out, and that, if accepted, it will not be published elsewhere in the same form without the written consent of the copyright holder. Upon acceptance of the submitted material, the author(s) must transfer copyright ownership to *CANNT Journal*. Statements and opinions contained within the work will remain the responsibility of the author(s).

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*CANNT Journal* operates on a double-blind peer review process. The names of the reviewers will not be disclosed to the author(s) submitting the manuscript, and the name(s) of the author(s) will not be disclosed to the reviewers.

All contributions will be initially assessed by the editors for suitability for the journal. Manuscripts deemed suitable are sent to two independent expert reviewers to assess the quality of the paper. A manuscript will only be sent for review if the editors determine that the paper meets the appropriate quality and relevance requirements in keeping with the particular aim and scope of *CANNT Journal*.

The editors are responsible for the final decision regarding acceptance or rejection of the manuscript. Editors are not involved in decisions about papers that they have written themselves or have been written by family members or colleagues, or which relate to products or services in which the editor has an interest. All manuscript submissions are subject to the journal's usual independent peer review process.

The criteria for acceptance for all manuscripts include the quality and originality of the research or intellectual material, its significance/appeal to journal readership, and the general writing style.

## PREPARING THE SUBMISSION

The following components are required for all submissions. Manuscripts that do not meet these requirements will be returned to the corresponding author for technical revisions before undergoing peer review.

The manuscript should be submitted in separate files in the following order: title page; abstract with key words; main text including references; and figures/tables. A cover letter may be supplied at the authors' discretion.

### Title page

Include:

- Title of the manuscript (concise and informative)
- Short running title of fewer than 40 characters
- Full names, highest academic degrees, and affiliations of all authors with email address and telephone/fax number of corresponding author
- Authors' institutional affiliations (department, institution, city, country) where research work was conducted
- Any acknowledgements (including disclosure of funding), credits, or disclaimers, conflict of interest statement for all authors

## Abstract and keywords

Submit structured or summary abstract of up to 250 words. Word limit includes headers in a structured abstract (e.g., *background, purpose, method, findings, and discussion*).

The abstract should be a succinct summary of the major issue, problem, or topic being addressed, and the findings and/or conclusions in the manuscript. It should not duplicate material in the main text. It should not contain sub-headings, abbreviations, or reference citations.

Provide up to eight keywords that describe the contents of the manuscript.

## Main text (manuscript, reference list)

Main text:

- Maximum length 15–20 pages, double-spaced
- Use the *Publication Manual of the American Psychological Association (APA) 7<sup>th</sup> edition* (copyright 2020) for style and format guidelines.
- As manuscripts are double-blind peer reviewed, the main text should not include any information that might identify the authors. Therefore, do not include any identifying information (i.e., authors' names).
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## Tables/figures

- Submit each table or figure as a separate file, and as editable text and not as an image.
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### Preliminary

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After the peer review, the editors make a decision regarding the eligibility of the article for selection based on the comments and recommendations of the reviewers. Based on the peer review evaluation, the editors make one of the following decisions:

- Accept without revisions
- Accept after completing minor revisions
- Re-submit after completing major revisions – re-review by original reviewers
- Reject

## AFTER ACCEPTANCE

Corresponding authors will receive a PDF proof of the article. The page proof should be carefully proofread for any copyediting or typesetting errors. It is the authors' responsibility to ensure that there are no errors in the proofs. Authors should also make sure that any renumbered tables, figures, or references match text citations and that figure legends correspond with text citations and actual figures. Proofs must be returned within the deadline specified by the editors.

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The corresponding author will receive a hard copy of the journal issue as well as a PDF copy of the article.

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# Lignes directrices pour la soumission des manuscrits au *Journal ACITN*

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Le *Journal ACITN* est une revue publiée trimestriellement qui met en valeur l'excellence des écrits sur les soins infirmiers et les technologies en néphrologie par le biais d'articles évalués par des pairs qui examinent les questions et les tendances actuelles de la pratique, de la formation et de la recherche dans ce domaine. Le *Journal ACITN* est la revue officielle de l'Association canadienne des infirmières et infirmiers et des technologues de néphrologie et soutient la mission de l'association pour servir ses membres en perfectionnant le développement des connaissances en matière de soins infirmiers et de technologies en néphrologie. La revue est référencée dans les bases de données MEDLINE et CINAHL.

## POLITIQUES RÉDACTIONNELLES

Le *Journal ACITN* accepte les manuscrits portant sur la formation, la pratique, la recherche sur les soins infirmiers et les technologies de néphrologie ou la politique en matière de santé. Le manuscrit doit être la propriété intellectuelle unique des auteurs. Une fois acceptés, les manuscrits deviennent la propriété permanente du *Journal ACITN* et ne peuvent être reproduits ailleurs sans l'autorisation écrite de l'éditeur.

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- Rapports de recherche originaux;
- Articles cliniques pertinents;
- Rapports sur des approches innovatrices en matière d'amélioration de la qualité;
- Textes narratifs relatant une expérience de pratique infirmière ou technologique;
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Toutes les contributions seront initialement évaluées par les rédactrices en chef pour leur pertinence à la revue. Les manuscrits réputés acceptables sont envoyés à deux experts indépendants qui en évalueront la qualité. Un manuscrit ne sera envoyé pour évaluation que si les rédactrices en chef déterminent que le manuscrit répond aux exigences de qualité et de pertinence appropriées, conformément à l'objectif et au champ d'application particuliers du *Journal ACITN*.

Les rédactrices sont responsables de la décision définitive en ce qui a trait à l'acceptation ou au rejet du manuscrit. Les rédactrices en chef n'interviennent pas dans les décisions relatives aux articles qu'elles-mêmes ont rédigés ou que des proches ou des collègues ont écrits ou encore qui portent sur des produits ou services pour lesquels elles sont en conflit d'intérêts. Toutes les soumissions de manuscrit font l'objet du processus habituel d'évaluation par les pairs indépendants de la revue.

Les critères d'acceptation de tous les manuscrits comprennent la qualité et l'originalité de la recherche ou du matériel intellectuel, son importance ou son attrait pour le lectorat de la revue et le style d'écriture en général.

## PRÉPARATION DE LA SOUMISSION

Les éléments suivants sont requis pour toutes les soumissions. Les manuscrits qui ne répondent pas à ces exigences seront renvoyés à l'auteur-ressource en vue de révisions techniques avant d'être soumis à l'évaluation par les pairs.

Le manuscrit doit être soumis en fichiers séparés dans cet ordre : page titre; résumé avec mots clés; corps du texte incluant les références; et les figures ou les tableaux. Une lettre de présentation peut être fournie à la discrétion des auteurs.

## Page titre

Inclure :

- Titre du manuscrit (concis et descriptif)
- Titre court comptant moins de 40 caractères
- Nom complet, diplôme de plus haut grade et affiliations de tous les auteurs, adresse courriel et numéros de téléphone/télécopieur de l'auteur-ressource
- Affiliations institutionnelles des auteurs (département, établissement, ville, pays) où les travaux de recherche ont été réalisés
- Tous les remerciements (y compris la divulgation du financement), les crédits ou les avertissements, un énoncé de conflit d'intérêts pour tous les auteurs

## Résumé avec mots clés

Soumettre un résumé structuré ou succinct de 250 mots au maximum. La limite de mots inclut les en-têtes dans un résumé structuré (p. ex., *contexte, objet, méthode, résultats et discussion*).

Le résumé doit être une description succincte de la question, du problème ou du sujet principal abordé dans le manuscrit, ainsi que les résultats ou conclusions présentés. Il ne doit pas reproduire le corps du texte. Il ne doit pas contenir de sous-titres, d'abréviations ou de citations de référence.

Fournir jusqu'à huit mots clés qui décrivent le contenu du manuscrit.

## Corps du texte (manuscrit, liste de référence)

Corps du texte :

- Longueur maximum de 15 à 20 pages, à double interligne
- Se servir du guide de style *Publication Manual of the American Psychological Association (APA)*, 7<sup>e</sup> édition (droit d'auteur 2020) pour les lignes directrices en matière de style et de format
- Comme les manuscrits font l'objet d'une évaluation par des pairs à double insu, le corps du texte ne doit inclure aucune information pouvant servir à identifier les auteurs. Par conséquent, il ne faut pas inclure de renseignements d'identification (p. ex., noms des auteurs)
- Paginer sans interruption dans le coin supérieur droit
- Citer les tableaux ou les figures à la suite
- S'assurer d'approuver ou d'éliminer toutes les modifications de suivi de votre document Word avant le téléversement

Références :

- N'utiliser que des sources publiées dignes de foi et de qualité
- À double interligne à la fin du manuscrit
- La liste de citations et de références doit être conforme au guide de style de l'APA, 7<sup>e</sup> édition (droit d'auteur 2020)
- Fournir les adresses URL pour toutes les références, le cas échéant
- S'assurer que toutes les références citées dans le texte figurent dans la liste de référence (et vice versa)

## Tableaux ou figures

- Soumettre chaque tableau ou figure dans un fichier séparé, sous forme modifiable et non sous forme d'image
- Préparer les tableaux ou les figures selon le guide de style de l'APA, 7<sup>e</sup> édition (droit d'auteur 2020)
- Citer les tableaux ou les figures à la suite dans le texte et les numéroter dans cet ordre. Ne pas incorporer les tableaux ou les figures dans le fichier texte du manuscrit
- Numéroter les tableaux et les figures à la suite selon leur apparition dans le texte et positionner le titre du tableau ou de la figure et toute note connexe sous le corps du tableau ou de la figure
- Utiliser les tableaux avec retenue et s'assurer que les données qui y sont présentées clarifient et complètent les résultats décrits dans le corps du texte, sans toutefois les reproduire. Seuls les tableaux sur 3 pages de manuscrit ou moins seront acceptés aux fins de publication dans l'article.
- Les auteurs qui utilisent des tableaux ou des figures précédemment publiés doivent inclure l'autorisation écrite de l'éditeur original. Cette autorisation doit être jointe au manuscrit soumis.



## SOUSSION DU MANUSCRIT

Après avoir préparé le matériel de soumission conformément aux directives indiquées dans la rubrique « Préparation de la soumission » ci-dessus, les manuscrits doivent être soumis en ligne à cette adresse : <https://cannt-acitn.ca/journal/ojs/index.php/canntj>

Les nouveaux utilisateurs doivent cliquer sur « Register » (S'inscrire) dans le coin supérieur droit de la page. Une fois inscrit, sélectionner « Submissions » (Soumissions) du menu déroulant « About » (À propos de).

## APRÈS LA SOUMISSION

L'examen du manuscrit se déroule en trois étapes avant que la décision ultime soit prise sur le statut de l'article aux fins de publication.

### Examen préliminaire

Examen préliminaire par les rédactrices en chef afin de déterminer la pertinence de l'article aux fins d'évaluation par les pairs. Les rédactrices en chef examinent toutes les exigences de présentation de manuscrits, notamment le style et le format du manuscrit.

### Évaluation rédactionnelle par les pairs

Le processus d'évaluation par les pairs détermine la valeur scientifique de l'article. Tous les manuscrits sont évalués par deux membres du comité d'évaluation rédactionnelle. Les critères d'acceptation pour tous les textes reposent sur la qualité et l'originalité de l'œuvre et sur son importance aux yeux du lectorat de la revue. Les manuscrits sont envoyés aux évaluateurs uniquement si les rédactrices en chef décident que le texte mérite un examen plus approfondi.

### Détermination de l'admissibilité aux fins de publication

Après l'évaluation par les pairs, les rédactrices en chef prennent une décision concernant l'admissibilité de l'article à la sélection en se fondant sur les commentaires et les recommandations des évaluateurs. Selon l'évaluation par les pairs, les rédactrices en chef prennent l'une des décisions suivantes :

- Accepter le manuscrit sans modifications
- Accepter le manuscrit une fois les modifications mineures apportées
- Soumettre de nouveau le manuscrit une fois les modifications majeures apportées – réévaluation par les évaluateurs d'origine
- Rejeter le manuscrit

## APRÈS L'ACCEPTATION

Les auteurs-ressources recevront une épreuve en format PDF de l'article. L'épreuve d'imposition doit être soigneusement relue afin de détecter toute erreur d'édition ou de composition. Il incombe aux auteurs de s'assurer que les épreuves sont exemptes d'erreurs. Les auteurs doivent également s'assurer que les tableaux, les figures ou les références renumérotés correspondent aux citations du texte et que les légendes des figures correspondent aux citations du texte et aux figures réelles. Les épreuves doivent être renvoyées dans le délai précisé par les rédactrices en chef.

Les modifications apportées à l'épreuve qui vont au-delà de ce qui est nécessaire pour corriger des erreurs ou pour répondre à des questions ou qui constituent un remaniement du matériel précédemment accepté **ne** seront **pas** permises. Les rédactrices en chef se réservent le droit de rejeter toute modification qui n'influe pas sur l'exactitude du contenu.

## APRÈS LA PUBLICATION

L'auteur-ressource recevra une copie papier du numéro de la revue ainsi qu'une copie PDF de l'article.

S'il est accepté, votre article ne doit pas être publié nulle part ailleurs sous une forme similaire, en toute autre langue, sans le consentement de l'éditeur. Vous ne pouvez pas publier le fichier PDF de votre article révisé ou de votre article définitif publié dans un service d'archives ou sur un site de médias sociaux en ligne.

### OPTION D'ACCÈS LIBRE

Les auteurs d'articles acceptés dans le cadre d'une évaluation par les pairs peuvent choisir de payer une redevance pour permettre aux lecteurs du monde entier d'accéder en ligne à leur article publié, sans restriction et à perpétuité, dès sa publication. Cette option n'a aucune influence sur le processus d'évaluation par les pairs. Tous les manuscrits font l'objet d'un processus standard d'évaluation par les pairs à double insu et seront acceptés ou refusés en fonction de leur propre valeur.

Des frais de traitement de l'article de 250,00 \$ sont facturés à l'acceptation du manuscrit et doivent être payés dans les cinq (5) jours par le ou les auteurs. Le paiement doit être traité pour que l'article soit publié en accès libre.

### CONFLITS D'INTÉRÊTS ET SOURCE DE FINANCEMENT

Au moment de la soumission du manuscrit, les auteurs doivent divulguer toute source potentielle de conflit d'intérêts, ce qui inclut toute relation ou tout intérêt financier qui pourrait être perçu comme influençant leur objectivité. La présence d'un conflit d'intérêts n'empêche pas la publication. Les auteurs doivent également déclarer qu'ils n'ont aucun conflit d'intérêts à déclarer. Les sources de financement doivent figurer sur la page titre sous la rubrique « Conflits d'intérêts et source de financement ». Chaque auteur doit remplir et soumettre le formulaire d'entente de transfert du droit d'auteur de la revue, lequel comprend une section sur la déclaration de conflits d'intérêts potentiels.

### ENTENTE DE TRANSFERT DU DROIT D'AUTEUR

Au moment de la soumission, l'auteur qui soumet un manuscrit recevra un formulaire d'entente de transfert du droit d'auteur et de déclaration de conflits d'intérêts. Les coauteurs recevront des directives par courriel pour aussi remplir le formulaire afin d'amorcer le processus d'évaluation.

### COORDONNÉES DU BUREAU DE LA RÉDACTION

Jovina Bachynski et Rosa Marticorena, rédactrices  
cannt.journal1@gmail.com

