

2021 Update

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Nephrology Nursing Standards and Practice Recommendations



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

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Preface

Nephrology nursing is a specialized, complex and multidimensional practice focusing on the care of patients, families, and populations with kidney disease. It encompasses diverse opportunities of practice areas within a wide range of nursing roles. It comprises primary, secondary and tertiary care delivered across the life span continuum. Nephrology nurses share specialized knowledge and expertise required to provide competent, evidence-based care, as collaborative interdisciplinary team members. The *CANNT Nursing Standards and Practice Recommendations* provide the broad framework for nephrology nursing practice and delineate the responsibilities to which nephrology nurses are held accountable.

The CANNT Board of Directors strive to keep standards current and, thus, mandate updates reflective of the changing nephrology nursing practice. Enhancements to the standards build upon previous publications and are inclusive of the latest advancements in technology and new evidence in nephrology knowledge. Revisions incorporate evidence-based practice with nursing expertise necessary to care for the significantly and rapidly changing complexity of patient populations, which are older and sicker with multiple chronic comorbidities within an innovative patient-centred model of care. This document is congruent with national and provincial standards and allows for provincial and institutional interpretation within varied healthcare systems.

The practice recommendations updates are comprehensive of the full breadth of the evolving nephrology nursing practice. The new addition of chronic kidney disease diagnosis, classification and management is current and reports Canadian incidence and prevalence rates. An emphasis on cultural safety (culturally sensitive) and patient-centred care is integrated throughout, which is especially reflective of the growing Indigenous and immigrant nephrology patient populations. The expanded section on the wide range of home modalities focuses on the expertise necessary to overcome challenges in light of the anticipated growth from provincial initiatives.

The CANNT Executive Board would like to thank the nurses who volunteered their time and shared their experience, expertise, and knowledge as contributors and content reviewers. These necessary updates and revisions would not have been possible without their commitment and substantial contributions. We would also like to acknowledge the important contribution of previous working groups who have given of their time and experience to lay a foundation for us to continue building on.

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CANNT Nursing Standards and Practice Recommendations Committee Chair

Introduction

Standards demonstrate to the public, government and other stakeholders that a profession is dedicated to maintaining public trust and upholding the criteria of its professional practice (Canadian Nurses Association (CNA), 2019). The CANNT Nephrology Nursing Standards provide a framework for nephrology nursing practice, linking professional practice accountabilities, competence, research, leadership and quality.

Historical Background

In 1968, the Canadian Society of Extracorporeal Technicians (CANSECT) was formed and Letters Patent were granted by the Canadian government. From 1968 to 1974, CANSECT was comprised of members involved in the fields of heart and lung perfusion and dialysis. These two different disciplines were linked by the common concept of extracorporeal circulation. In 1975, the differences between these two groups grew to outweigh the common purpose that brought them together. The two groups separated and the dialysis membership adopted the name, Canadian Society of Perfusionists (C.S.P.). In 1977, this group became the Canadian Society of Dialysis Perfusionists (CSDP) or the Societe canadienne des perfusionistes en dialyse. The goal of the CSDP was to share and improve the quality of extracorporeal technology.

In 1984, the CSDP's name was changed to the Canadian Association of Nephrology Nurses and Technicians (CANNT) or L'Association canadienne des infirmieres en techniciens de nephrologie. In 1996 the name was altered to the Canadian Association of Nephrology Nurses and Technologists. This name change reflects not only the growth and expansion that has occurred in our specialty, but also it emphasizes our increasing awareness of identity—who we are and what we do. We are nurses and technologists involved in the specialized care of nephrology patients.

Nephrology nursing is defined as “a specialty practice addressing the protection, promotion and optimization of health abilities, prevention of illness and injury, facilitation of healing, alleviation of suffering through the diagnosis and treatment of human response, and advocacy in the care of individuals, families, groups, communities, and populations affected by kidney disease” (Gomez, 2017). It encompasses the primary, secondary and tertiary care of individuals with potential and chronic kidney disease (CKD), end stage renal disease, acute kidney injury (AKI) and other health conditions requiring nephrologic intervention. Nephrology nursing practice spans the continuum of care for patients with kidney disease to provide care to neonatal, pediatric, adult, and older adults in all racial/ethnic groups. The nursing care can be complex these patient populations may have various comorbidities including cardiovascular disease, diabetes, hypertension, infectious disease, and/or mineral and bone disease. In addition, many face psychological issues such as depression and anxiety (Gomez, 2017).

CANNT's Mission

To provide leadership and promote the best possible nephrology care and practice through education, research, and communication.

CANNT's Vision

CANNT as the keystone of evidence in nephrology nursing and technological care in Canada.

Context of Practice

Nephrology nursing is a growing and evolving specialty in Canada. Certification in nephrology nursing (CNeph (C)) through the CNA is increasing, with more than 1,100 registered nurses holding this designation (CNA, 2019). Nephrology nurses practise in all provinces and territories including urban teaching centres, rural and remote settings. In each province and territory there is a nursing regulatory body that oversees and regulates the practice of nursing.

The incidence and prevalence of chronic kidney disease in Canada have continued to increase over the last two decades (Canadian Institute for Health Information [CIHI], 2017). Currently the Kidney Foundation reports there are approximately 49,000 Canadians being treated for kidney failure; 57.5% on dialysis and 42.5% living with a functioning kidney transplant (Kidney Foundation of Canada, 2019). The prevalence rate for patients being treated by kidney replacement therapy has increased 131% in the last 20 years. They also contend that one in 10 Canadians have kidney disease, and the rate of new patients with ESKD has gone up by 36% in the past 20 years. Diabetes is the most common cause of ESKD, accounting for almost 40% of new diagnosis followed by renal vascular disease, primarily hypertension (Kidney Foundation of Canada, 2019; Moist et al., 2014). At-risk ethnic populations for chronic kidney disease include Aboriginal/Indigenous, Asian, South Asian, Pacific Island, African, Caribbean, and Hispanic (Kidney Foundation of Canada, 2019; Canadian Society of Nephrology, 2015).

Nephrology nurses provide care across the lifespan and health continuum, including acute and chronic care to patients with kidney disease. They are involved in health promotion, illness prevention, management of acute, chronic, and end-of-life care, and rehabilitation. They practise in diverse settings and clinical environments including, but not limited to CKD stage 1–5 (not on dialysis) clinics, hemodialysis and peritoneal dialysis clinics, acute care nephrology wards, critical care areas, operating room, home therapies, and kidney and kidney/pancreas transplant wards and clinics.

Canadian nephrology nurses function in a variety of roles including Nurse Practitioners, Registered Nurses and Registered/Licensed Practical Nurses, advanced practice nurses, educators, researchers, leaders, and administrators. Kidney disease care relies on a multidisciplinary approach with nurses playing a pivotal role in coordinating this care. A challenge for nephrology nursing will be the ability to change and respond to the unique healthcare needs of a growing aging kidney disease population. Nursing

standards and practice recommendations, help to articulate this specialty role to the public, other healthcare providers, and stakeholder groups that strive to improve care for patients at risk for and living with kidney disease.

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Nephrology Nursing Standards

Direct Care

Assessment

The nephrology nurse provides a comprehensive health assessment for patients with kidney disease appropriate to the nephrology nursing practice setting.

The nephrology nurse demonstrates this standard by:

- assessing patient and family understanding of chronic kidney disease;
- assessing patient and family understanding of the impact of chronic kidney disease;
- assessing patient and family readiness to learn about kidney disease;
- assessing patient self-care abilities, values, preferences, needs, health goals, and expected outcomes;
- using appropriate evidence based tools/techniques for interviewing and collecting patient information;
- using health assessment frameworks appropriate for chronic disease management;
- assessing known risk factors associated with kidney disease;
- synthesizing data in a holistic manner to understand patient health issues and patient perception of health and goals for health; and
- collecting data including but not limited to demographics, social determinants of health, health disparities, and physical, functional, psychosocial, emotional, cognitive, sexual, cultural, age-related, environmental, spiritual/transpersonal, and economic assessments pertinent to the individual with kidney disease;

- engaging the patient and the other interdisciplinary team members in holistic, culturally sensitive data collection;
- identifying barriers to effective communication based on psychosocial, literacy, financial, and cultural considerations;
- recognizing impact of one's own personal attitudes, values and beliefs on the assessment process
- assessing the impact on family dynamics on health and wellness
- prioritizing data collection based on the patient's immediate condition or the anticipated needs of the patient or situation;
- applying ethical, legal, and privacy guidelines and policies to the collection, maintenance, use and dissemination of data and information;
- recognizing the patient as the authority on their own health by honoring their preferences; and
- documenting relevant data accurately, timely and in a manner accessible to the interdisciplinary team.

Planning

The nephrology nurse develops a plan of care appropriate to the level of kidney disease and individualized to the patient's driven outcomes.

The nephrology nurse demonstrates this standard by:

- developing an individualized holistic, evidence-based plan in collaboration with the patient and family and the interdisciplinary team that establishes goals and prioritizes of care
- collaborating with the patient and family to understand their goals and expected outcomes for health;
- collaborating, prioritizing, and coordinating care with the interdisciplinary team members and patients and families to achieve expected outcomes;
- ensuring the plan of care includes health promotion and prevention strategies to reduce and prevent illness and provide supportive/palliative and comfort care, as indicated;
- including strategies that promote independence, autonomy, and self reliance;
- incorporating evidence-based strategies and outcomes for managing chronic kidney disease along the health/illness trajectory;
- documenting the plan using standardized language and recognized terminology; and
- identifying barriers to care, assessment strategies, diagnostic strategies, and therapeutic interventions within the plan that reflect current evidence, including data, research, literature and expert clinical knowledge.

Implementation

The nephrology nurse implements and coordinates the plan of care for patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- collaborating with the patient and the family to implement the plan in a safe, effective, timely, patient-centred and equitable manner;

- educating patients and families about stages of kidney disease, treatments, and best practices in advance of kidney replacement therapy that includes information on all modalities, including self-care dialysis and transplantation;
- assisting the patient and family to identify options for care while providing anticipatory guidance to promote health and prevent or reduce the risk of negative health outcomes;
- advocating for resources to help patients and families achieve optimal health;
- integrating critical thinking, patient preferences, and technology solutions to enhance nephrology nursing practice and patient outcomes;
- coordinating, modifying, and documenting the plan of care;
- collaborating and communicating with interdisciplinary team members and community across the continuum of care; and
- providing culturally congruent, holistic kidney disease care that focuses on the patient and the family and addresses the needs of the CKD population across all stages and life spans.

Evaluation

The nephrology nurse continually evaluates the care and outcomes for patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- conducting a holistic, systematic, ongoing and criterion-based evaluation of the patient response to interventions and goals prescribed in the plan of care;
- collaborating with the patient and family and interdisciplinary team members involved in the evaluation process;
- critically analyzing clinical outcomes against best demonstrated practice outcomes for kidney disease;
- documenting outcomes of kidney disease care and achievement of patient health goals; and
- revising the plan of care in collaboration with the patient and interdisciplinary team members to meet ongoing and changing healthcare needs.

Collaboration

The nephrology nurse collaborates with the patient and family, and the interdisciplinary team members across the continuum of care to provide and coordinate services to the kidney disease population.

The nephrology nurse demonstrates this standard by:

- providing consultative services to facilitate discussion and team functions in a manner that protects dignity, respect, privacy and confidentiality;
- initiating necessary referrals and consults to allied health professionals and community organizations to achieve expected outcomes of the kidney disease plan of care;
- participating in committees/work groups established for the purpose of improving kidney disease care;
- sharing expert nephrology nursing knowledge with the interdisciplinary team members to promote excellence in kidney disease care;

- providing and participating in educational initiatives aimed at increasing the knowledge, skill, and ability of the healthcare team and community organizations involved in the care of patients with kidney disease; and
- ensuring information pertaining to assessment, planning, and provision of care (including anticipated outcomes) is documented and accessible to all members of the multidisciplinary team involved in the care of the patient with kidney disease.

Competence

The nephrology nurse attains and maintains knowledge and skills that reflect current nursing practice.

The nephrology nurse demonstrates this standard by:

- being responsible/accountable for their own learning and professional development;
- identifying gaps in knowledge and formulating a plan to meet their learning needs;
- participating in nephrology unit/program orientation programs, professional practice committees, and peer teaching/learning opportunities;
- acquiring and maintaining Canadian Nurses Association certification in nephrology nursing, CNeph(C);
- attending conferences, workshops, and educational activities pertinent to nephrology nursing practice;
- staying current with trends and research in nephrology nursing;
- using and promoting the best evidence to provide chronic kidney disease care;
- participating in professional reflective practice;
- participating in performance review/evaluation;
- continually improving knowledge and practice required to meet licensure policies set by nursing regulatory and professional organizations; and
- providing education and sharing expert knowledge through mentorship and preceptor opportunities.

Evidence-Based Nursing Practice

The nephrology nurse participates integrates evidence and research findings into nephrology nursing practice and kidney disease care.

The nephrology nurse demonstrates this standard by:

- identifying questions and issues related to nephrology nursing practice and kidney disease care that can be answered by nursing research;
- identifying knowledge gaps in nephrology nursing practice and kidney disease care;
- critically appraising the validity, relevance, and applicability of research findings to address patient issues;
- considering nephrology expertise, patient preferences, other forms of care, and available resources in relation to available evidence;
- applying knowledge gained from research and best demonstrated practices to care for the patient with kidney disease;
- integrating relevant nephrology related research into nursing policies and procedures and quality care outcome initiatives;

- participating in nursing, collaborative interdisciplinary, and allied health research;
- developing research proposals in accordance with organizational research review standards and ethics; and
- disseminating research findings through abstracts, presentations, and publication.

Leadership

Advocacy

The nephrology nurse advocates for improving the care for and quality of life of patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- empowering patients and families to develop realistic, achievable, patient-centred health goals, and collaborating on a plan of care that includes advance healthcare directives;
- collaborating with healthcare team members and the patient and their family to implement strategies to achieve patient-centred health goals ;
- demonstrating knowledge and understanding of the perspectives , traditions , values, practices and family systems of the culturally diverse populations , families and communities of individuals with acute and chronic kidney disease across the continuum;
- promoting equal access to services , diagnostic tests, interventions, health promotion and disease prevention, enrollment in research and/or evidence based programs;
- demonstrating respect, empathy and equity in patient and family interactions including vulnerable cultural groups, including lesbians, gay, bisexual and transgender groups;
- engaging indigenous people including First Nation and Inuit patients, families and communities to support and provide care that reflects community priorities and incorporates traditional culture
- considering cultural influences on decision making regarding treatment modalities, supportive care and end-of-life care;
- considering social determinants of health
- educating other health professionals about the needs and challenges of patients with kidney disease;
- communicating with the patient, family, and members of the healthcare team regarding full disclosure of treatment options including the option of not having dialysis or withdrawal of renal replacement therapy;
- providing information about and promoting advance healthcare directives;
- providing awareness of the availability of palliative care services;
- identifying gaps in the care of patients with kidney disease and taking actions to narrow and close these gaps;
- participating in committees, work groups, political lobbying activities, and/or other activities aimed at improving the care of patients with kidney disease; and
- following appropriate organizational policy/procedure when a substitute decision maker needs to be involved in care and end of life care.

Professional Leadership

The nephrology nurse demonstrates professional leadership by providing, facilitating, and promoting the best possible care for patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- taking initiative to improve kidney disease care;
- role-modeling professional values, beliefs, and attributes (e.g., acquiring nephrology nursing certification, promoting continuing education, and developing and achieving annual professional reflective practice goals);
- collaborating with patients and their families and the health team to provide professional practice that respects the rights of patients;
- advocating for patients, a patient-centred approach to care, a healthy workplace and the nursing profession;
- providing direction to, collaborating with, and sharing knowledge and expertise with novices, students, and unregulated healthcare providers;
- acting as a role model utilizing mentorship characteristics and ideally becoming a formal mentor;
- promoting best demonstrated practices;
- participating in nursing associations, committees, or interest groups to contribute to the evolution of nephrology practice;
- providing leadership through formal and informal roles (e.g., team leader, charge nurse, preceptor);
- taking action to manage change and resolve conflict; and
- participating in quality improvement initiatives;
- utilizing best demonstrated practices;
- utilizing human and material resources effectively and efficiently; and
- integrating telehealth and mobile health technologies into practice to promote positive interactions between the patient and family and the interdisciplinary team members.

Ethics in Nephrology Practice

There have been many ethical dilemmas identified and resolved within nephrology practice over the years. Nephrology nurses need to remain informed and active to identify the ethical principles underlying or potentially being violated by actions being proposed or adopted relevant to nursing and nephrology care. New technologies and treatments currently being developed have the potential to create new ethical problems or dilemmas for both the nephrology patients and the healthcare professionals. Nephrology nurses encounter ethical conflict, uncertainty and moral distress in their everyday practice due in part to continuous changes in the healthcare system, technology, personal experiences and societal values and religious beliefs.

Ethical dilemmas occur when patients, families, and/or healthcare professionals disagree about a decision or proposed action. Recognition and discussion of the difference in beliefs and opinions by all stakeholders is paramount to its resolution. Nephrology nursing practice is unique in both its focus and the longevity of relationships with

patients (Ulrich, 2017). As such nephrology nurses must acknowledge their ability and obtain the power to influence patient care outcomes in order to practice in an ethical manner. These competencies include nursing knowledge and skill, an understanding of ethical principles and models, good relationships with patients and the health-care team, and the communication skills to nurture these relationships.

Ethical decision making in nephrology requires a formal process that utilizes the ethical principles and patient-centered care to ensure justice as fairness for patients with kidney disease. This may also involve professional norms, institutional policies, and legal precedents.

Ethical issues identified in nephrology include treatment reimbursement (allocation of resources), continued growth of patients who cannot pay for their medications /treatment (justice as fairness), fair reimbursement for new methods for delivery of dialysis, such as home hemodialysis (allocation of resources), an increased number of patients requesting transplants with the known lack of available organs and changes in donor organ sources (allocation of resources, justice as fairness). (Greenspan et al, 2020).

The nephrology nurse understands, upholds and promotes the ethical standards of the nursing profession in the care of patients with kidney disease.

The nephrology nurse demonstrates this standard by:

- presenting his or her name, title and role clearly and accurately and acting in a way that promotes respect for the nursing profession;
- advocating for patients' rights to informed decision making and self-determination within ethical, legal and regulatory parameters;
- providing care that preserves and protects patient dignity;
- demonstrating honesty and integrity;
- protecting patient privacy and confidentiality;
- recognizing, respecting and promoting the patient's right to be informed and be involved in shared decision making about treatment choices for acute and chronic kidney conditions;
- promoting and maintaining respectful communication in all professional interactions by recognizing and respecting the valuable contributions of other members of the healthcare team;
- treating all others in a respectful manner;
- making equitable decisions about the allocation of resources based on patient needs;
- identifying the effect of his or her own values, beliefs and experiences in carrying out nursing practice activities;
- recognizing and identifying ethical concerns and issues and taking action to prevent or resolve them by consulting with the appropriate person or body;
- recognizing potential conflicts and evaluating the effectiveness of actions;
- advocating for the rights, health, quality and safety of the patient and family;

- initiating, maintaining and terminating nurse-patient relationships with appropriate professional role boundaries;
- recognizing ethical situations where further expertise from an hospital ethicist is needed.

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NEPHROLOGY NURSING PRACTICE RECOMMENDATIONS

Chronic Kidney Disease: Diagnosis, Classification and Management

Chronic Kidney disease has been defined as either kidney damage or glomerular filtration rate (GFR) less than 60 mL/min for more than three months or the presence of abnormalities in urine sediment, renal imaging or biopsy results. The classification system of the stages of CKD is based on the calculated GFR, albuminuria and etiology and lists five graded categories. It provides a common language for patients and healthcare workers to improve communication, enhance education and promote the conduct of clinical research, as well as a framework for the evaluation, referral, and development of a clinical action plan for patients (KDIGO, 2012).

The incidence of chronic kidney disease is increasing with an estimated 1.3 to 2.9 million Canadians currently diagnosed. (Jha et al., 2013; James et al., 2010). The populations at greatest risk for developing CKD include elderly people and those with concomitant illness such as diabetes, hypertension, or cardiovascular disease, or those with a family history of CKD (James et al., 2010). The increased incidence of CKD has resulted in an increased focus on pre-dialysis care in the adult population with the goal of delaying the progression of CKD, preventing and treating complications, treating comorbidities and preparing for renal replacement therapies.

It is prudent, therefore, that CKD care include the identification, modification and/or prevention of risk factors associated with CKD progression. Risk factors include cause of CKD, level of glomerular filtration rate (GFR), level of albuminuria, age, sex, race/ethnicity, elevated blood pressure, hyperglycemia, dyslipidemia, smoking, obesity, history of cardiovascular disease, and ongoing exposure to nephrotoxins. Risk factors that are modifiable or preventable include blood pressure, hyperglycemia, dyslipidemia, smoking, obesity and exposure to nephrotoxic agents (KDIGO, 2013). A verified tool has been developed to accurately predict the two- and five-year probability of treated kidney failure for a potential patient with CKD Stage 3 to 5 (Tangri et al., 2011).

A multidisciplinary approach to CKD care is recognized as preferable with demonstrated survival advantage for patients, as well as a cost benefit to the healthcare system (Chen et al., 2019). Nephrology nurses are instrumental in the coordination and delivery of this care and have the potential to have a positive impact on the course of kidney disease. Patient and family education regarding appropriate CKD management includes lifestyles modifications such as regular exercise, healthy eating and avoidance of smoking, options for care and, if necessary, preparation for renal replacement therapy (Bello et al., 2019). Early chronic kidney disease management can lead to effective planning and appropriate timing of dialysis start and access creation.

The focus of care for pediatric patients emphasizes primary prevention, early detection, and aggressive management (Kogan & Harshman, 2019). The renal replacement therapy of choice for the pediatric population is transplantation; preferably pre-emptive renal transplantation with a living donor when available (Francis et al., 2020).

Integral to this care is a self-management approach that focuses on patient/family-centred care and collaboration with the healthcare team. Enhancing self-care and management improves management of symptoms, quality of life, and coping; it also decreases healthcare utilization (Narva et al., 2016). Health promotion and disease management are fundamental to patients at CKD stages 1-5 (not on dialysis). The nephrology nurse plays an integral role in assessing, coordinating care, providing education and interventions and follow-up of this patient population

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assessment of Renal Function and Chronic Kidney Disease Progression

Assesses renal function and progression of chronic kidney disease including, but not limited to:

- height at initial visit for adults and each visit for pediatric patients;
- weight;
- serum urea and creatinine;
- serum electrolytes;
- serum calcium, phosphorus, albumin; parathyroid hormone levels;
- proteinuria (i.e. albumin to creatinine ratio, protein to creatinine ratio); and
- estimated glomerular filtration rate.

Modifiable Lifestyle Risk Factors

Assesses modifiable risk factors associated with lifestyle that contribute to chronic kidney disease while engaging the client to be active in learning and goal setting to modify risk factors including, but not limited to:

- hypertension;
- dietary considerations- protein, sodium and potassium;
- smoking;
- alcohol use;
- exercise;
- avoidance of nephrotoxic drugs- herbal, antibiotic, anti-neoplastic, cocaine, steroids, NSAIDS; and stress.

Patient Education

Uses a learner centred approach to education that will assist patients to become active in and build their confidence to manage their own health including, but not limited to:

- functions of the kidney;
- chronic kidney disease, stages, signs and symptoms;
- common causes of chronic kidney disease;

- nutrition and chronic kidney disease;
- psychosocial and lifestyle issues associated with chronic illness;
- role of medications in CKD management including medications to avoid and education about medication management;
- modifiable lifestyle factors, and their role in ability to slow progression;
- living healthy with chronic kidney disease;
- options for care, including all forms of dialysis, transplantation, conservative and palliative therapy;
- vein preservation – use hand veins for venipunctures and intravenous and encourage end-stage kidney disease (ESKD) Life-Plan with comprehensive evaluation of patient's life-time with ESKD and kidney replacement options and access planning (National Kidney Foundation, 2020);
- management of chronic kidney disease when dialysis is declined or not appropriate; and
- advance healthcare directives.

Engages the patient to participate in a collaborative plan of action, which is goal specific and includes principles of self-management in order to meet their needs including, but not limited to:

- assesses readiness to learn/change
- provides information about chronic kidney disease care delivery setting and other relevant healthcare service information;
- provides education about chronic kidney disease and chronic kidney disease management using a variety of methods and tools (1:1 teaching, class opportunities, peer support, reading, visual);
- provides information about patient level of kidney function, risk factors, and self management strategies to engage the patient in actively participating in care;
- provides education about renal replacement therapy options;
- provides education about access creation and coordinates consults related to access planning and creation;
- provides education about managing chronic kidney disease when dialysis is declined or inappropriate and explores patient feelings around this issue;
- provides information about advance directives and resources available for developing an advance directive;
- promotes self-management abilities and strategies to promote health;
- provides information and support to enable patients to master skills for self-management; and
- provides instruction, organizes programs, and/or refers patients to health promotion classes (e.g., smoking cessation, dyslipidemia, exercise, blood pressure management, stress management, symptom management technique).

Links to clinical resources

Kidney Disease Improving Global Outcomes (KDIGO). (2103). *Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease*. https://kdigo.org/wp-content/uploads/2017/02/KDIGO_2012_CKD_GL.pdf

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Nursing Practice Recommendations Spanning the Continuum of Chronic Kidney Disease Care

Chronic Kidney Disease Self-Management Strategies

Chronic illness is the leading cause of death and disability in Canada (Chronic Disease Prevention Alliance of Canada [CDPAC], 2018) and can be challenging for patients, their families, and those who provide their care. The management and prevention of chronic diseases, including chronic kidney disease, represents one of the biggest challenges to our healthcare system, taking a toll on the healthcare system, economy and quality of life (Canadian Nurses Association [CNA], 2012). The CDPAC reports that a third of Canadians have a least one chronic health condition and that two thirds die as a result of cancer, cardiovascular disease, Type 2 diabetes, and chronic obstructive lung disorders (CDPAC, 2018). Patients with chronic kidney disease usually have these chronic comorbid conditions that may affect the course of CKD. Control of the diseases may

decrease morbidity and mortality in patients with CKD (KDIGO, 2013). Chronic illness impacts both physical and psychosocial health and wellbeing for patients. Learning to live with and manage symptoms of chronic illness is an important strategy for patients with chronic kidney disease.

For Canadians with chronic diseases there is a growing interest in self-management support programs that emphasize the patient's central role in managing their illness. Self-management complements traditional patient education by helping patients achieve the best possible quality of life with their chronic condition (CNA, 2012). Self-management support leads to patient outcomes that show improved problem-solving skills, self-efficacy, decision-making, health status, and healthcare utilization.

The primary outcome in empowering individuals with CKD with self-care management is to delay the progression of CKD and prevent and manage comorbid conditions (Gomez, 2017). Nephrology nurses assist patients across the continuum of kidney disease to develop skills and strategies to recognize and manage symptoms associated with disease, complex diet and medication plans, as well as competencies required to self-manage home peritoneal or hemodialysis. The nephrology nurse complements traditional education, which consists of giving information and teaching technical skills with self-management education. Patients and families that receive adequate self-management support become an additional resource in the larger process of chronic disease management (Peng et al., 2019).

Patients with chronic diseases have the confidence, choice and ability to effectively manage their symptoms, treatment, physical, emotional and social consequences, and lifestyle changes. The interventions identified as supporting self-management include key components, such as skill building, tools and resources, education and behavioural counselling and overcoming structural barriers (Zimbudzi, 2019).

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assesses patient and family needs related to CKD self-management strategies including, but not limited to:

- ability to make decisions about their care;
- coping strategies that could assist with care management;
- degree of willingness to manage their chronic illness;
- readiness for change;
- learning needs;
- identifying barriers to achieving patient goals; and
- identifying support systems available.

Collaborates with the patient and family to develop a plan to manage CKD and improve outcomes including, but not limited to:

- identifying patient's ability to make decisions regarding their care;
- providing the patient and family with information about all options so that they are able to participate fully in decisions about their care and make informed choices;

- exploring patient goals and helps them to be able to discuss strategies to attain them;
- encouraging the identification and use of community resources to address needs;
- providing information about peer support groups and self-management workshops; and
- encouraging the use of stress management and relaxation methods.

Implements self-management education by developing problem-solving skills. This education consists of, but is not limited to encouraging patients and families to:

- identify their problems;
- make decisions;
- set their goals;
- take appropriate actions; and
- seek out available resources.

Collaborates with other disciplines to eliminate duplication of resources, reduce fragmentation of care, and ensure optimal resource management to meet the needs of the patient and family including, but not limited to:

- collaborating with the patient, family, and other essential disciplines and community resources for optimal care delivery;
- documenting and communicating the plan of care;
- evaluating the effectiveness of the plan of care with the patient;
- communicating outcomes and changes to the plan of care with other health professionals and agencies involved in fulfillment of the plan of care; and
- ensuring those involved in the plan of care understand each member's role and responsibilities for achieving outcomes as outlined in the plan of care.

Links to clinical resources

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Advance Care Planning, Conservative Management, and Palliative Care

Advance Care Planning

Advance care planning is a process that enables patients with decisional capacity to express their wishes about future health care in consultation with their healthcare providers, family members, and other important people in their lives (Castner, 2020; Philip et al., 2018). The process may involve discussion, knowledge sharing, and informed decision making around future and potential end-of-life treatment options and preferences. It may take many conversations for the advance care plan to evolve. The primary goal of advance care planning is to seek consensus on care plans that reflect the values and preferences of the patient.

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assesses readiness to participate in discussions about advance care planning and end-of life care and introduces concepts of advance care planning as early in the course of kidney disease as possible.

Promotes informed decision making regarding treatment options and care for kidney disease including, but not limited to:

- providing information and education about treatment options for kidney disease;
- assisting the patient and family to understand information they receive about treatment options for kidney disease;
- clarifying questions and concerns;
- assessing for symptoms of depression and stages of the grieving process; and
- involving appropriate health team members in discussions about advance care planning.

Assesses patient and family current knowledge level, identified learning needs, and current preparations around advance care planning including, but not limited to:

- values and beliefs about death and dying;
- religious considerations;
- cultural considerations;
- living will (proxy decision making documents);
- will;
- enduring power of attorney;
- resuscitation; and
- funeral arrangements.

Regularly reviews health status, treatments for kidney disease, and progress, and ensures informed decision making regarding ongoing care.

Promotes and respects patient autonomy regarding treatment choices and care for kidney disease, including the right to change decisions regarding dialysis therapy and other care parameters.

Conservative Management

Conservative management is caring for a patient who chooses not to start dialysis as their kidney function worsens. The goals of conservative management should centre on living well without dialysis, keeping the patient as comfortable as possible and assisting the patient in achieving a good quality of life. Conservative management can bridge a patient to a palliative care approach, as it can take months to years for a patient to arrive at end of life. When symptom burden becomes too much patients care is often taken over by a specialized palliative team that assists in transition from living at home to being in hospice if symptoms are significant and difficult to manage in the home setting.

Palliative Care

Palliative care is “an approach that improves the quality of life of patients and their families facing the problems associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual” (World Health Organization, 2019). Palliative care should be considered early in the course of illness, in conjunction with other therapies that are intended to prolong life, and

includes those investigations needed to better understand and manage distressing clinical complications (World Health Organization, 2019).

Patients with chronic kidney disease may decline renal replacement therapy, withdraw from dialysis or approach death while still receiving renal replacement therapy. Quality of life and dignity at the end of life are vital for individuals living with kidney disease. In fulfilling these goals, nephrology nurses focus on preventing and relieving suffering through the management of symptoms that result in discomfort. Palliative care may be offered in conjunction with other forms of appropriate medical treatment.

Nephrology nurses spend significant time with patients and their families over the course of their kidney disease and treatment. They are actively involved in providing education and discussions that help to promote decision making about treatment options and ongoing care for individuals with kidney disease. Decisional conflict occurs frequently as our patients struggle with decision to not initiate dialysis or stop dialysis. This wavering can cause emotional distress to the patients and families and can affect the staff as well.

Using the best available evidence and incorporating best evidence informed guidelines, the nephrology nurse:

Assesses the palliative care needs of the patient and family throughout the continuum of kidney disease including, but not limited to:

- exploring understanding of illness trajectory and prognosis;
- identifying learning needs to promote informed decision making about renal replacement therapies and declining dialysis treatments;
- ensuring that the patient and family understand that a choice of “no dialysis” does not mean withdrawal of active treatment for managing symptoms or promoting quality of life;
- assessing for symptoms of depression and/or stages of the grieving process;
- exploring fears and concerns regarding kidney disease, treatments, and perceived prognosis;
- promoting advance care planning;
- assessing patient and family expectations and wishes for continuing and end-of-life care; and
- respecting the patient’s decisions regarding treatment options and right to revise their decisions and initiate renal replacement therapy at any time.

Develops a plan in collaboration with the patient and family that addresses individual and family priorities for care including, but not limited to:

- physical needs;
- psychosocial needs;
- spiritual needs;
- communication needs and expectations;
- environmental needs; and
- any other identified needs.

Assesses the patient for signs and symptoms of discomfort including, but not limited to those related to:

- integumentary system (e.g. pruritus, edema, skin breakdown, dehydration);
- gastrointestinal system (e.g., nausea, vomiting, constipation, diarrhea);
- respiratory system (e.g., dyspnea, cough, congestion);
- neurological system (e.g., neuropathy, seizures, myoclonus, restless legs);
- cognitive system (e.g., agitation, confusion, depression, delirium); and
- other common symptoms related to kidney disease (e.g., fatigue, cramps, pain, sleep disturbance).

Implements strategies to optimize comfort and quality of life.

Initiates referral to palliative care or hospice in collaboration with the individual and /or family living with kidney disease.

Links to clinical resources

Speak up - Advance Care Planning Website. <http://www.advancecareplanning.ca/>

End of Life Care during the Last Days and Hours. RNAO Clinical Best Practice Guideline (2011). http://rnao.ca/sites/rnao-ca/files/End-of-Life_Care_During_the_Last_Days_and_Hours_0.pdf

Decision Support for Adults Living with Chronic Kidney Disease: Registered Nurses of Ontario (RNAO) Nursing Best Practice Guideline (2009). <http://rnao.ca/bpg/guidelines/decision-support-adults-living-chronic-kidney-disease>

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Blood Pressure

Hypertension is a leading cause of kidney disease in Canada (Kidney Foundation of Canada, 2015a). Controlling hypertension reduces overall risk for cardiovascular disease (KDOQI, 2012). Ideal blood pressure control is associated with decreased progression of kidney disease (KDOQI, 2012). The Canadian Hypertension Education Program (CHEP) (2018) and Registered Nurses Association of Ontario Nursing Best Practice Guidelines (2009) provide detailed evidence-based guidelines for managing hypertension. Much of the evidence for blood pressure management comes from research carried out with the general population. The optimal blood pressure targets for patients with chronic kidney disease stage 5 receiving hemodialysis are unknown and widely accepted guidelines for other populations are difficult to relate to the dialysis population. Therefore, these practice recommendations should not be generalized to the dialysis patient population (Wheeler & Becker, 2013; Hamrahian, 2017; Kalaitzidis et al., 2018; Jindal et al., 2006). Nephrology nurses are instrumental in assessing, detecting, monitoring, treating, and evaluating patients for and with hypertension in Canada.

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assesses the blood pressure of patients with kidney disease to detect and monitor for hypertension.

Assesses modifiable lifestyle risk factors for hypertension including, but not limited to:

- poor dietary habits (i.e. dietary sodium);
- abdominal obesity;
- physical inactivity;
- dysglycemia;
- tobacco smoking;
- stress;
- alcohol consumption; and
- non-adherence.

Supports antihypertensive medication management including and not limited to:

- assessing current medication history, regimens, successes, and challenges;
- assisting the patient to simplify medication regimens where possible;

- maintaining knowledge about the classes of medications that may be prescribed for hypertension management; and
- providing education, in collaboration with authorized prescribers and pharmacists, about the pharmacological management of hypertension.

Develops a plan in collaboration with the patient to address modifiable lifestyle risk factors including, but not limited to:

- encouraging self-management strategies such as home blood pressure monitoring to promote greater patient understanding, responsibility, and improved outcomes;
- providing instruction on proper blood pressure measurement technique as outlined in CHEP guidelines (2018);
- referring to a registered dietitian as necessary; and
- educating patients about the potential to decrease and slow kidney disease progression and reduce risk from cardiovascular complications by achieving target blood pressure.

Supports patients in the management of hypertension including, but not limited to:

- developing strategies in collaboration with patients to improve modifiable cardiovascular risk factors;
- educating patients about antihypertensive medications;
- educating patients about goals and targets for blood pressure management and benefits of achieving these goals and targets; and
- educating patients on how to identify edema or fluid retention.

Evaluates patient's ability to achieve blood pressure targets including, but not limited to:

- assessing blood pressure at each visit;
- reviewing medication history and regimen; and
- modifying plan of care in collaboration with the patient to achieve blood pressure targets.

Links to clinical resources

- Canadian Hypertension Education Program Recommendations (2018). http://www.hypertension.ca/images/CHEP_2018/2018_CompleteCHEPRecommendations_EN_HCP1009.pdf
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Anemia

Anemia is a common complication of kidney disease that starts in the early stages of kidney disease and is associated with decreased quality of life (Dutka, 2012; KDOQI, 2012). While cause and effect relationships have not been clearly defined, treating anemia and raising hemoglobin levels in patients with kidney disease has been associated with improved quality of life, improved muscle strength, and

decreased transfusion requirements, hospitalization, and mortality (Batchelor et al, 2020, Fishbone and Spinowitz, 2018; Ye et al, 2018). Nephrology nurses play an active role in assessing, teaching, planning, monitoring, and evaluating anemia in patients with kidney disease.

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assesses patients with kidney disease for signs and symptoms of anemia including, but not limited to:

- decreased energy and activity levels;
- decreased exercise capacity;
- increased shortness of breath;
- sleep disturbance;
- depression;
- decreased hemoglobin;
- decreased iron stores;
- chest pains; and
- pallor.

Assesses patients with kidney disease for possible causes of anemia including, but not limited to:

- blood loss;
- iron deficiency;
- erythropoietin deficiency;
- vitamin deficiencies;
- uremia/inadequate dialysis;
- secondary hyperparathyroidism;
- inflammation/infection;
- malnutrition;
- hypothyroidism;
- lesion/malignancy; and
- heavy metal or aluminum toxicity.

Assesses current patient and knowledge level, self-management abilities, and anemia management strategies, including, but not limited to:

- understanding of anemia associated with kidney disease;
- understanding of treatments for anemia associated with kidney disease;
- current medication history including vitamins, iron supplements, and erythropoiesis stimulating agents; and
- patient ability to administer erythropoiesis stimulating agents.

Develops a plan in collaboration with the patient and health care team to achieve anemia targets and improve functional ability for patients with kidney disease including, but not limited to:

- educating the patient about signs, symptoms and consequences of anemia associated with kidney disease;
- educating the patient about medication management (vitamins, iron, erythropoiesis stimulating agents) for anemia including benefits, side effects, strategies to reduce side effects, and signs and symptoms to report to healthcare professionals; and
- reinforcing importance of adherence to anemia treatments.

Monitors and evaluates patient response to anemia therapy including, but not limited to:

- monitoring for improvement in signs and symptoms of anemia;
- monitoring hemoglobin and iron stores regularly;
- assessing on an ongoing basis possible causes for inadequate response to therapy;
- assessing on an ongoing basis for possible side-effects and/or complications associated with therapy; and
- modifying plan of care in collaboration with the patient and healthcare team to achieve anemia targets.

Links to clinical resources

Canadian Society of Nephrology Clinical Practice Guidelines for the Management of Anemia Associated with Chronic Kidney Disease (2008). <https://www.cnsnscn.ca/committees/clinical-practice-guidelines/library>

Kidney Disease: Improving Global Outcomes (KDIGO) (2012). KDIGO Clinical Practice Guideline for Anemia in Chronic Kidney Disease. *Kidney Inter.*, (Suppl. 2012, 2, 279–335. <https://kdigo.org/wp-content/uploads/2016/10/KDIGO-2012-Anemia-Guideline-English.pdf>

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CKD Mineral and Bone Disorders

Decreasing renal function affects homeostasis of the mineral metabolism cycle. Additionally, the inability of the body to activate vitamin D occurring in CKD influences the absorption of calcium from the digestive tract. The resulting imbalance of calcium and phosphorus is believed to contribute to renal osteodystrophy, secondary hyperparathyroidism, and soft tissue and vascular calcification (Bacchetta et al., 2020; KDIGO, 2017). These long-term complications influence/affect morbidity and mortality of the CKD patient (Bover et al., 2017). Renal replacement therapy is only partially effective at treating mineral metabolism and further management is required with nursing care and support.

Nephrology nurses play an active role in assessing, teaching, planning, monitoring, and evaluating bone and mineral metabolism in patients with CKD.

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assesses patients for risk factors associated with CKD mineral and bone disorders including, but not limited to:

- cardiovascular risk factors
- GFR approaching 30 mL/min or less;
- older age;
- history of fracture;
- immobility;
- risk of falls;
- use of glucocorticoids;
- abnormal serum calcium, phosphate, PTH, total alkaline phosphatase levels and Vitamin D levels ;
- malnutrition and/or malabsorption; and
- delayed growth in children.

Assesses patients with kidney disease for signs and symptoms of CKD mineral and bone disorders including, but not limited to:

- serum phosphorus, calcium, albumin, parathyroid hormone level;
- pruritis;

- bone and joint pain and swelling;
- wounds (calcific uremic arteriolopathy); and
- eye irritation and inflammation.

Assesses patient and family identified learning needs related to CKD mineral and bone disorders including, but not limited to:

- complications related to CKD mineral and bone disorder (i.e., bone disease, secondary hyperparathyroidism, cardiovascular disease, soft tissue calcification);
- importance of diet, exercise, and medications to manage CKD mineral and bone disorder; and
- signs and symptoms to report (i.e. pruritis, bone pain, skin lesions/lumps/bumps, eye irritation).

Assesses current treatment plan for CKD mineral and bone disorders including patient self-management skills, knowledge, and ability to carry out this plan including, but not limited to:

- diet;
- phosphate binders;
- vitamin D and analogs;
- calcimimetics;
- side effects (i.e. gastrointestinal upset, constipation, unpalatable);
- timing of medications for CKD mineral and bone disorder in relation to meals and other medications that may affect absorption or effectiveness; and
- dialysis adequacy.

Develops and initiates a plan, in collaboration with the patient and family, to achieve desired targets and outcomes related to CKD mineral and bone disorders including, but not limited to:

- referral to registered dietitian for diet counselling;
- reinforcement of diet instruction and restrictions;
- referral to pharmacist for medication education
- administration and monitoring of medications to control CKD mineral and bone disorder;
- assisting patient in mastery of skills for self-management;
- simplifying medication regimen where possible;
- referral to other health professionals as necessary (social worker; physiotherapy);
- exploration of perceived barriers to achieving targets and outcomes (i.e. financial, complexity of plan; side effects); and
- evaluating outcomes in collaboration with the patient and revises the plan of care when necessary.

Monitors and evaluates patient response to CKD mineral and bone disorder therapy including, but not limited to:

- monitoring for improvement in signs and symptoms related to CKD mineral and bone disorder;
- monitoring serum calcium, phosphorus, albumin, and parathyroid hormone levels regularly;
- assessing, on an ongoing basis, possible causes for inadequate response to therapy;
- assessing, on an ongoing basis, for possible side-effects and/or complications of therapy; and
- modifying the plan of care in collaboration with the patient and health care team to achieve targets.

Links to clinical resources

Canadian Society of Nephrology. (2010). Commentary on the 2009 KDIGO Clinical Practice Guideline for the Diagnosis, Evaluation and Treatment of CKD-Mineral and Bone Disorder (CKD-MBD). *AJKD*; 55(5), 800-812. <http://download.journals.elsevierhealth.com/pdfs/journals/0272-6386/PIIS0272638610004877>

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Kidney Disease: Improving Global Outcomes (KDIGO) CKD-MBD Work Group. (2017) KDIGO clinical practice guideline update for the diagnosis, evaluation, prevention, and treatment of chronic kidney disease-mineral and bone disorder (CKD-MBD). <https://kdigo.org/wp-content/uploads/2017/02/2017-KDIGO-CKD-MBD-GL-Update.pdf>

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Wesseling-Perry, K., & Salusky, I. B. (2013). Chronic kidney disease: mineral and bone disorder in children. *Seminars in nephrology*, 33(2), 169-179. <https://doi.org/10.1016/j.semnephrol.2012.12.017>

Nutrition and Diet Therapy

Treatment with dietary intervention is one of the most important aspects of managing kidney disease. Dietary restrictions are almost always necessary to maintain metabolic homeostasis, but must be balanced to avoid malnutrition. Many patients with kidney disease are malnourished and it is known that patients with hypoalbuminuria tend to do poorly on dialysis and have higher mortality rates (Zha & Qian, 2017).

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assesses nutritional status and barriers to achieving nutritional and dietary requirements, identified by the dietitian, to determine nutritional and resource needs including, but not limited to:

- weight, height, and body mass index (adult);
- weight/height index (pediatric);
- head circumference (age 3 years and under);
- edema;
- serum urea, creatinine, albumin, phosphorus, calcium, lipid profile, glucose profile, bicarbonate, sodium, potassium, magnesium, urine for microalbuminuria or proteinuria;
- metabolic acidosis;
- anemia;
- current dietary habits, restrictions, food preferences, and cultural considerations;
- lifestyle habits including smoking, alcohol consumption, and exercise tolerance/ frequency;
- ability to follow diet and medication regimens;
- advancement for infants from liquid to solids (pediatric);
- ability to obtain and prepare food including mixing special formulas for infants;
- ability to chew and swallow;
- affordability;
- gastrointestinal disturbance;
- other illnesses requiring special dietary consideration;
- allergies;
- level of kidney disease;
- dialysis modality and adequacy;
- medication history;
- financial costs to patients for special diets especially in the northern regions;
- cultural and societal importance of food to First Nations' people and all Canadians; and
- need for vitamin and mineral supplements.

Assesses current knowledge level and patient/parent or caregiver identified learning needs about nutritional requirements and dietary restrictions, initiates referral to dietitian for nutrition intervention and counseling, and implements a plan in collaboration with the patient including, but not limited to, providing education and information regarding:

- diet, nutrition, and health considerations;
- reinforcement of registered dietitian's counselling and prescription;

- healthy choices and alternatives;
- blood work results as they relate to dietary therapy;
- tools and strategies to understand and manage fluid and hydration;
- need for vitamin and mineral supplements as necessary (e.g., multivitamins, folic acid, iron, sodium bicarbonate);
- phosphorus allowance;
- calcium requirements;
- potassium allowance;
- sodium reduction and allowance;
- protein requirements;
- importance and impact of protein in kidney disease and need for dietitian consult if restrictions are required;
- appropriate considerations related to level of kidney disease, dialysis modality, individual needs, and growth and development;
- avoiding herbal products that may have nephrotoxic effects;
- importance of adhering to dietary recommendations/restrictions for protein and sodium (if applicable) in an effort to delay the progression of kidney disease; potential consequences of and complications related to hyperkalemia, mineral metabolism disturbances, and excessive sodium and water intake; and
- importance of culturally appropriate and individualized approaches to nutritional interventions.

Monitors and evaluates patient response to nutrition and diet therapy including, but not limited to:

- monitoring for improved nutritional markers including height and weight;
- monitoring albumin, serum urea, calcium, phosphorus, glucose, bicarbonate, hemoglobin, and iron stores regularly;
- assessing on an ongoing basis for possible causes for inadequate response to nutrition and diet therapy;
- monitoring for potential negative outcome of over-restrictive therapeutic dietary regimes and
- modifying plan of care in collaboration with the patient, family, dietitian and other members of the healthcare team to achieve nutrition and dietary targets.

Links to clinical resources

- National Kidney Foundation. (2012). KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. http://www.kdigo.org/clinical_practice_guidelines/pdf/CKD/KDIGO_2012_CKD_GL.pdf
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Diabetes

Diabetes is the leading cause of end stage renal disease in Canada and the prevalence is increasing over time. In 2008, 32% of patients in End stage renal disease had diabetes; in 2017, that has increased to 38%. In 2008, individuals with diabetes made up 45% of new ESRD patients; in 2017, that incidence has increased to 55% of new ESRD patients (Canadian Institute for Health Information [CIHI], 2018). Risk factors for type 2 diabetes includes being overweight or obese, physical inactivity, poor nutrition, low economic status and smoking (Public Health Agency of Canada, 2018). Diabetes rates in Aboriginal Canadians with end stage renal disease are almost twice as high non-Aboriginal patients (CIHI, 2013). Also, aboriginal patients are a decade younger and are more likely to be obese (40% versus 27%) than their non-Aboriginal counterparts (CIHI, 2013). Rates of diabetes in the South Asian population are even higher at 2.3 times that of the white adult population.

In general, patients with diabetes are at greater risk for rapid progression of kidney disease than individuals without diabetes. The five-year survival rate for adults on dialysis under 65 years is low at 52% for those having a primary diagnosis of diabetes compared to 73% for those without diabetes (CIHI, 2018). People with diabetes and CKD are also at higher risk of complications. The incidence of diabetic foot ulcers leading to complications and amputations is high in the kidney disease population with diabetes (Otte et al., 2015; Subramanian et al., 2019).

Intensive glycemic management through diet, medications and physical activity are especially important for individuals with chronic kidney disease. The progression of renal failure leading to the need for renal replacement therapy can be delayed through intensive glycemic management and blood pressure control along with the use of medications to disrupt the renin-angiotensin-aldosterone system (Diabetes Canada, 2018; Kidney Disease Improving Global Outcomes, 2012). For those on dialysis, intensive glycemic management reduces the risk of developing diabetes and vascular complications. For most adults, a target A1C below 7% is recommended although for individuals who experience recurrent severe hypoglycemia or are functionally dependent or frail or have a limited life expectancy a recommended A1C target may be between 7.1 to 8.5% (Diabetes Canada, 2018). Working to achieve those targets within the context of CKD requires individuals to balance complex medical needs and daily choices in what they eat, the activities they do and the medications they take. This highlights the need to approach care incorporating self-management support and ensure patients are provided with the necessary resources, education and support to self-manage their condition (Perfetti, 2013), but it is the patient that is in charge of managing their CKD supported by the healthcare team (Canadian Institute of Health Research, 2019).

Nephrology nurses play an important role in assessing, monitoring, educating, counseling and supporting patients

with CKD and diabetes to integrate interventions to delay progression of kidney disease and reduce the risk of diabetes and vascular complications.

Pediatric conditions. Note: these standards have been written to provide guidance for care of adults with diabetes and CKD. For pediatrics, especially with type 1 diabetes, care is best provided in partnership with a pediatric diabetes team or services.

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assesses patients: current health status, understanding and knowledge of glycemic management, understanding of screening and prevention strategies and identified learning needs and self-management goals including, but not limited to:

Current health status

Assesses for modifiable and non-modifiable risk factors that contribute to diabetes and progression of diabetic kidney disease and management including, but not limited to:

Modifiable risk factors

- overweight;
- abdominal obesity;
- hypertension;
- physical inactivity;
- tobacco smoking;
- alcohol consumption; and
- glycemic management.

Non-modifiable risk factors

- first degree relative with Type 2 Diabetes;
- member of high risk population African, Arab, Hispanic, Indigenous, South Asian, Asian, low socioeconomic status);
- age \geq 40 years; and
- history of gestational diabetes or pre-diabetes.

Assesses current health status including medical history, clinical parameters including bloodwork for CKD, diabetes and cardiovascular health, medication regime and physical health including, but not limited to:

- reviewing relevant medical history including renal health and comorbid conditions;
- assessing bloodwork including level of kidney function, lipid profile and average glycemic control via HgbA1C;
- assessing glycemic control in relation to level of kidney function and intersection with renal replacement therapy;
- reviewing current medication history and regimens; and
 - considers level of kidney function and risks associated with medications as a key variable in dose adjustment and
 - medication appropriateness (i.e. need for dose adjustment/discontinuing medications, potential increased half-life of insulin);
- assess patient reported history of taking medications

- assessing physical health including signs of microvascular complications such as: nephropathy, retinopathy and neuropathy.
 - assesses patient for symptoms of urine changes;
 - assesses patient for symptoms of vision changes;
 - inspects feet for structural abnormalities and foot calluses and ulcers;
 - palpates pedal pulses; and
 - tests for loss of sensation with 10-g monofilament (CDA, 2103).

Assesses understanding and knowledge of glycemic management (diet, exercise, medications) including, but not limited to:

- understanding the relationship of diabetes to kidney disease and that kidney disease is a classically “silent” disease;
- understanding the importance of blood glucose control in delaying CKD progression;
- educating patients about goals and targets for diabetes management;
 - confirm target A1C for individual patient based on dependency & frailty, understanding also with CKD the red blood cell has a shorter lifespan than in the general population, therefore this tool may be less reliable in the renal population.
- self-monitoring of blood glucose (refer to diabetes services as needed);
 - ability to test own blood glucose;
 - awareness of how often to measure blood sugars based on medication; regime
 - ability to interpret Blood Glucose testing; and
 - ability to recognize, treat and report hypoglycemia.
- assessing for psychological, physical, and financial barriers that may prohibit recommended self-monitoring of blood glucose levels; and
- referring to diabetes services, as needed.

Assess understanding of diet including, but not limited to:

- understanding the basics of a diabetes-renal diet based on their current level of kidney function and/or treatment regime. Refer to dietitian as needed.
 - assesses understanding of impact of various foods on blood sugar;
 - assesses understanding of impact of dialysis on blood sugar (as needed);
 - understands basic dietary approaches (plate method, carb counting, low glycemic index foods); and
 - understands basic dietary recommendations in terms of glucose, lipids and fibre.

Assesses understanding of exercise including, but not limited to:

- understanding the basics of exercise (30 minutes five days per week);
- understanding impact of exercise on blood sugar;
- ability to achieve glycemic control targets while avoiding hypoglycemia;

- ensuring glycemic control is part of a multifactorial intervention strategy addressing cardiovascular risk factors;
- availability and current use of community resources to help manage diabetes; and
- exploring the impact of cultural practices and beliefs on adaptation to

Assesses diabetes medication management including, but not limited to:

- successes and challenges with medication management;
- side effects of medications;
- understanding the role of medications particularly Angiotensin Converting Enzyme Inhibitors/Angiotensin Receptor Blockers in delaying progression of kidney disease;
- assisting patients to simplify medication regimens where possible;
- educating patients about prescribed medications to manage diabetes, slow progression of kidney disease, and lower cardiovascular disease risk;
- educates patients about dyslipidemia being common in people with diabetes and CKD; and
- assessing use of dyslipidemia medication therapies and their side effects (i.e. myopathy).

Using best evidence informed guidelines, identifies, promotes and educates about screening that aids in prevention, onset and delay in progression of early nephropathy and complications including, but not limited to:

- understanding of increased risk for cardiovascular disease;
- screening for proteinuria such as persistent albuminuria (early sign of nephropathy [CDA, 2013]);
- monitoring of effectiveness and possible side effects and complications of medications to reduce proteinuria and prevent progression of nephropathy (i.e. cough, hyperkalemia, rise in creatinine with ACE inhibitors);
- blood pressure management;
- annual dilated retinal eye exam;
- routine foot exam; and
- routine follow up with primary care provider

Assesses patients with kidney disease and diabetes for foot complications such as neuropathy, vascular disease, and foot ulceration including, but not limited to:

- completing risk assessment for complications (history of previous foot ulcers, impaired sensation, poor circulation; evidence of infection, self-management behavior and knowledge. Risk assessment facilitates targeting high risk patients and tailoring education to their needs (Daly et al., 2013);
- providing foot examinations annually for patients without neuropathy, every six months for patients with neuropathy and no deformity, and every three months for patients with a history of deformity and/or vascular disease, and every one-three months for patients with a history of ulceration (Ndip et al, 2010);

- providing foot care education including: importance of daily inspection, proper nail and skin care, proper footwear, counselling to avoid foot trauma, smoking cessation and seeking prompt attention if problems occur; and smoking cessation;
- assessing for neuropathic pain;
- coordinating referral for patients with foot ulcers to a provider with expertise in diabetes foot care; and
- recognizing that any infection must be treated aggressively.

Develops and initiates a treatment plan in collaboration with the patient to manage diabetes risk factors associated with kidney disease and cardiovascular disease. The plan includes, but is not limited to:

- understanding the patient's role and promotes self-management as an integral strategy for achieving targets and goals;
- promoting patient goal setting for health behaviours using SMART goals (Specific, Measurable, Achievable, Realistic and Time-sensitive);
- assisting patients in the mastery of self-management strategies (managing dietary needs, activity level, monitoring of blood glucose, blood pressure, management of hyper/hypo glycemia);
- providing follow up and feedback for patients on progression towards SMART goals;
- providing education regarding diabetes, cardiovascular and kidney disease based on patient identified learning needs and patient goals; and
- referring to community programs (cardiac rehabilitation, nutrition classes, exercise programs, etc.).

Links to clinical resources

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Note: See section on Blood Pressure for links to blood pressure clinical resources

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Other resources supporting practice recommendations

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Cardiovascular Risk Factors

CKD is an independent risk factor for cardiovascular disease and cardiovascular disease is the leading cause of death for patients with kidney disease (Di Lullo, et al., 2015; Major et al., 2018). Dyslipidemia is highly prevalent in this population and may be indicated in the progression of CKD (Ferro et al., 2018). The incidence of cardiovascular disease is higher in the kidney disease population than in the general population and even higher in the kidney disease population with diabetes. Treatment and control of cardiovascular disease risk factors, both traditional and non-traditional are of primary importance for patients with of kidney disease (Gansevoort et al., 2013).

There is evidence to support the use of statins and dyslipidemia targets in early stages of chronic kidney disease to reduce cardiovascular risk, (Ferro et al., 2018; Hager et al., 2017). However, there is a paucity of evidence regarding treatments to reduce cardiovascular risk in patients on dialysis and those with advanced chronic kidney disease (Hager et al., 2017). These recommendations cannot be generalized to the dialysis population and those patients with advanced chronic kidney disease, therefore program specific recommendations should be followed.

Nephrology nurses are important partners with other healthcare providers and patients to assist in the assessment, education, treatment, monitoring, and evaluation of cardiovascular risk factors for patients with kidney disease.

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assesses and promotes evidence informed lifestyle modification aimed at reducing cardiovascular disease including, but not limited to:

- unhealthy food choices;
- hypertension;
- physical inactivity;
- dysglycemia;
- alcohol consumption;
- tobacco smoking;
- stress and mental health issues; and
- nonadherence.

Considers non-traditional cardiovascular risk factors associated with kidney disease including, but not limited to:

- anemia;
- excess fluid volume; and
- hyperparathyroidism.

Assesses cardiovascular medication management including, but not limited to:

- assessing current medication history and regimens;
- assessing successes and challenges with medication management; and
- assessing for side effects of medications.

Develops a plan, in collaboration with the patient, to address risk factors associated with cardiovascular disease including, but not limited to:

- encouraging self-management strategies including home blood pressure monitoring to promote greater patient understanding and responsibility, and improve outcomes;
- providing diet instruction and refers to registered dietitian as necessary;
- assists patients to simplify medication regimens where possible;
- promoting smoking cessation, healthy lifestyle choices, and maintaining healthy weight; and
- utilizing/referring patient to community-based programs (e.g., cardiac rehabilitation, nutrition classes, and exercise programs).

Provides information to patients on the management of

cardiovascular disease risk factors including, but not limited to:

- educating patients about goals and targets for cardiovascular disease risk factors;
- educating patients about prescribed medications to manage/lower cardiovascular disease risk;
- assisting patients in the development of self-management strategies (e.g., home blood pressure monitoring, diaries, logs); and
- assisting patient to master skills for self-management.

Monitors and evaluates patient response to interventions to reduce cardiovascular disease risk factors including, but not limited to:

- assessing on an ongoing basis possible causes and barriers to achieving targets for cardiovascular disease risk reduction;
- assessing for possible side-effects and/or complications of therapy;
- monitoring for improved and/or stabilized signs and symptoms related to cardiovascular disease;
- monitoring improvement in lifestyle modification behaviors to reduce cardiovascular disease risk factors; and
- modifying plan of care in collaboration with the patient and health care team to cardiovascular disease risk reduction targets.

Links to clinical resources

Kidney Disease Improving Global Outcomes (KDIGO). (2013). KDIGO 2012 Clinical Practice Guideline for Lipid Management in Chronic Kidney Disease. *Kidney International*, 3(3). <https://kdigo.org/wp-content/uploads/2017/02/KDIGO-2013-Lipids-Guideline-English.pdf>

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Acute Kidney Injury

Acute kidney injury (AKI) is characterized by a sudden loss of kidney function caused by an illness, injury, toxin or other stress to the kidneys. The loss of kidney function can occur over a number of hours or days and results in the retention of metabolic waste products and a decreased ability to regulate fluid, electrolytes and acid-base balance (Joannidis et al., 2017). The severity of renal dysfunction may be mild, requiring little intervention, to severe, necessitating renal replacement therapy. Although AKI is potentially reversible, the mortality rate is high (Kellum et al., 2013). Patients who survive AKI may not fully recover renal function and are at risk of developing chronic kidney disease (Anathhanam & Lewington, 2013)

AKI is categorized as pre-renal, intra-renal, or post renal

and refers to the area where the disruption in kidney function occurred. Pre-renal AKI results from diminished renal perfusion, and accounts for about 70% of AKI cases. Insults that lead to hypovolemia, decreased cardiac output, decreased peripheral vascular resistance and obstruction of renal vessels are all pre-renal causes of AKI (Fallon, 2015). Acute tubular necrosis accounts for the majority of cases of intra-renal AKI, often as a result of exposure to nephrotoxic agents or renal ischemia, sepsis, or exposure to nephrotoxic agents. Other causes include acute glomerulonephritis and acute interstitial nephritis. Post renal causes are least common, and are related to obstruction of urine flow anywhere in the urinary tract.

Understanding the factors involved in AKI allows the nephrology nurse the potential to identify, intervene earlier, and possibly prevent serious complications from AKI in patients who are at risk (Hulse & Davies, 2015). The nephrology nurse plays an integral role in risk factor assessment for AKI and supportive therapy of those who develop AKI until the kidney injury heals (Lameire & Kellum, 2013). The goals of supportive therapy are to maintain homeostasis and prevent life-threatening complications such as infection, fluid/electrolyte imbalance, acid-base imbalance and gastrointestinal bleeding (Chawla et al., 2017). Nephrology nurses must be aware of the phases of acute renal failure, which include onset, oliguric, diuretic, and recovery, as goals of care vary during the various phases.

Using the best available evidence and best evidence-informed guidelines, the nephrology nurse:

Assesses for common risk factors for developing AKI including, but not limited to:

- pre-existing kidney disease (the most important risk factor);
- age greater than 60;
- very young age;
- surgery especially cardiovascular;
- type 2 diabetes;
- heart disease;
- hepatorenal syndrome;
- obstructive uropathy;
- exposure to nephrotoxins (i.e. radiocontrast dye, and medications that cause intra-renal vasoconstriction such as NSAIDs);
- multisystem organ failure such as from septic shock;
- major trauma causing rhabdomyolysis from crush injuries or drug induced muscle injury;
- volume depletion or significant blood loss; and
- diagnosis of sepsis.

Assesses for causes of AKI including, but not limited to:

- * Prerenal
 - decreased cardiac output
 - myocardial infarction
 - cardiac failure
 - cardiac dysrhythmias
 - cardiac tamponade
 - vasodilation from sepsis, shock and anaphylaxis

- decreased intravascular volume
 - burns
 - vomiting and diarrhea
 - use of diuretics
 - hemorrhage
- obstruction of renal vessels
 - renal artery or vein thrombosis
 - renal artery stenosis
 - emboli
 - occlusion
 - trauma
- Intrarenal
 - Nephrotoxicity
 - drug exposure
 - toxic products of organisms
 - chemicals/heavy metals
 - pesticides
 - snake or insect venom
 - Exposure to nephrotoxic iodinated contrast medium
 - Acute glomerulonephritis
 - Lupus
 - Wegener's
 - Goodpasture Syndrome
 - Bacterial (strep) or viral infections (HIV, hepatitis)
 - Acute interstitial nephritis
 - Drug reactions especially to NSAIDs and antibiotics
 - Autoimmune disorders
 - Long-term use of NSAIDs
- Post renal
 - Obstruction of flow of urine
 - Prostate issues
 - Bladder or kidney stones
 - Trauma

Assesses patients for the following parameters, including, but not limited to:

- vital signs;
- skin integrity;
- nutritional status;
- knowledge needs of patient and family; and
- coping and support systems.

Monitors and evaluates patient response to therapy including, but not limited to:

- serum electrolytes, blood urea nitrogen, creatinine;
- fluid volume status (i.e., intake and output, edema, pulmonary edema, weight, central venous pressure);
- vital signs;
- monitoring for improvement in symptoms; and
- modifying plan of care in collaboration with the patient and health care team to achieve desired outcomes.

Assesses and monitors for progression through acute renal failure stages including, but not limited to:

Onset

- mild reduction in normal daily urine output;
- mild lethargy; and
- mild malaise.

Oliguric/Anuric Phase:

- 24 hour urine total 400 ml or less;
- electrolyte imbalances (i.e. hyperkalemia, hyperphosphatemia, hypocalcemia, metabolic acidosis);
- listlessness/fatigue;
- confusion or altered LOC related to electrolyte imbalances;
- fever;
- crackles upon lung auscultation (due to fluid overload);
- shortness of breath (due to fluid overload);
- jugular vein distention (due to fluid overload);
- periorbital, peripheral or sacral edema (due to fluid overload);
- ascites (due to fluid overload);
- capillary fragility as evidenced by easy bruising; and
- anorexia, nausea, vomiting, diarrhea, constipation.

Diuretic Phase:

- urine output of 3 to 5 liters in a 24 hour period;
- lethargy or muscle weakness (due to hypokalemia);
- decreased blood pressure (due to fluid depletion);
- dry mucous membranes (due to fluid depletion); and
- poor skin turgor and delayed capillary refill (due to fluid depletion).

Recovery Phase:

- urine output of 1500 to 1800 ml in a 24 hour period;
- stabilization of serum potassium, bicarbonate, BUN and creatinine;
- reduction in lethargy and shortness of breath; and
- reduction in adventitious breath sounds.

Provides renal replacement therapy in keeping with program guidelines.

Links to clinical resources

KDIGO Acute Kidney Injury (2012). http://www.kdigo.org/clinical_practice_guidelines/pdf/KDIGO%20AKI%20Guideline.pdf

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Other resources supporting practice recommendations

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Renal Replacement Therapies

Transplantation

Renal transplantation is the preferred renal replacement treatment for the majority of adults with chronic kidney disease because it extends their life expectancy and improves their quality of life (Augustine, 2018). It is also the leading modality for pediatric patients due to fewer hospitalizations and better mortality rates (Filler, 2016; Canadian Institute for Health Information [CIHI], 2018; USRDS, 2019). For most patients, transplantation offers a return to a healthier productive lifestyle with different dietary and fluid restrictions which patients generally find more palatable (Milovanov et al., 2018).

Nephrology nurses play an important role throughout the course of transplantation, which incorporates assessment, the surgical procedure, and post-transplant care. They are involved in the coordination, monitoring, counselling, and education of renal transplant recipients with regard to the transplant process, the associated potential complications and treatments, as well as health promoting behaviours and risk reduction.

Nurses caring for renal transplant recipients require specialty knowledge and skills to reduce problems in the early post-transplant period by prevention, anticipation and

early intervention to maximize short-term and long-term graft outcome (Urstad et al., 2018). Short-term complications are generally those seen within the first year of transplantation and are most often related to the surgery or immunosuppressive medications (Ammi et al., 2016; Conte & Secchi, 2018; Wang et al., 2019). Patients receiving a renal transplant require immunosuppressive medications to prevent rejection. These medications require special monitoring and are associated with some significant interactions with many common medications, as well as long-term complications. Concordance with these medication regimens can decline over time for reasons that are complex and multifactorial (Low et al., 2018; Taber et al., 2017) leading to graft failure. Nurses play a pivotal role helping renal transplant recipients achieve improved understanding and concordance with treatments throughout the transplant process (Jennings, 2019).

Nursing care of renal transplant recipients also relies on specialty knowledge and skills to assess for and manage long-term complications associated with renal transplantation. Long-term complications post renal transplant include rejection, infection, cardiovascular disease, hypertension, diabetes, dyslipidemia, mineral, and bone disorders, malignancies, (Baker & Marks, 2019). The incidence of cardiovascular disease post transplantation is high and remains the primary cause of mortality for kidney transplant recipients (Dogan et al., 2019).

Nephrology nurses work collaboratively with organ procurement coordinators and the interdisciplinary team to provide holistic evidence informed care to the renal transplant patient population.

(The practice recommendations addressed in this document are broad in scope and not intended to replace any existing mandatory standards related to renal transplantation.)

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Explores the possible benefits and risks of transplantation including, but not limited to:

Benefits

- increased energy, less fatigue;
- decreased mortality;
- improved quality of life over dialysis;
- ability to return to work if unable to before; and
- minimized dietary restrictions.

Risks :

- risks associated with anesthesia;
- surgical complications;
- increased risk of infection;
- lifelong medication regime;
- anxiety, depression, sadness;
- rejection of the new graft; and
- death.

Pre-emptive living donor transplantation should always be promoted as the first-line treatment for kidney failure.

Living Donor

In collaboration with the interdisciplinary nephrology/transplant team, assesses knowledge level and donor patient /parent or caregiver identified learning needs related to donation/ transplantation and in collaboration with the donor patient develops a plan to meet these learning needs including, but not limited to:

- organ donation;
- ABO compatibility;
- histocompatibility testing;
- donor evaluation including health history and physical, socioeconomic (occupation), mental health and psychosocial (willingness to donate, family dynamics and supports) assessment;
- diagnostic tests and procedures;
- exclusionary donor candidate criteria or contraindications;
- donor nephrectomy, open versus laparoscopic;
- potential benefits;
- potential risks factors including family history, personal history, existing medical conditions, and developing chronic kidney disease;
- post-operative recovery and convalescence;
- financial concerns and insurance coverage;
- follow-up care both initial and long term including monitoring of creatinine, urinalysis and blood pressure; and
- possibility of nonfunctioning graft/kidney.

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Recipient Education and Evaluation

In collaboration with the interdisciplinary nephrology/transplant team, will coordinate a program based medical and psychosocial assessment on every potential transplant recipient including, but not limited to:

- ensuring transplantation is technically possible;
- ensuring the recipient's survival are not compromised by transplantation;
- ensuring that graft survival is not limited by premature death (maximum benefit obtained from a limited resource);
- ensuring pre-existing conditions are not exacerbated by transplantation;
- identifying measure to be taken to minimize preoperative and postoperative complications; and
- informing patients of the likely risks and benefits of transplantation.

In collaboration with the interdisciplinary nephrology/transplant team, assesses knowledge level and patient/parent or caregiver identified learning needs related to transplantation and in collaboration with the patient develops a plan to meet these learning needs which may include, but is not limited to:

- initiating referral to the transplant coordinator;
- identifying possible emotional responses of family members or significant others to the request for evaluation as a potential organ donor;

- understanding diagnostic tests and procedures for the assessment of risk factors including infection, malignancy, cardiovascular, peripheral vascular disease, immunology;
- understanding prophylactic and the importance of vaccinations and immunizations pre transplant while patient is not immunosuppressed;
- understanding medical and psychosocial evaluation by the multidisciplinary transplant team including surgeon, transplant nephrologist, social worker, recipient coordinator, anesthetist;
- understanding transplant wait list and protocols for patient selection when organ/graft available;
- understanding sources of donation including living (related, unrelated, paired exchange) and deceased (after brain death, after cardiac death, extended criteria) donor transplants;
- identifying advantages and disadvantages of living and deceased donation;
- understanding graft survival outcomes and importance of adherence to treatment plan;
- notifying the transplant program of changes in health status;
- appreciating the need to be healthy at the time of transplant and the possibility of not receiving a transplant if changes have occurred that would prevent a successful transplant outcome;
- being aware of possible dialysis pre transplant;
- understanding transplant surgery;
- understanding risks and benefits of transplantation;
- understanding the need for immunosuppressive therapy;
- being aware of the convalescence post-operative course, length of stay, potential complications, diagnostic tests and procedures, long-term follow-up and possibility of recurrence of original disease;
- understanding patient responsibilities, expectations and health goals;
- understanding the effect on lifestyle including disability benefits;
- exploring drug coverage for medications post-transplant; and
- referring to social worker for financial evaluation and to identify sources of social and financial support, as necessary.

Assesses current health promoting behaviours and health management strategies including, but not limited to:

- current health habits and activities to promote health;
- current self care management abilities and adherence to treatment plan; and
- predisposing cardiovascular risk factors (e.g., hypertension, diabetes, dyslipidemia, smoking, obesity).

Assesses immunologic status for common viruses, as outlined in program guidelines, with particular attention to cytomegalovirus and Epstein-Barr virus status to determine risk of infection including, but not limited to:

- cross matching and histocompatibility testing including tissue typing, lymphocyte cross match, cytotoxic screening and panel reactive antibodies;

- previous transplants, blood transfusions and pregnancy;
- history, status and presence of active autoimmune diseases;
- TB testing;
- Hepatitis B and C;
- viral and fungal screening including cytomegalovirus viral load, Epstein-Barr viral load, HIV and varicella; and
- cytomegalovirus status of donor.

Administers prophylactic vaccinations and immunizations virus treatments (cytomegalovirus and Epstein-Barr), as per unit protocol.

Post-operative care and management of the kidney transplant recipient

Follow-up (inpatient care)

Assesses knowledge level and patient/parent or caregiver identified learning needs related to the anticipated post-operative course, possible tests and procedures. Collaborates with the patient's multidisciplinary team to develop a plan to meet these needs. The plan includes, but is not limited to:

- pain management;
- blood tests to monitor graft function, immunosuppressive medication levels, and potential complications;
- biopsies;
- ultrasounds;
- scans;
- nutrition and fluid requirements;
- activity level; and
- signs and symptoms to report.

Assesses fluid volume status and electrolyte balance according to unit-based policies and protocols including, but not limited to:

- blood pressure and pulse rate;
- fluid intake and output;
- monitoring of daily weight loss or gain;
- skin turgor;
- mucous membranes;
- edema (peripheral, sacral, periorbital) ;
- central venous pressure monitoring;
- heart sounds;
- jugular venous distention;
- breath sounds;
- respiratory rate;
- cough and/or dyspnea;
- serum electrolytes;
- serum urea;
- serum creatinine; and
- complete blood count.

Implements and evaluates a plan to manage fluid and electrolyte balance, as prescribed and reports patients' response deviations from established protocols and parameters to the appropriate healthcare provider. The patient may require dialysis for hyperkalemia or fluid volume overload if delayed graft function post-transplant.

Assesses respiratory status/function for to prevent post-operative atelectasis and risk for respiratory infection including, but not limited to:

- respiratory rate;
- rhythm and depth;
- cough;
- character and consistency of sputum;
- breath sounds;
- laboratory results;
- fever;
- pain;
- oxygen saturation per pulse oximetry;
- arterial blood gas results;
- level of consciousness; and
- use of narcotics.

Facilitates deep breathing and coughing exercises and mobilization to prevent post-operative atelectasis and risk for respiratory infection and reports patients' response deviations from established protocols and parameters to health-care provider.

Assesses for signs and symptoms of graft dysfunction, including rejection, and reports deviations from established protocols and parameters including, but not limited to:

- increased creatinine and urea;
- abnormal electrolyte levels
- immunosuppressive drug levels falling outside of unit based protocols or patient specific parameters;
- decreased or cessation in urine output;
- swelling or pain over the graft;
- fever;
- elevated blood pressure;
- weight gain;
- edema; and
- decreased respiratory status.

Assesses for signs and symptoms of urinary tract infection and/or catheter and/or urethral obstruction including, but not limited to:

- decreased urine output;
- bladder distension and or spasms;
- sense of urgency; and
- lower abdominal pain or burning.

Maintains urinary catheter patency and initiates interventions to decrease risk of UTI as per unit-based protocols and reports deviations from established protocols and parameters to appropriate healthcare provider.

Assesses transplant operative site including, but not limited to:

- swelling
- blisters;
- redness;
- drainage;
- bleeding;
- tenderness; and
- impaired healing.

Assesses surgical drains for patency and amount, colour and consistency of drainage.

Provides wound care as per unit guidelines.

Assesses for signs and symptoms of wound complications such as lymphocele, hematomas and abscess formation that may cause pressure to the transplant site resulting in reduced kidney function including, but not limited to:

- graft tenderness;
- decreased or cessation of urine output;
- elevated creatinine;
- pelvic/abdominal swelling;
- leg swelling on the same side as the graft;
- urinary incontinence; and
- drainage from wound or increased drainage from surgical drains.

Assesses for signs and symptoms of infection and reports deviations from established protocols and parameters including, but not limited to:

- fever;
- chills;
- wound drainage;
- elevated white blood cell count;
- thrush/oral lesions;
- rhinorrhea;
- cough;
- dysuria;
- hematuria;
- urinary frequency;
- foul smelling urine;
- cloudy urine;
- flank pain;
- nausea and or vomiting; and
- rash.

Administers immunosuppressive and other medications as ordered. Monitors and evaluates patient response to medication therapy including, but not limited to:

- patient reported signs/symptoms;
- laboratory results of drug levels;
- serum creatinine;
- complete blood cell count; and
- liver function tests as necessary.

In preparation for discharge, assesses current patient knowledge level and self-management abilities regarding immunosuppressive and other medication therapies. Develops a plan in collaboration with the patient and appropriate healthcare provider to meet these needs including, but not limited to:

- type, purpose, dosage and frequency of administration, and route;
- side effects;
- drug interactions (with other medications, foods and beverages including herbs and grapefruit);
- precautions;
- over-the-counter medications to avoid, restrict or use
- importance of reporting medications ordered by other healthcare providers to transplant team

- importance of immunosuppressant blood trough levels
- what to do if medication vomited or forgotten; and
- signs and symptoms to report.

Assesses knowledge level, patient-identified learning needs and self-management abilities related to discharge planning in collaboration with the patient, and develops a plan in collaboration with the patient and multidisciplinary team to meet these needs including, but not limited to:

- medication management;
- wound management;
- nutritional changes;
- increased susceptibility to infection;
- increased susceptibility to severe neurological forms of West Nile virus;
- signs and symptoms of infection;
- signs and symptoms of rejection;
- signs and symptoms of mechanical complications such as urinary retention;
- activity limitations and /or lifestyle modifications; and
- discharge plan including plan for follow up.

Promotes participation in care and self-management as able.

Post-transplant follow-up (out-patient care)

Assesses for signs and symptoms of acute rejection and chronic allograft nephropathy including, but not limited to:

- graft swelling and tenderness;
- decreasing GFR;
- increasing creatinine trend;
- immunosuppressive drug levels falling outside established protocols or patient tailored regime;
- concordance with immunosuppressive and other medication regimen;
- proteinuria;
- hematuria;
- hypertension;
- weight gain;
- edema; and
- decreased urine output.

Assesses for signs and symptoms of infection and reports deviations from established protocols and parameters including, but not limited to:

- fever;
- chills;
- wound drainage;
- elevated white blood cell count;
- elevated creatinine;
- thrush/oral lesions;
- rhinorrhea;
- cough;
- dysuria;
- hematuria;
- urinary frequency;
- foul smelling urine;
- cloudy urine;
- flank pain; and
- rash.

Assesses current knowledge level and learning needs about infection associated with renal transplantation and develops a plan to meet these learning needs including, but not limited to:

- preventive measures and health practices to reduce exposure to infectious agents including immunizations, antibiotic prophylaxis for dental procedures
- signs and symptoms of infection; and
- reporting and seeking help.

Common Infections:

- most common infections 0–1 month post-transplant include candida, urinary tract infection, wound infection, line sepsis, pneumonia, and herpes virus and donor derived HIV and West Nile (Fishman, 2017);
- most common infections 1–6 months post-transplant infections include: poliovirus, cytomegalovirus, pneumocystis jiroveci, Epstein-Barr virus, hepatitis B and C, aspergillus fumigatus, candida, nocardia, toxoplasma gondii, listeria monocytogenes, histoplasmosis, coccidioidomycosis (Fishman, 2017).
- most common infections beyond six months post-transplant include community-acquired infections cytomegalovirus retinitis, cryptococcus, polyoma virus, mycobacteria (Cowan et al., 2018).

Assesses transplant immunosuppression and other medication management including, but not limited to:

- review prescribed medication regimen;
- ability to manage regimen and adherence to regimen including reasons for non concordance such as side-effects and financial difficulties;
- explore patient concerns and perceived barriers and challenges with regimen;
- knowledge deficits regarding immunosuppressive medications; and
- bowel habits for potential changes in medication absorption or gastrointestinal function.

Develops a plan in collaboration with the patient and addresses knowledge deficits, concerns, and barriers around immunosuppressive medication regimen.

Assesses for common post-transplant cardiovascular risk factors including, but not limited to:

- hypertension;
- diabetes: pre-existing or new onset;
- hyperlipidemia;
- obesity; and
- smoking
 - assesses patient for smoking;
 - explores patient level of motivation for smoking cessation;
 - provides information about effect on health in the context of renal transplant and increased risk for cardiovascular disease; and
 - provides information about smoking cessation programs.

Assesses patient for signs and symptoms of malignancy including, but not limited to:

- persistent unexplained fever;
- weight loss;
- new lumps or masses; and
- skin lesions.

Assesses current knowledge level and patient-identified learning needs about the increased risk for malignancy associated with anti-rejection medications and develops a plan in collaboration with the patient to meet these learning needs including, but not limited to:

- increased risk for some types of cancers (i.e. non-melanoma skin cancer, lymphoproliferative disorders, cancer of the kidney and urinary tract, cervical carcinoma, liver cancer);
- importance avoiding sun exposure and wearing of sun screen;
- importance of checking skin regularly to note changes in moles and pigmentation;
- importance of regular screening investigations such as: Papanicolaou smear, mammograms, prostate specific antigen screening, and colorectal screening;
- importance of reporting persistent fever, weight loss, new lumps or masses, skin lesions;
- importance of avoiding first and second-hand smoke;
- importance of immunizations (no live vaccines); and
- importance of regular follow up with transplant team, family doctor and other specialists as applicable.

Assesses for risk factors, as well as signs and symptoms of post-transplant mineral and bone disorders including, but not limited to:

- bone or joint pain;
- pre-transplant bone and mineral disorders (hyperparathyroidism, dialysis-related amyloid bone disease);
- avascular bone necrosis;
- obesity; and
- immunosuppression-related bone disease.

Assesses current knowledge level and patient-identified learning needs about increased risk for bone disease and treatments to reduce risk post transplant. Develops a plan in collaboration with the patient to meet these learning needs.

Educates patients about increased risk for bone disease including, but not limited to:

- the potential need for calcium supplements, vitamins, vitamin D, bisphosphonates;
- bone mineral density testing;
- weight-bearing exercise;
- limiting alcohol consumption; and
- importance of not smoking.

Assesses knowledge level, patient-identified learning needs, and readiness to learn of patients with progressive renal insufficiency and chronic allograft deterioration. In collaboration with the patient and interdisciplinary healthcare team develops a plan to meet these needs. The plan may include but, is not limited to:

- grief counselling and psychological support;
- education about mineral metabolism and progressive renal insufficiency;
- education about nutritional and fluid requirements;
- education about anemia related to progressive renal insufficiency;
- education about dialysis treatment modalities and conservative management;
- access planning;
- information about advance directives;
- information about chronic kidney disease care delivery setting and other relevant healthcare service information;
- collaboration with, and/or referral to chronic kidney disease clinic;
- collaboration with, and/or referral to dialysis program; and
- referral to transplant coordinator.

Pediatric Considerations

Within the field of kidney transplantation, pediatric recipients are a unique population. The incidence of kidney disease in children in Canada is less than that seen in the adult population (Turner et al., 2016). The pediatric transplant recipient can range in age from 1 to 18 years. Care must envelope specific transplant treatment and also be adapted for the age of the recipient. Parents are an integral part of the team. If a transplant is done when a child is very young education of the child/teen must be ongoing, as the child ages. Additional support for teens and parents must be provided as the youth adapts to the self-management role during development to adult maturity.

There are several crucial concepts of importance that must be considered when planning the care of the pediatric renal transplant recipient. The nephrology nurse working with the pediatric renal transplant population should incorporate the concepts in the practice recommendations previously listed.

Important concepts of pediatric renal transplant care for incorporation in the practice recommendations include, but are not limited to:

- Primary diagnosis
 - leading causes of renal failure in children include, but are not limited to:
 - renal hypoplasia/dysplasia
 - congenital obstructive uropathies
 - focal glomerular sclerosis
 - lupus erythematosus
 - goal: pre-emptive transplant whenever possible; greatly impacts planning and timing for transplantation (Verghese, 2017);
 - corrective or constructive urological surgery may be required pre-transplant.
- Donor source
 - living donation is strongly encouraged as there is statistical evidence of improved success rates (Hebert et al, 2017):
 - particularly true with younger aged children;

- facilitates planning of transplant surgery which can be particularly important in the very small child;
- an adult-sized kidney from a relatively young adult is the best option (Chaudhuri et al., 2016).
- Immunology
 - infections:
 - higher risk of primary and new strain CMV, EBV and BKV infections
 - higher risk of diarrheal infections;
 - high risk of other viral community acquired infections (Skaggs Huang & Danziger-Isakov, 2019).
 - vaccinations:
 - imperative all immunizations be up to date pre-transplant;
 - 'live' vaccinations cannot be administered post transplant;
 - ongoing monitoring of protection required;
 - if immunity becomes non-existent recipient must be informed regarding precautionary measures.
 - immunosuppression:
 - induction therapy is routinely used in the majority of pediatric transplants (Mincham et al., 2017);
 - maintenance therapy is generally higher than that required in the adult population.
- Complications
 - surgical considerations related to transplanting an adult sized kidney into a child (Goldsmith et al, 2010):
 - vascular challenges;
 - fluid requirements.
 - medical:
 - major challenges related to fluid management continue
 - increased risk of PTLD secondary to increased need for higher requirements of immunosuppression and primary EBV infection, careful monitoring essential
- Growth and development
 - lack of growth indicates need for transplantation even if child has not reached CRF Grade V (non-responsive or unable to use growth hormone);
 - catch-up growth can be seen in the young child post-transplant (Gil et al, 2018; Winterberg & Garro, 2019).
- Psycho-social concerns
 - family
 - disruption of family unit (relocation of parent with child to be close to treatment).
 - adolescent/youth
 - high risk of graft loss during adolescence (Kabore et al., 2017) (care given must anticipate and decrease risk);
 - transition planning of transfer of care of the youth to an adult program is imperative for both pediatric and adult care teams.

Links to clinical resources

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Hemodialysis

Hemodialysis is a common renal replacement therapy offered in hospital based units, freestanding units not in hospitals, or as a self-care home modality. Prescriptions and methods for hemodialysis vary depending on the individual.

Hemodialysis Vascular Access

Despite technological advances and strengths in hemodialysis programs, the key to successful hemodialysis remains the ability to establish functional vascular access. The arteriovenous fistula is considered the gold standard for access

related to its decreased complication rate such as infection (Bylsa et al., 2017; Duque et al., 2017). KDOQI (2019) suggests a patient-focused approach to access by considering individual patient needs and preferences when choosing access and planning for future access. KDOQI considers it reasonable and important to ensure that the predetermined dialysis access is usable to provide the prescribed dialysis when it is determined that patient will initiate the planned dialysis (e.g. Av access is mature and ready for cannulation). Nephrology nurses are responsible for following infection prevention and control policies and protocols when accessing any type of hemodialysis access. Access is closely linked to adequacy of the treatment (Malovrh, 2017). Adequate dialysis decreases morbidity and mortality.

(a) Arteriovenous Fistula/Arteriovenous Graft

Using current and available evidence and evidence informed guidelines, the nephrology nurse:

Assesses patients for, and if appropriate, promotes arteriovenous fistula as first-line, long-term hemodialysis access including, but not limited to:

- if appropriate, providing education about the benefits of arteriovenous fistulas over other forms of vascular access;
- identifying appropriate patients for referral for arteriovenous fistulas;
- exploring concerns around arteriovenous fistula creation, clarifying misconceptions and developing a plan with the patient to address concerns;
- providing arteriovenous fistula candidates with instructions regarding limb restriction and protecting the chosen arteriovenous fistula limb and blood vessels from injury that may compromise creation and development of an arteriovenous fistula; and
- providing information about arteriovenous grafts and central venous catheters if an arteriovenous fistula is not an option or appropriate.

Assesses the arteriovenous fistula/graft and limb after creation and prior to each hemodialysis to determine physical and functional readiness for use including, but not limited to:

- impaired healing of the incision site over the new arteriovenous fistula/graft;
- swelling;
- redness;
- bleeding/bruising;
- drainage;
- tenderness/pain;
- aneurysm formation;
- skin irritation;
- maturation;
- direction of blood flow in new arteriovenous fistula/graft;
- cyanosis of the finger tips and delayed capillary refill of the nail beds;
- numbness, tingling, pain in extremity;
- presence and quality of bruit and thrill;
- temperature for abnormal warmth or coolness; and
- comparative temperature of digits in both access and non-access limbs.

Monitors, records, and reports the access flow of the arteriovenous fistula/graft as per unit guidelines.

Addresses any concerns from the patient regarding arteriovenous fistula/graft access.

Develops, documents, and follows a cannulation plan.

Cannulates arteriovenous fistula/graft in accordance with established unit protocol and using CANNT Vascular Access Guidelines for management of vascular access in hemodialysis patients (CANNT, 2020) as a guideline

Uses appropriate cleaning and infection control techniques when assessing and caring for arteriovenous fistula/graft

Assesses the patients' arteriovenous fistula/graft for complications during hemodialysis treatment including, but not limited to:

- cannulation difficulties;
- pain;
- bleeding;
- infiltration;
- hematoma;
- blood flow rates;
- arterial/venous pressures outside established parameters; and
- changes in access flow.

Instructs the patient with an arteriovenous fistula/graft to report signs and symptoms suggestive of complications, and seek medical attention for, but not limited to:

- fever;
- chills;
- bleeding;
- drainage;
- absence of/or diminished thrill;
- swelling of access limb;
- skin irritation; and
- numbness, tingling, and/or decreased motor function of the access limb.

Educates the patient about possible complications associated with an arteriovenous fistula/graft including, but not limited to:

- infection;
- thrombosis;
- stenosis;
- bleeding;
- steal syndrome;
- failure of fistula maturation; and
- venipuncture infiltration.

Provides instruction regarding the appropriate cleaning of the arteriovenous fistula/graft.

Educates and instructs patients with an arteriovenous fistula/graft about the care and protection of the access and access limb including, but not limited to:

- checking the thrill/pulse in access daily;
- using the access site only for dialysis;
- protecting from injury such as bumps and cuts;

- avoiding blood pressure checks, injections, and blood drawing in the access limb and request blood drawing from hand veins;
- avoiding sleeping on access limb;
- avoiding tight jewelry or tight clothing is worn over access site; and
- avoiding heavy lifting.

Notifies the appropriate health care provider regarding assessment findings that preclude or alter use of the access and hemodialysis treatment plan.

(b) Central Venous Catheter

Using the best available evidence and best evidence informed guidelines, the nephrology nurse:

Assesses the patient for complications post insertion of a central venous catheter including, but not limited to:

- airway management and/or respiratory arrest;
- respiratory distress;
- cyanosis;
- bleeding, bruising, or swelling;
- hypotension with tachycardia;
- cardiac arrhythmia;
- catheter and dressing integrity; and
- pain.

Ensures that central venous catheter tip placement is verified after new catheter insertion before proceeding with hemodialysis treatment.

Assesses the patient and central venous catheter access and exit site prior to each treatment including, but not limited to:

- patency;
- redness;
- discharge;
- swelling;
- bruising;
- bleeding;
- tenderness;
- line integrity;
- neck and facial swelling; and
- any concerns from the patient regarding central venous catheter access.

Assesses the patients' central venous catheter access for complications during hemodialysis treatment including, but not limited to:

- pain;
- bleeding;
- blood flow rates;
- arterial/venous pressures outside established parameters;
- respiratory distress; and
- catheter integrity.

Administers a thrombolytic agent, i.e. CathFlo Activase (alteplase), as per unit protocol or physician/appropriate healthcare provider orders for treatment of central venous catheter dysfunction.

Educates the patient about possible complications associated with hemodialysis central venous catheter access including, but not limited to:

- infection;
- central vein stenosis/thrombosis;
- catheter occlusion/fibrin sheath formation;
- catheter malfunction;
- bleeding;
- air or thrombo embolism;
- hemothorax/pneumothorax/cardiac tamponade; and
- vascular erosion, laceration, perforation.

Hemodialysis Adequacy

Assesses the patient on an ongoing basis for signs and symptoms of inadequate hemodialysis including, but not limited to:

- prolonged recovery time post dialysis;
- fatigue;
- hypertension/numerous antihypertensive medications;
- abnormal sleep patterns/insomnia;
- worsening nutritional status; loss of appetite/malnutrition;
- altered taste;
- nausea;
- vomiting;
- pruritis;
- weight loss/gain;
- anemia;
- secondary hyperparathyroidism/bone disease;
- neuropathy;
- restless legs;
- abnormal electrolytes;
- pericarditis/ left ventricular hypertrophy;
- decline in cognitive function /difficulty concentrating; and
- delayed growth and development or weight gain in pediatric patients.

Assesses possible causes for hemodialysis delivered dose parameters that are below the minimum acceptable level (i.e. urea clearance < 65% or Kt/V < 1.2) including, but not limited to:

- inadequate extracorporeal blood flow rate/low pump speeds;
- inadequate dialysate flow;
- shortened treatment length due to frequent alarms, clinical complications and shortened treatment times;
- inadequate access blood flow;
- recirculation;
- arteriovenous fistula/graft stenosis;
- error in sampling procedure;
- inappropriate dialyzer size or clearance;
- inadequate dialyzer priming;
- excessive dialyzer clotting; and
- incorrect needle placement or reversal of blood lines.

Educates and develops a plan in collaboration with the patient to achieve adequate dialysis treatments including, but not limited to:

- adhering to prescribed hemodialysis dose including the length and frequency of treatments;
- understanding possible consequences and complications related to inadequate hemodialysis adequacy;
- maximizing extracorporeal blood flow rate/pump speeds;
- minimizing complications such as hypotension and cramps that potentially shorten hemodialysis time;
- appropriate needle size and placement; and
- adherence to dietary and fluid restriction.

Collects data and participates in quality assurance activities to improve hemodialysis adequacy as multidisciplinary team member.

Hemodialysis Treatment and Complications

Confirms hemodialysis prescription and orders prior to initiating treatment including, but not limited to:

- dialyzer type and size;
- electrolyte/molecular composition of dialysate;
- frequency and length of treatment;
- blood flow (if appropriate);
- dialysate flow rate;
- anticoagulation;
- dialysate temperature;
- ultrafiltration profiling;
- sodium profiling; and
- target weight /ultrafiltration fluid amount.

Reviews and assesses the most recent laboratory tests prior to hemodialysis treatment and assesses for discrepancies with dialysis prescription.

Assesses the patient's interdialytic health status/health concerns for complications and/or changes including, but not limited to:

- dizziness, headache or blurred vision;
- weakness, fatigue;
- decreased cognitive function and/or mental health;
- hypotension;
- feeling unwell/decreased level of activity;
- fever, chills;
- nausea;
- vomiting;
- diarrhea, constipation or tarry stool;
- urgency or frequency of urination;
- loss of appetite;
- degree of thirst;
- insomnia;
- pain;
- chest pain or palpitations;
- shortness of breath, dyspnea;
- new medications, changes in medication dosing, or discontinued medications;
- bleeding;
- bruising;
- falls, injuries;
- increased post treatment recovery time; and
- medical/surgical treatments or procedures.

Assessment includes:

- symptom onset;
- location/radiation;
- duration;
- intensity/character; and
- aggravating and relieving factors.

Collaborates with appropriate healthcare provider and the patient to develop and implement a plan of care to improve hemodialysis adequacy.

Completes a focused physical assessment of the patient before, during, and after hemodialysis including, but not limited to:

- weight (pre and post dialysis);
- temperature;
- blood pressure (sitting, standing and/or lying if applicable);
- heart rate;
- respiratory rate and quality;
- edema (peripheral, facial, sacral, periorbital, fontanel);
- jugular venous distention;
- intake (oral, parenteral, intradialytic);
- output including all fluid losses;
- level of consciousness and orientation;
- heart sounds (if applicable);
- lung sounds;
- complaints of pain;
- signs of bleeding and
- unusual weakness or change in level of functioning.

Assesses hemodialysis equipment prior to hemodialysis initiation for:

- disinfection procedures and residual testing as per facility policy;
- completion of alarm testing, functioning alarms and parameters set as per facility policy;
- integrity of extracorporeal circuit and absence of kinking and air;
- dialysate type, composition, conductivity and temperature;
- preparation of prescribed dialyzer as per facility policy, and absence of air and
- water treatment congruent with unit policy.

Assesses the patient during the hemodialysis treatment to ensure that access is secure (i.e. needles and CVC connections secure and access is visible).

Assess the patient throughout the hemodialysis treatment and monitors the hemodialysis machine and extracorporeal circuit for complications and responds to unexpected outcomes including, but not limited to:

- hypotension;
- muscle cramping;
- chest pain;
- disequilibrium syndrome;
- air embolism;
- hemolysis;
- bleeding/hemorrhage/exsanguination;
- blood leak;
- clotting of extracorporeal circuit;
- cardiac events (e.g., dysrhythmias, angina, uremic pericarditis, cardiac arrest);

- dialyzer reaction;
- pyrogenic reaction and
- infection.

Engages the patient in the hemodialysis treatment and encourages participation and self-management when possible.

Collaborates with the patient/parent or and multidisciplinary team/healthcare provider to evaluate the hemodialysis treatment, set treatment goals, and revises the plan of care as necessary to optimize treatment and prevent and/or minimize complications for next treatment.

Assesses knowledge needs and develops and implements a plan in collaboration with the patient regarding hemodialysis therapy and associated treatments including, but not limited to:

- diet/fluid;
- anemia;
- bone and mineral metabolism;
- medications; and
- care of access.

Medication Management

Assesses medication regimen and develops a plan with the patient that includes, but is not limited to:

- current medication regimens, successes, and challenges;
- assists the patient to simplify medication regimens;
- administers prescribed medications during the hemodialysis treatment;
- identifies indications and interactions for commonly administered hemodialysis medications (e.g., erythropoiesis stimulating agents, iron preparations, vitamin D sterols, antibiotics, thrombolytic agents);
- completes and documents a medication history, as per unit policy, and assesses for any dosing changes, new or discontinued medications with each treatment; and
- educates the patient/ parent or caregiver about medications, including timing in relation to hemodialysis schedule and assists patient to simplify medication regimen where possible.

Infection Control Practices

Follows unit-based infection control procedures for:

- preparing the dialysate, extracorporeal system and patient supplies;
- providing patient care during treatment initiation, dressing changes, and discontinuation;
- cleaning and disinfection of equipment and work area between patient appointments;
- handling medications;
- handling and disposal of contaminated supplies;
- adherence to infection and prevention and control measures;
- ensures appropriate isolation techniques;
- vaccinations for influenza and pneumonia, as per unit policy;
- tuberculosis if pertinent to patient population;
- screening patients for antibiotic resistant organisms (i.e., Methicillin Resistant Staphylococcus Aureus, Vancomycin Resistant Enterococcus), as per unit policy; and
- follows unit policy for initial testing, vaccination, and follow-up of hepatitis B and C.

Adheres to unit policies related to prevention and transmission of blood-borne pathogens:

- ensures inspection of the internal pressure tubing set and pressure sensing port for possible blood contamination;
- uses an external transducer protector and alarm capabilities as indicated in the manufacturer's instructions;
- assesses the external transducer protector for wetness. If this becomes wet, it is replaced immediately and inspected. If fluid is visible on the side of the transducer protector that faces the machine, ensures qualified personnel should open the machine and check for contamination after the treatment is completed;
- ensures that if contamination has occurred, the machine is taken out of service and disinfected before further use on another patient.

Links to clinical resources

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- Hemodialysis Adequacy, Peritoneal Dialysis Adequacy, and Vascular Access. KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations. [http://www.ajkd.org/issue/S0272-6386\(06\)X0213-5](http://www.ajkd.org/issue/S0272-6386(06)X0213-5)
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- KDOQI Clinical Practice Guideline for Vascular Access: 2019 Update. [https://www.ajkd.org/article/S0272-6386\(19\)31137-0/fulltext](https://www.ajkd.org/article/S0272-6386(19)31137-0/fulltext)

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- Canadian Association of Nephrology Nurses and Technologist (CANNT). (2020). *Vascular Access Guidelines*.
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Other resources supporting practice recommendations

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Home Dialysis Therapies

Hemodialysis and peritoneal dialysis, in their various forms, may be self-managed in a limited or fully independent capacity at self-care facilities or at home. There is a renewed interest in home dialysis with newer, more user-friendly technology, an acceptance of shared decision making with dialysis modality selection and a general belief in the benefits to the patient and the healthcare system (Harwood & Dominski, 2017).

Nephrology nurses play an integral role in the coordination, monitoring, counseling and education of patients and their family/caregiver undertaking home dialysis therapies. Ongoing education and support for the patient and caregiver(s) is vital to reduce caregiver fatigue and burnout and ensure ongoing success (Walker et al., 2015). In providing effective instruction for home hemodialysis self-managed dialysis therapies, nephrology nurses apply principles of learning and education theory that are age and developmentally appropriate.

Using the best available evidence and best evidence-informed guidelines, the nephrology nurse:

Assesses current knowledge and motivating factors to promote shared decision making regarding dialysis modalities including, but not limited to:

- personal experiences
- preferences
- relationships
- culture
- ethnicity
- health literacy
- level of education and/or
- socioeconomic level

Provides information and clarifies misconceptions about home dialysis modalities and explores patient home dialysis modality preference.

Explores the possible benefits and barriers of home dialysis modalities including, but not limited to:

3. Benefits

- increased control over illness;
- greater opportunity for adequate dialysis;
- convenience;
- comfortable environment;
- increased time for daily activities;
- decreased travel time;
- increased dialysis schedule flexibility;
- increased time with family;
- increased quality of life
- greater independence and control over treatments;
- less exposure to organisms found in dialysis centers; and
- decreased cost to healthcare system

Barriers

- increased responsibilities and caregiver burden;
- decreased cognitive ability and inadequate vision;

- lack of social supports;
- unstable living arrangements;
- age or the effects of aging;
- comorbid status;
- nonadherence;
- language;
- increased treatment time required for setup and cleaning;
- potential expenses of electricity and water;
- supply management;
- medication administration;
- training time commitment;
- possible increased stressors; inability to cope with the burden;
- accommodation requirements during training period; and
- child care requirements during training.

Home Hemodialysis

There are many different types of home hemodialysis therapies with varying prescriptions available to ensure the optimal therapy to patients. They include conventional hemodialysis, shorter more frequent dialysis therapy and, long nocturnal hemodialysis. The goal of determining an individualized, optimal prescription is a balance of benefit and burden to address patient needs. (Lockridge et al., 2015).

Using the best available evidence and best evidence informed guidelines, the nephrology nurse assesses:

Patient suitability for home hemodialysis including, but not limited to:

- physical stability;
- nutritional status;
- communication ability;
- ability to maintain self-care;
- psychological – coping ability;
- cognitive suitability; and
- social support and person(s) to be involved in training.

The home environment suitability for home hemodialysis including, but not limited to:

- cleanliness;
- local ordinances regarding waste disposal, building permits, etc;
- water and plumbing;
- electricity;
- telephone access; and
- space for supply storage and equipment.

Known contraindications to home hemodialysis including, but not limited to:

- structurally unstable dwelling and or the presence of excessive dampness, mold, vermin and environmental pollutants;
- inadequate storage room;
- inadequate telephone service;
- unstable and/or inadequate electrical supply;
- nonpotable water supply with inadequate pressure;
- inadequate plumbing and sewage system;
- unstable medical conditions;
- lack of suitable vascular access;

- unstable behaviour problems (psychosis, anxiety, injection drug use, alcoholism);
- contraindications to anticoagulant use; and
- severe and unstable hypotension.

Please refer to the previous section on hemodialysis for nephrology nursing standards relating to vascular access, adequacy, treatment and complications, and infection control.

Incorporates information from a variety of sources and completes a learning needs assessment considering, but not limited to:

- current knowledge level and patient identified learning needs in relation to home hemodialysis dialysis;
- health history and laboratory values;
- readiness and ability to learn including: current health status and symptoms, effects of medications, mental status, previous knowledge and experiences, motivation, health behaviours and attitudes, and coping skills;
- maturational/developmental readiness including: life experiences, literacy, vocabulary, physical barriers, and problem-solving abilities;
- cultural, ethnic, and religious background;
- patient preferred learning style;
- socioeconomic status; and
- social support networks.

Develops and implements a home hemodialysis learning plan in collaboration with the patient/caregiver/support person to meet identified learning needs.

The plan incorporates the learning needs assessment and also takes into consideration factors that may influence the training process and length of training completion including, but not limited to:

- the knowledge, skills, and abilities to be achieved as a result of education;
- learning materials appropriate to age, gender, culture, religious orientation, education, language, reading level, and any physical barriers;
- content that is appropriate and understandable;
- realistic and achievable goals;
- an interactive process;
- therapeutic relationship;
- opportunity for feedback and clarification;
- learning or behavioral outcome;
- nurse/patient ratio; and
- different types of home hemodialysis therapies and different prescriptions.

The plan includes, but is not limited to:

- learning objectives, expected duration of treatment and criteria for successful completion;
- benefits, responsibilities and expectations of the program;
- patients' rights and responsibilities;
- transitional process from training to home;
- return demonstration and other evaluation methods;
- communication with health care members;

- resources;
- review of kidney function;
- principles of dialysis;
- concept of dry/goal/target weight;
- dialysis prescription;
- goals of treatment;
- physical assessment, vital signs, fluid
- access management and care;
- dialysis techniques and procedures;
- dialysis schedules;
- possible complications and risks;
- signs and symptoms to report;
- identifying and managing and reporting problems or concerns that should be reported to the dialysis program;
- what to do and who to call in case of emergency;
- troubleshooting technical problems;
- diet/nutritional considerations;
- infection control measures;
- medication administration;
- specimen collection;
- maintenance of treatment records keeping;
- lifestyle adaptations;
- mobility and activity;
- environment considerations for equipment and procedures;
- financial considerations;
- ordering and inventory of supplies;
- care and cleaning of equipment; and
- disposal of contaminated waste and dialysate.

Collaborates with the patient/parent or caregiver, multidisciplinary team/healthcare provider to set treatment goals, evaluate the home hemodialysis treatment, and revise the plan of care as necessary to optimize treatment and prevent and/or minimize complications.

Provides ongoing monitoring of patient receiving home hemodialysis including, but not limited to:

- vital signs including blood pressure;
- degree of independence or assistance required for performing treatment;
- hemodialysis treatment records;
- laboratory results;
- dialysis adequacy;
- fluid balance;
- management of problems and emergencies;
- vascular access;
- medications reconciliation;
- knowledge of dialysis procedures;
- new learning needs;
- level of activity;
- quality of life;
- satisfaction of care and care burden;
- incidence of infectious complications; and
- nutrition.

Collects data and participates in quality assurance activities to improve home hemodialysis outcomes including the following quality indicators, but not limited to:

- training time;
- training failure rates;
- adequacy;
- infection rates; and
- growth of program-number of patients.

Assesses medication regimen and develops a plan with the patient that includes, but is not limited to:

- current medication regimens, successes, and challenges;
- educates patient about medication and possible considerations with dialysis treatment modality;
- instructs patient on the proper technique for administration of intradialytic or intraperitoneal medication administration; and
- assists the patient to simplify medication regimens where possible.

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Peritoneal Dialysis

Peritoneal dialysis is an important form of renal replacement therapy for patients with chronic kidney disease (stage 5). Numerous advantages include: preservation of residual renal function, reduced healthcare costs, quality-of-life enhancement including independent living and travelling, improved blood pressure and heart health, better hemodynamic and anemia control and reduced incidence of bacteremia.

It has the advantage of being a home-based therapy, and there is some evidence that patients receiving this type of dialysis have been more satisfied with their care than patients on hemodialysis (Juergensen et al., 2006).

Nephrology nurses play an important role in the coordination, monitoring, counselling and education of patients receiving peritoneal dialysis. In doing so, nephrology nurses focus on the benefits and challenges associated with peritoneal dialysis, the peritoneal dialysis procedure, self-management skills, associated potential complications, and health-promoting behaviours.

Using the best available evidence and best evidence informed guidelines, the nephrology nurse assesses:

Prior to PD catheter insertion

Patient/parent or caregiver ability, supports and potential barriers to perform peritoneal dialysis including, but not limited to:

- visual and/or hearing impairment;
- paralysis;
- amputation;
- poor hygiene;
- lack of dexterity and frailty;
- cognitive impairment, i.e. poor memory, dementia;
- history of noncompliance; and
- mental health.

Potential relative contraindications for peritoneal dialysis including, but not limited to:

- extensive abdominal adhesions that may limit ultrafiltration and dialysate flow;
- documented loss of peritoneal function;
- encapsulating peritoneal sclerosis;
- pleuroperitoneal leak;
- irreparable hernia(s);
- abdominal aortic aneurysm;
- colostomy; and
- diverticular disease.

Assesses current knowledge level, readiness to learn, potential barriers to learning (cultural beliefs, language, literacy level, age and environment) and patient/parent or caregiver identified learning needs about peritoneal dialysis, develops and implements a plan including, but not limited to:

- benefits associated with peritoneal dialysis including:
 - improved quality of life
 - decreased hospitalizations
 - tolerance of gentle fluid removal
 - patients can remain at home and have less disruption to lifestyle;
- risks including the incidence and nature of complications such as bowel and bladder perforation, bleeding and peritonitis;
- concerns and questions about peritoneal dialysis including:
 - reason requiring dialysis
 - type and location of catheter
 - surgical procedure and typical degree of pain and discomfort
 - normal progression of healing and
 - bowel preparation and the importance of avoiding constipation prior to and after catheter insertion.

After PD catheter insertion

Provides exit site care and educates the patient/parent or caregiver in the postoperative care of the peritoneal dialysis catheter including, but not limited to:

- keeping operative site clean to minimize bacterial colonization of exit site and tunnel;
- dressing to be changed as per unit-specific protocol and if soiled or not adhering;
- stabilizing the catheter to minimize catheter movement and prevent trauma to the exit site and traction to the cuff(s);
- normal progression of healing; and
- cleaning the site as per organization approved standard cleaning protocol.

Dialysis Adequacy

Assesses the patient on an ongoing basis for signs and symptoms of inadequate dialysis including, but not limited to:

- fatigue;
- loss of appetite;
- nausea;
- vomiting;
- pruritis;

- difficulty concentrating;
- weight loss;
- anemia;
- secondary hyperparathyroidism;
- neuropathy;
- restless legs;
- edema;
- abnormal electrolytes;
- pericarditis/pericardial effusions;
- changes in cognitive function; and
- delayed growth and or weight gain in pediatric patients.

Assesses adequacy of peritoneal dialysis

(d) Assesses possible causes for peritoneal dialysis delivered dose parameters that are below the minimum acceptable level (i.e. weekly Kt/V < 1.7) including, but not limited to:

- change in peritoneal membrane transport characteristics;
- membrane failure;
- loss of residual renal function;
- missed peritoneal dialysis exchanges; lack of adherence to prescription
- inadequate dialysis prescription; and
- sampling error.

(e) Assesses physical findings including:

- target weight;
- blood pressure;
- heart rate;
- chest pain;
- bowel regimen;
- respiratory rate and quality;
- edema (peripheral, facial, sacral, periorbital); and
- cognitive function.

Assesses the suitability of the dialysis prescription, peritoneal membrane transport characteristics, patient's size and assessment findings and recommends, in collaboration with physician or appropriate healthcare provider, appropriate volume and frequency of exchanges and target weight.

Collects data and participates in quality assurance activities to improve peritoneal dialysis adequacy outcomes.

Educates the patient/parent or caregiver about dialysis adequacy, the importance of receiving full dialysis treatments including adherence to dialysis prescription and possible complications related to inadequate dialysis.

Peritoneal Dialysis Treatment and Complications

Assesses knowledge needs and develops and implements a plan in collaboration with the patient regarding possible complications associated with peritoneal dialysis including, but not limited to:

Noninfectious Peritoneal Dialysis Related Complications

- trauma to catheter tract;
- incisional hernia;
- exit site leak;
- intra-abdominal leak;

- genital leak;
- hydrothorax-pleural leak;
- inflow/outflow problems;
- bloody/cloudy effluent;
- constipation;
- obesity;
- hyperglycemia;
- hyper/hypovolemia;
- catheter complications including: obstruction, cuff extrusion, and damage to catheter;
- drain pain;
- malnutrition; and
- GI effects including heartburn, regurgitation, constipation and diarrhea

Educates the patient/parent or caregiver about infectious complications, the importance of prevention by adherence to technique and recognizing and reporting signs and symptoms of infections including, but not limited to:

Exit Site/Tunnel Infection

- exit site redness;
- drainage;
- tenderness/discomfort;
- overgrown granulation tissue;
- swelling and
- induration

Peritonitis

- abdominal pain;
- abdominal distention;
- abdominal tenderness;
- cloudy effluent;
- fever;
- nausea;
- vomiting;
- hypotension;
- positive culture of dialysate fluid; and
- peritoneal dialysis effluent cell count with white blood cell count >100 cells/ μ L and >50% neutrophils with or without positive cultures in addition to cloudy effluent and abdominal pain.’

Definitions of Peritonitis Episodes
Recurrent: occurs within 4 weeks of completing therapy, with a different organism than the original infection
Relapsing: occurs within 4 weeks of completing therapy with the same organism as the original infection or with one sterile episode
Repeat: occurs in more than 4 weeks of completing therapy with the same organism as the original infection
Refractory: failure to respond to therapy within 5 days of receiving the appropriate antibiotic for the infection
Catheter-related: associated with exit site or tunnel infection, with same organism, or with one site, sterile (Li et al., 2016)

Assesses knowledge needs and develops and implements a plan in collaboration with the patient regarding peritoneal dialysis therapy and associated treatments including, but not limited to:

- diet;
- fluid;
- blood pressure control;
- bowel regimen;
- anemia;
- bone and mineral metabolism; and
- medications.

Medication Management

Assesses medication regimen and develops a plan with the patient that includes, but is not limited to:

- reviewing current medication regimens, successes, and challenges;
- identifying indications and interactions for commonly administered medications for patients receiving peritoneal dialysis (e.g., erythropoietin stimulating agents, iron supplements, phosphate binders, vitamin D sterols, vitamins, heparin, antibiotics);
- completing and documenting a medication history as per unit policy and assesses for any dosing changes, and new or discontinued medications;
- instructing the patient on the proper technique for administration of intraperitoneal medications; and
- educating the patient about medications and assists the patient to simplify the medication regimen, where possible.

Infection Control Practices

Assess patient /parent or caregiver knowledge level and patient identified learning needs regarding infection control recommendations associated with peritoneal dialysis and develops a plan in collaboration with the patient to address these needs.

Educates the patient about infection control recommendations including, but not limited to:

- performing hand hygiene after handling pets and safeguarding the room from pets where dialysis is performed and supplies are stored;
- informing healthcare providers of other healthcare procedures for the consideration of prophylaxis antibiotics regarding protection of PD catheter. Swimming is a potential possibility. Follow unit-specific protocols regarding protection of PD catheter
- swimming in ocean or private pool, as per program policy; and
- avoiding hot tubs, jacuzzis, and soaking tubs.

Follows unit-based guidelines for hepatitis B surveillance and administers immunizations as ordered.

Links to clinical resources

Centers for Disease Control. (2005). Infection control for peritoneal dialysis patients. <http://www.bt.cdc.gov/disasters/pdf/icfordialysis.pdf>
 Infection Control for Peritoneal Dialysis (PD) Patients after a Disaster. <https://www.cdc.gov/disasters/icfordialysis.html>

International Society of Peritoneal Dialysis Guidelines. <https://ispd.org/ispd-guidelines/>

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Other resources supporting practice recommendations

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