



Trillium  
Gift of Life  
Network

# Clinical Handbook for Kidney Transplantation

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**Disclaimer:** The content in this Handbook has been developed through collaborative efforts between Trillium Gift of Life Network and experts from Ontario's kidney transplant programs. It is based on available literature and expert opinions at the time of development. The Handbook is not intended to be an exhaustive analysis of all kidney transplant literature and practices, and may not reflect all available research and consensus from all experts. Other relevant scientific findings may have been published since completion of the Handbook and it may be superseded by an updated publication on the same topic. While every reasonable effort has been made to ensure the accuracy and validity of the information provided, TGLN and the expert contributors assume no responsibility for any errors or omissions in the content.

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# Acknowledgements

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## List of Abbreviations

CAD	Coronary Artery Disease
CKD	Chronic Kidney Disease
CVD	Cardiovascular disease
DAD	Discharge Abstract Database
EAU	European Association of Urology
EBPG	European Best Practice Guidelines
ECFAA	Excellent Care for All Act
ED	Emergency department
ERA-EDTA	European Renal Association – European Dialysis Transplant Association
ESRD	End-Stage Renal Disease
HCRS	Home Care Reporting System
IHD	Ischemic Heart Disease
KDIGO	Kidney Disease: Improving Global Outcomes
LHIN	Local Health Integration Network
LOS	Length of stay
MOHLTC	Ministry of Health and Long Term Care
NACRS	National Ambulatory Care Reporting System
OAGO	Office of the Auditor General of Ontario
OECD	Organization for Economic Cooperation and Development
ORN	Ontario Renal Network
PSG	Preyra Solutions Group
RRT	Renal Replacement Therapies
TGLN	Trillium Gift of Life Network
TOTAL	Trillium Organ and Tissue Allocation System

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# I. Purpose

The Clinical Handbook for Kidney Transplantation includes a clinical pathway and service bundles for kidney transplantation which have been developed in response to the *2010 Auditor General's Report on Organ and Tissue Transplantation* and the *2009 Organ and Tissue Wait Times Expert Panel Report* and as part of the Ministry of Health and Long-Term Care's commitment to quality healthcare and better outcomes.

It aims to identify opportunities to enhance integration of services across the patient care continuum; facilitate efforts to improve existing processes within Ontario's kidney transplant centres by reducing unnecessary practice variations and optimizing resource utilization; and inform policy frameworks and implementation approaches to the care of kidney transplant patients in Ontario.

The Clinical Handbook includes the following tools to guide the development of policies, procedures, and processes for transplant programs:

1. A clinical pathway for typical kidney transplant patients beginning from the time a referral is received by the transplant program to post-transplantation. The clinical pathway outlines the general process that Ontario patients follow specific to their transplant care, excluding ongoing care received as part of chronic kidney disease management.
2. Services that correspond to each stage of the transplant patient pathway.

To foster partnership and strengthen clinician engagement, the clinical pathway and service bundles were developed using opinions from clinical experts from all Ontario transplant centres, guided by national and international evidence-based guidelines. As a result, the Clinical Handbook is a compendium of evidence based rationale and clinical consensus on guidelines for kidney transplant patients.

**This document has been prepared as a tool for transplant hospitals and individual providers to support the development of clinical patient pathways for their organizations. The Handbook is not intended to replace the professional skill and judgement of healthcare providers, nor inhibit the development of new and innovative transplant solutions.**

## II. Improving Quality of Care

At the forefront of Canada's health-care system is a commitment to provide the highest standard of hospital and physician services. In Ontario, the Excellent Care for All Act (ECFAA) supports this by creating greater public accountability, increasing the focus on quality, bringing patient satisfaction to the forefront and basing patient care decisions on the best scientific evidence available. These dimensions of quality are supported by the following six domains:

- Improve **effectiveness** and reduce variation in clinical outcomes.
- Improve **appropriateness** by reducing practice variations and variations in volumes.
- Improve **integration** across the continuum of care.
- Improve **efficiency** by reducing unwarranted variation in resource utilization.
- Improve or maintain **access** to appropriate health services.
- Improve **patient centeredness** of health services.

Specific recommendations for the transplantation system were outlined in the *2010 Auditor General's Report on Organ and Tissue Transplantation* and the *2009 Organ and Tissue Wait Times Expert Panel Report*, both of which highlighted the need for a more efficient and equitable allocation system, improved referral practices and more effective oversight for organ transplantation. Since then, new liver and kidney allocation systems have been implemented, standardized practices for referral have been introduced, and performance indicators and evaluation metrics have been developed. Such initiatives are aimed at improving access to transplantation services by reducing geographical differences in wait times and establishing tools for patients and practitioners to support the transplant process.

Further improvements to quality can be achieved as system effectiveness is maximized by identifying variations in clinical outcomes. Data shows that short and long-term graft survival rates are favourable, but in 2010/11 approximately 25% of kidney transplant recipients visited the emergency department (ED) within 30 days after transplant (1). ED visits varied by transplant centre, as did lengths of stay in hospital. Furthermore, patient assessment techniques, long-term immunosuppression medication, and treatment of acute rejection, are among variations in kidney transplant care which have been documented as occurring both within, and between transplant hospitals (2,3). Unplanned hospital readmissions are costly and inefficient, while variations in practice demonstrate inconsistencies in how transplant patients are treated.

In its report, the Expert Panel specifically raised concern that Ontario does not have standard best practice guidelines for the pre- and post-care of transplant patients, stating that such guidelines are important since they would identify the care that transplant centres and the local community should provide. The Panel recommended:

- Ontario's transplantation community compile and/or develop pre- and post-care best practice standards and guidelines by organ, and ensure that healthcare providers use these standards and guidelines to inform their care.
- Trillium Gift of Life Network and the transplantation community establish a system to monitor the use of best practice standards and guidelines for adult and paediatric organ transplantation, and the outcomes of these procedures (4).

These recommendations align with the Excellent Care for All Act (ECFAA) with its increased emphasis on continuous quality improvement supported by evidence informed best practices and standards of care.

The clinical pathway and corresponding services in this handbook and the steps taken to monitor their implementation and outcomes are intended to improve the appropriateness and efficiency of transplant care by reducing unnecessary practice variations and optimizing resource utilization, as well as providing tools to enhance integration across the patient care continuum.

## **Clinical Pathways and Practice Guidelines**

Clinical pathways are tools used to manage quality in healthcare by standardizing processes. The objectives are to reduce unnecessary variations in practice, improve interdisciplinary cooperation, integrate care, and ultimately, improve clinical outcomes. They are especially useful in complex care systems, such as kidney transplant, where care may be delivered by multiple providers at multiple sites. Kidney transplant referrals require a minimum set of tests and consultations to be completed, as per the *Provincial Transplant Referral Form*, prior to being submitted to the transplant centre. Transplant centres review referrals and liaise with referring centres to complete additional tests as necessary before scheduling patients for a transplant assessment. During the transplant assessment process, patients are provided with transplant specific education and transplant specialists determine whether patients are eligible to be wait listed. While on the wait list, transplant centres require ongoing patient assessment, which includes blood testing and laboratory work from community healthcare providers. Once a patient is matched with a potential donor kidney, they are admitted and cared for by the transplant centre before, during, and immediately following their transplant surgery. Once transplanted, recipients receive ongoing care from a variety of providers including transplant specialists, community nephrologists, family physicians, and other medical practitioners based on their needs. The involvement of multiple providers creates considerable opportunity for variations in practice and resource utilization as the patient moves through the pathway.

The success of practice guidelines and clinical pathways in complex care systems such as kidney transplantation has been documented in a variety of areas. For example, in the treatment of community-acquired pneumonia across nineteen teaching and community hospitals in Canada, implementation of a clinical pathway reduced the use of institutional resources without causing adverse effects on the well-being of patients (5). Other individual clinical pathways, for stroke management, inguinal hernia repair, laparoscopic surgery, pancreaticoduodenectomy, and the management of fractured neck of femur, have been shown to reduce length of stay and total costs of acute hospital admission while maintaining quality of care, improving patient outcomes, interdisciplinary co-operation and staff satisfaction (6).

A systematic review of published literature and analysis of twenty-seven studies involving 11,398 participants found that, compared to usual care, patients managed according to clinical pathways encountered a reduction in in-hospital complications. Furthermore, the review presented evidence of decreased lengths of stay and reductions in hospital costs when clinical pathways were implemented (6). More generally, reviews of best practice clinical guideline dissemination and implementation strategies have shown that in the majority of cases, improvements in care are observed (7). In one study of 59 clinical guidelines, the authors concluded that “guidelines improve clinical practice and achieve health gains when introduced in the context of rigorous evaluations.”(8)



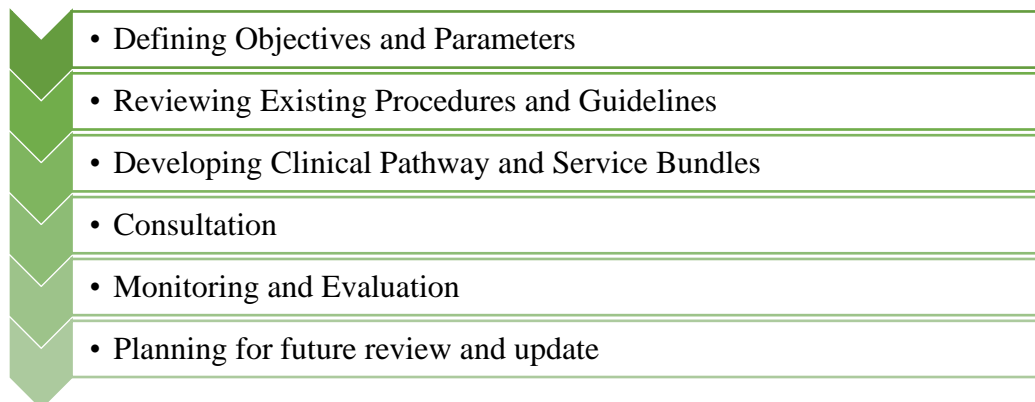
Ultimately, clinical guidelines can improve the experience of patients as they navigate through the transplant process by facilitating integrated care plans along the continuum. With the goal of optimizing care at all stages of the patient continuum, it is intended that this Clinical Handbook will facilitate efforts to improve existing processes in the care of kidney transplant patients in Ontario.

### III. Methods

In developing the Clinical Handbook, Trillium Gift of Life Network and the Provincial Kidney and Pancreas Working Group took a quality-driven approach for translating evidence into action. The overarching aim was to produce a *quality-driven, evidence-based* clinical pathway and service bundles using an *efficient* and *transparent* methodology for *action-ready* recommendations with *multi-disciplinary applicability* (9):

- **Quality-driven** means placing quality improvement at the forefront of clinical pathway and service bundles development, using current best evidence and multidisciplinary consensus to prioritize recommendations. Selection of key action statements is driven by opportunities to promote best practices, reduce unnecessary variations in care, and minimize inappropriate care or resource utilization.
- **Evidence-based** means supporting all decisions with the best available research evidence identified through systematic literature review and expert consensus.
- **Efficient** clinical pathway and service bundles make maximum use of available resources to create a timely product, moving from conception to publication within a reasonable timeframe.
- **Transparent methodology** is explicit, reproducible, and applied consistently so guideline users can link recommendations to the corresponding level of evidence, benefit-harm-cost relationship, and the roles of values and patient preferences in decision making.
- **Action-ready** recommendations tell providers what to do, to whom, under what specific circumstance, using unambiguous language that facilitates implementation and measurement.
- **Multi-disciplinary** validity and applicability means that all stakeholders (e.g., primary care, specialists, allied health, nursing, consumers) are part of the development and implementation processes.

To achieve these goals the following systematic process was used:



The following sections describe each of these steps in further detail.

## Defining Objectives and Parameters

### *Objectives*

In defining the objectives of developing a clinical pathway and service bundles, the Working Group was guided by the following key question:

**How can Ontario's transplant system provide the best quality of care to achieve the best possible outcomes for kidney and kidney/pancreas transplant patients?**

The Working Group agreed that the Clinical Handbook was an opportunity to develop and implement best practice guidelines for transplant centres throughout the transplant patient continuum, and determined that it must answer the following questions:

- **Who** should be defined as the patient population(s)?
- **What** practices and services are required in the treatment of transplant patients?
- **Where** can transplant patients expect to receive their treatment?
- **When** in their continuum of care can transplant patients expect to receive certain aspects of their care?

These guiding questions ensured that the patients' best interests remained at the centre of the development of the clinical pathway and service bundles.

### *Parameters*

From the outset, the Working Group identified the clinical population to include all patients in Ontario who have been referred to a transplant program for a kidney or kidney/pancreas transplant. The Working Group recognizes that transplant patients are also all part of the chronic kidney disease (CKD) health system that is managed by CKD programs and community nephrologists. CKD programs play an important role in the care of transplant patients, informing end stage kidney disease patients of their transplant options, referring patients to transplant centres, and managing the patients' underlying disease while on the wait list.

The Ontario Renal Network (ORN) is the provincial resource for the organization and management of the delivery of chronic kidney disease (CKD) programs in Ontario. Most transplant patients' care journey begin through the CKD programs, where they are informed of their transplant options for end stage kidney disease and where they continue to receive treatment for their CKD until their transplant. Given the ORN's role in managing CKD patients, the focus of this Clinical Handbook is specific to the subset of those patients who enter the transplant system. For the purposes of this Clinical Handbook, the pathway and bundles focus on the services required for transplantation. Ongoing management and service bundles related to CKD outside of transplant can be found through the Ontario Renal Network. ORN and TGLN will continue to collaborate on future projects that involve community involvement in the pre and post care phases which may impact future revised versions of this Handbook.

Because of differences in service needs, separate clinical bundles were created for adult and paediatric patients. This decision followed consultation with paediatric specialists and is due in part to anatomical, physiological, and psychological differences between children and adults, and because the common causes of chronic kidney disease in children are often different than those in adults. Within the adult group, distinct subpopulations with significantly different clinical characteristics requiring alternative or additional clinical services were identified.

To ensure a seamless transition between different stages of the transplant process, the Clinical Handbook encompasses a patient's full continuum of care, beginning from when a referral is received at the transplant program and continuing through transplantation and long-term, post-transplant management. In most cases, once a patient is referred and placed on the provincial wait list, the patient remains in the transplant care continuum until the transplant fails.

These parameters guided the development of the Clinical Handbook to ensure that full and proper considerations were given to all patient populations throughout their transplant continuum of care.

## Reviewing Existing Procedures and Guidelines

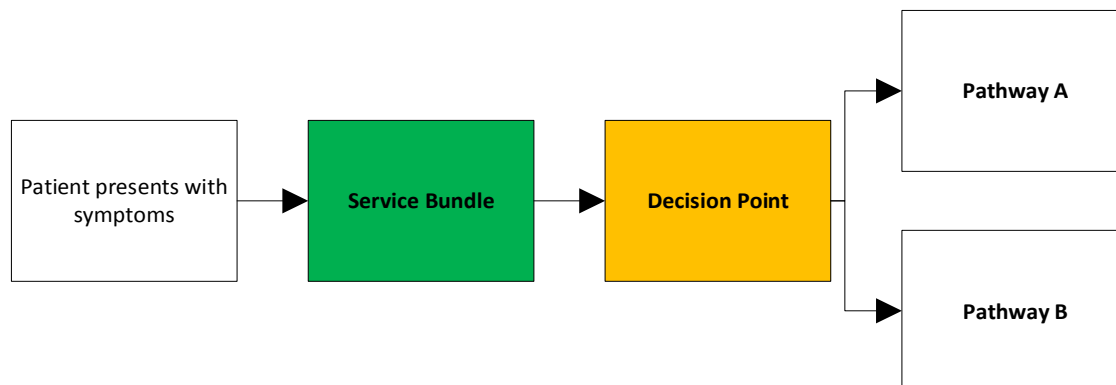
The Clinical Handbook contains a set of recommended practices reviewed and agreed upon by the Working Group and through wider consultation with the transplant community. In keeping with the ECFAA commitment to evidence-based care, considerable attention has been paid to ensure that the practices recommended here are supported by the best available evidence. An extensive review was carried out of existing practices at each of Ontario's kidney transplant programs, as well as published national and international clinical guidelines currently utilized in the management of kidney transplant patients throughout the world. This involved a detailed review of the following:

- Standard Operating Procedures from each of Ontario's kidney transplant programs
- An analysis completed by Preyra Solutions Group (PSG) using available data to analyze kidney transplant patient care patterns from the following clinical and administrative datasets:
  - Discharge Abstract Database (DAD)
  - National Ambulatory Care Reporting System (NACRS)
  - OHIP Physician Billing Database
  - Home Care Reporting System (HCRS)
  - Trillium Organ and Tissue Allocation System (TOTAL) Database
- Clinical guidelines from the following organizations (see appendix A for summary):
  - Kidney Disease: Improving Global Outcomes (KDIGO)
  - European Association of Urology (EAU)
  - European Renal Association-European Dialysis Transplant Association (ERA-EDTA)
  - UK Renal Association
  - American Society of Transplantation
  - Canadian Society of Transplantation
  - BC Transplant

The analysis was used to determine what services and procedures were carried out during a patient's care continuum at each of Ontario's kidney transplant centres. A full list of services was then compiled and compared with the clinical guidelines to determine if they could be considered best practice.

## Developing Clinical Pathway and Service Bundles

The clinical pathway model is structured around the parameters defined for the episode of care. The model describes the pathway of each patient case, from their initial presentation with symptoms warranting consideration of a transplant, through the subsequent components of care that they receive, before reaching an endpoint in their care. The pathway presents the critical decision points and phases of treatment within the continuum of care. Decision points provide patient-specific criteria for whether a particular case proceeds down one branch of the pathway or another. Once patients move down a particular branch, they receive a set of recommended practices that are clustered together as a bundle. Service bundles represent the major phases of care that patients receive during the transplant process. Figure 1 provides an illustrative example of a service bundle and assessment point:



Through the development of the clinical pathway, the Working Group identified five service bundles corresponding to the key stages in the patient care continuum:

1. **Pre-Transplant before Listing: Referral and Transplant Assessment** - the period before placement on the transplant wait list. It begins when the referral package is received by transplant centres and includes the services required during transplant eligibility assessment.
2. **Pre-Transplant after Listing: Wait List Period** - the period after placement on the wait list, but before the transplant operation.
3. **Preoperative Assessment and Transplant Surgery** - the period from when the patient is called in for the transplant operation, the preoperative assessment and the surgical procedure.
4. **Post-Transplant: During Hospital Admission** - the period following the transplant operation while the patient is in hospital before discharge.
5. **Post-Transplant: After Discharge** - the period following hospital discharge.

As each of the service bundles were developed, the Working Group identified differences in care based on medical conditions, the most common of which were the presence of heart disease, liver disease, diabetes, and obesity. As a result of the distinct service needs, three sub-patient populations were identified:

- **Standard Risk Patients:** patients without complex co-morbidities such as heart disease or diabetes within 2 years before transplant.
- **High-Risk Patients:** determined by transplant centres based on recipient medical factors including heart disease, diabetes, liver disease or obesity.
- **Kidney-Pancreas patients:** patients who require a simultaneous kidney and pancreas transplant.

These differences in care were not extensive enough to merit separate pathways or service bundles for each patient sub-group, therefore, where variations exist, these have been highlighted within each service bundle.

Services for each of the patient populations were then categorized into the following two groups:

- **Bundled services:**

These are services that are an essential part of the patient pathway and have a standard expected duration and frequency. For these services, the Working Group assigned a minimum standard frequency for the typical transplant patient at each phase of the care continuum. For example, surgical consultation is a bundled service that should be provided to transplant patients one time before listing and one time after listing. It is important to note that the set frequencies do not limit every patient's specific service needs. For example, the Working Group may have agreed that kidney transplant patients should have serology testing annually while on the wait list. However, some patients may have to undergo more frequent testing if indicated.

- **Unbundled Services:**

These are services that can potentially be provided to transplant patients but cannot be predicted and/or assigned a standard frequency for a given patient population. Included in this group are services whose frequency varies considerably across centres or services that are required for a patient based on the physician's overall assessment of their health and needs. These services should be provided at the physician's discretion. For example, a small percentage of kidney transplant patients will receive a respiratory consultation. Therefore, this service is recognized and included within the list of potential services, but is not assigned a standard frequency and duration.

To align the clinical pathway and service bundles to the needs of Ontario, TGLN conducted a full day workshop that included key members from every transplant program in the province. In addition to the Working Group members, front line staff and members of the Ontario Renal Network (ORN) were invited to identify patient pathways and practices that are currently being performed. Members were encouraged to share their program's experiences to facilitate knowledge transfer and provide input for areas of improvement.

## Consultation

Using the results from the full day workshop, the expertise of Ontario clinicians, published guidelines, and available data, TGLN provided each transplant program with a draft of the developed service bundles. TGLN solicited feedback from each of the seven kidney transplant centers in Ontario and ensured they had an opportunity to respond to the content in the Clinical Handbook. The centres were asked the following key questions:

- Are there any services identified that should or should not be included in the service bundles?
- How are the services outlined in the service bundles similar or dissimilar to current practice at your centre?
- What resources would be required to implement these practices?
- Are there any barriers to implementing these practices at your centres? Are there any enablers to implementing these practices at your centres?

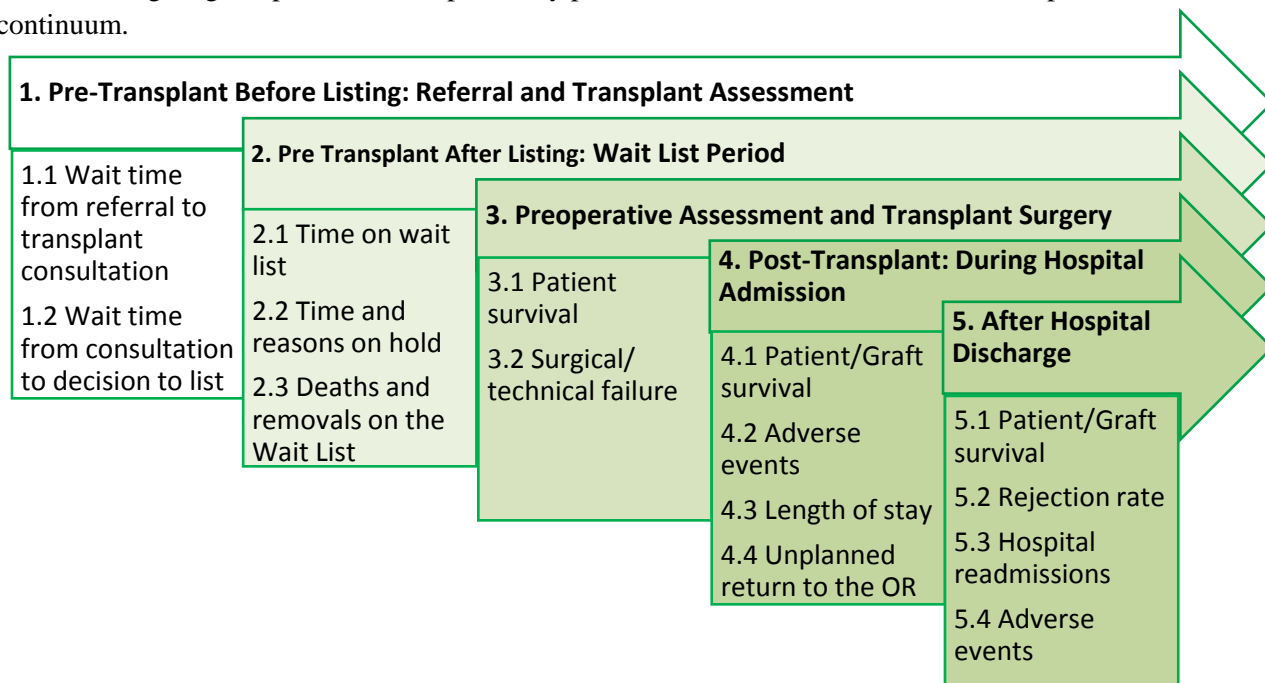
To ensure transparency in the consultation process, all feedback was collated, with a summary provided to each of the transplant centres detailing the action taken on proposed changes to the service bundles. Centres were then given an opportunity for final review of the revised bundles and asked to submit any final comments.

Once a draft Clinical Handbook was completed, TGLN distributed it to each kidney transplant program in Ontario for the opportunity for review and respond to the content in the Clinical Handbook.

## Monitoring and Evaluation

Efforts to regularly monitor and evaluate the kidney transplantation system in Ontario are taken to improve the transplant process and identifies opportunities for further improvement. With the expertise of the Provincial Working Groups, TGLN has identified key performance indicators for each stage of the patient care continuum that will help clinicians and administrators monitor quality of care and identify associated opportunities for improvement within their centres.

The following diagram provides a sample of key process and outcome indicators for each phase of the care continuum.



Indicators during the pre-transplant phases of the care continuum focus on timely transplant assessment, consultation, and wait list management to promote patient safety and timely access to transplant. For the surgical and post-transplant phases, the focus is on patient outcomes, such as patient death, graft failure, length of stay and hospital readmissions and adverse events. Although these are baseline quality indicators that will be collected for all transplant patients, TGLN has worked with the Kidney and Pancreas Working Group to develop definitions that would be most relevant for kidney and pancreas transplant patients.



As part of the TGLN's quality improvement framework, performance indicators will be reported and distributed to transplant programs. Transplant programs may use the reports to evaluate their own processes at each stage of the care continuum and enable centres to track, audit, and evaluate the implementation of the clinical pathway and best practice services within their centres. Through such monitoring, variances can be identified, progress monitored, and practices refined over time to improve patient outcomes.

TGLN, in collaboration with the Kidney and Pancreas Working Group will utilize the performance indicators to monitor and evaluate the transplant system as a whole. The Group may review the current state of the system and make recommendations to support practice changes where notable variations have been identified. Indicators will be reviewed regularly to ensure they remain relevant and align with quality objectives to promote ongoing improvement at both hospital and system levels.

### **Plan for Future Review and Update**

The clinical pathway and service bundles will be revised when appropriate to ensure developments in kidney transplant best practice are reflected. Upon the release of new or updated best practice guidelines, new evidence, or policy changes, TGLN will conduct a review of the Clinical Handbook. If no guidelines are published, the Clinical Handbook will be reviewed every 2 years by the Provincial Kidney and Pancreas Working Group. Comments received will be incorporated and reviewed by the Working Group as necessary.

As partnerships between TGLN and ORN continue to grow, further development of a Clinical Handbook that outlines an integrated patient pathway beginning at the CKD programs may be beneficial for patients who move between the two systems. Future work may focus on bridging patient transitions between renal and transplant programs, including identification of where, and by whom, services required for transplant are completed.

## IV. Overview of Kidney Transplantation

Renal disease describes a variety of diseases and disorders that affect the kidneys. Most diseases of the kidney attack its filtering units, the nephrons, and damage the kidney's ability to eliminate wastes and excess fluids. Chronic renal failure, or chronic kidney disease (CKD), is a slow and progressive decline of kidney function, most commonly caused in North America by diabetes or high blood pressure. While not all CKD patients progress to end-stage renal disease (ESRD), for those who do, dialysis or kidney transplantation is required to sustain life. These are known as renal replacement therapies (RRT) because they attempt to “replace” the normal function of the kidneys.

In Canada there are an estimated 2.6 million people who have kidney disease (10). According to the Canadian Institute for Health Information, as of December 31 2013 there were 41,931 people being treated for ESRD, of whom 24,114 were receiving dialysis and 17,817 were living with a functioning kidney transplant. Since 1994, the prevalence rate for ESRD patients being treated by dialysis has increased in total by nearly 123% (11).

Kidney transplantation is the best treatment available for most patients with end-stage renal disease (2). It not only improves the quality of life for patients, but has shown to be a life-prolonging procedure. A kidney transplant may be from a deceased or living donor. In most transplants, only one kidney is transplanted, but, in certain circumstances, particularly in expanded criteria donors (ECD), two kidneys may be transplanted.

Patient and graft survival after kidney transplantation is the most important outcome measure for assessing success. Although dialysis once offered a greater chance of survival than transplantation, particularly in the short-term, recent studies have reported a lower risk of mortality among kidney transplant recipients versus dialysis patients. One study has estimated the long-term mortality risk for transplant recipients to be 68% lower than that of dialysis patients on the waiting list,(12) while another found that although there was an increased risk of mortality in the initial post-transplant period, the risk of mortality at one-year for transplanted patients was considerably less than that of patients who remained on the waiting list for an additional year (13).

As shown in table 1, overall transplant success rates in Canada are favourable. One-year survival rates are over 90%, and five-year survival rates are over 80%. Because only modest improvements have been observed in long-term graft survival rates in the last decade, efforts have shifted from improving early graft outcomes to altering the natural course of late graft failure (14).

**Table 1: Unadjusted Three-Month and One-, Three- and Five-Year Graft Survival Rates in Adult Deceased Donor Kidney Transplant Recipients, First Graft, Canada, 2004 to 2013 (Percentage)**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number	509	616	639	643	678	653	689	716	727	719
3 Months	96.1	95.5	96.4	95.6	95.3	97.4	96.7	97.3	96.6	96.6
1 Year	92.3	93.2	93.1	92.1	92.3	94.8	92.6	94.8	94.9	
3 Years	85.6	86.2	87.0	86.8	87.8	90.0	88.1			
5 Years	79.9	81.2	81.4	82.7	81.4					

Source: Canadian Organ Replacement Register, 2015, Canadian Institute for Health Information

The risk of death has fallen over the years in all categories of patients but especially in the older age groups and in those with considerable comorbid disease including patients with diabetes mellitus. For example, in the mid-1970s average one-year patient survival in those over 35 years of age was only around 60% while in younger adults it was approximately 85%. By the 1990s, the difference had narrowed to just over 5% with one-year survival at just below 90% for older patients and 95% or above for younger adult recipients. Thus in the short-term, kidney transplantation offers a good prospect of survival for patients who are free of major comorbid illness (15).

There has also been a significant improvement over time in the longer-term survival of transplant recipients. However, the survival of transplant recipients does remain significantly lower than the general population. This is, in part, due to comorbid medical illness, pre-transplant dialysis treatment, and factors uniquely related to transplantation, including the need for maintenance immunosuppression and other drug effects (16). For kidney transplant patients, cardiovascular disease is the leading cause of death following transplant, accounting for 40–55% of all deaths, with cancer and infection being the other primary causes (15).

## V. Kidney Transplantation in Ontario

### Data and Volumes

Kidney transplantation prolongs survival, improves quality of life and is less costly than dialysis, which is estimated at \$83,000 per patient, per year,(10) therefore is the recommended treatment for ESRD patients in Ontario. Over the past decade more than 5000 kidney and kidney/pancreas transplantations have been performed in Ontario. There are seven centres at which kidney and kidney/pancreas transplant procedures are performed. Adult transplants are performed at University Health Network, London Health Sciences Centre, St. Michael’s Hospital, St. Joseph’s Healthcare Hamilton, The Ottawa Hospital and Kingston General Hospital, and paediatric transplants are performed at The Hospital for Sick Children, London Health Sciences Centre and The Ottawa Hospital. Table 2 shows the number of kidney and kidney/pancreas transplants that have been completed in Ontario since 2004.

**Table 2: Kidney transplantation volumes in Ontario, 2004-2014**

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Kidney (deceased)	216	215	253	303	262	333	316	311	385	307	385
Kidney (living)	173	202	221	207	219	231	221	208	197	209	203
Kidney/Pancreas	15	26	24	23	24	20	19	29	23	30	33

Source: TGLN, 2015

Recent data indicates that more than 18,000 patients are currently receiving treatment for ESRD in Ontario, either through dialysis or a functioning graft. As can be seen in table 3, the province’s rate per million is higher than the national rate, and is continuing to grow.

**Table 3: Treatment of End-Stage Organ Failure in Ontario, 2010-14**

	2010	2011	2012	2013	2014
Number	15,807	16,370	16,860	17,484	18,390
Ont. Rate per Million	1,195.0	1,224.1	1,248.3	1,291.5	1,344.5
Canada Rate per Million	1,174.2	1,201.3	1,229.5	1,260.1	1,291.0

Source: Canadian Organ Replacement Register Annual Report, 2016

Despite increasing transplant volumes, wait list numbers for kidney transplantation remain consistently above 1,000. This is evident in Table 4 which shows the number of people on the wait list at the end of each calendar year since 2004.

**Table 4: Ontario waiting list figure for kidney, kidney/pancreas and pancreas only, 2004-2014**

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Kidney	1288	1236	1142	1155	1193	1162	1073	1095	1105	1037	1103
Kidney/Pancreas	44	37	52	45	37	46	48	47	55	51	56

Source: TGLN, 2015

Kidney transplant data since 2005 indicates that, on average, patients wait 4-6 years from wait list start date to transplant. Table 5 shows the average number of days from the start of dialysis to kidney transplantation from 2004 to 2014.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Kidney	1768	1878	1970	1807	1960	1669	1730	1590	1568	1676	1766
Kidney/Pancreas	1308	1088	1551	1193	1266	1043	1315	1154	1278	1325	1136

Source: TGLN, 2015

## Trillium Gift of Life Network

Trillium Gift of Life Network (TGLN) is an agency of the Ontario Ministry of Health and Long-Term Care established in 2002 with responsibility for co-ordinating the donation of organs and tissue in Ontario. Following recommendations from the *2010 Auditor General's Report on Organ and Tissue Transplantation* and the *2009 Organ and Tissue Wait Times Expert Panel Report* for an integrated donor and transplant system, in 2011/12 TGLN's mandate was extended to include transplantation.

TGLN's transplant strategy aims to support the development of a sustainable end to end transplant system and to continually strive to improve the dimensions of quality, safety, effectiveness, access, patient centered and integrated care – all to enable better patient outcomes. This includes developing a provincial transplant system that provides equitable access through standardized processes and planning to enable better patient outcomes, and harmonizing the patient journey across the transplant continuum from pre-transplant through to post-transplant care.

Strategies to enhance the kidney transplant system are facilitated by TGLN through the Provincial Kidney Pancreas Working Group, which includes medical and administrative membership from each of Ontario's kidney transplant programs as well as the Ontario Renal Network (ORN). The Working Group's mandate is to consider all aspects related to the transplant patient's journey and recommend evidence-based policies and practices to ensure equitable access to quality patient care.

TGLN and the Provincial Kidney Pancreas Working Group has implemented the following key initiatives aimed at improving patient access and equity, and the quality of care along the patient continuum:

- **Provincial Kidney Allocation System**

On February 12, 2014 a new process for allocating deceased donor kidneys for transplantation was implemented. In the previous allocation model, donor kidneys that became available in one of the five regional kidney waiting lists (London, Toronto, Ottawa, Hamilton and Kingston) were allocated to patients within that region first. As such, the number of transplants were directly linked to the number of organ donors in that region.

The new provincial sharing system is designed to improve access to kidney transplant and minimize geographical differences in wait times. It also provides sensitized patients (those patients where, based on immunological testing, it is hard to match an appropriate donor) with access to all donor

kidneys in the province, thereby increasing the probability of finding a match and reducing the typically long wait times experienced by these patients. As donor kidneys are made available, the first kidney is retained within the local region. If no local match is found, the kidney will then be offered for sharing within the province. If a second kidney is available, it is offered for sharing within the province and the National Highly Sensitized (HSP) registry.

- **HSP Registry**

On May 27, 2014, Ontario joined Canadian Blood Services' (CBS) Highly Sensitized patient (HSP) registry which increases transplant opportunities for kidney transplant patients who are highly sensitized (cPRA  $\geq$  95) by allocating kidneys from the national donor pool.

- **Referral and Listing Criteria**

Despite the recognized benefits of kidney transplantation over dialysis, the Expert Panel noted that only 13% of people on dialysis in Ontario were on a kidney transplant wait list. It further noted that there was “some evidence to suggest that not everyone who could benefit from an organ transplant is put on an organ transplant list.” In its report, the Auditor General recommended that TGLN, in conjunction with transplant hospitals and physicians, should “determine the best way to communicate referral criteria to non-transplant physicians, so that individuals who would benefit from a transplant (including from a quality-of-life perspective) are added to the wait list.”

TGLN has since taken measures to improve the referral process so that all patients who meet the criteria can be referred for transplant specialist consultation and assessment. These include:

- Standardized referral form to ensure patient transplant consultations are performed consistently and in a timely manner;
- Standardized referral and listing criteria to ensure that patients are receiving uniform access to transplant services.

- **Performance Measurement and Monitoring**

In May 2013, TGLN finalized a set of performance indicators to be developed as part of its quality framework for system monitoring and improvement. This includes thirteen key metrics from the Auditor General recommendations such as patient wait time, organ yield, deaths and removal on the wait list, patient and graft survival, and organ disposition.

- **TGLN-ORN Partnership**

TGLN has formally partnered with the Ontario Renal Network (ORN) to improve access to transplantation for all ESRD patients. The objective of the TGLN-ORN Partnership is to ensure an integrated, person-centred, collaborative and continuous kidney care continuum, with a focus on improving patient education on transplant options and bridging patient transitions between renal and transplant programs.

The development of the Clinical Handbook is part of the ongoing provincial initiative to facilitate Ontario's goals of consistently delivering high quality kidney transplant care across the province.

## Transplantation Process

Kidney transplantation is the preferred form of renal replacement therapy for patients with advanced kidney disease. Because all kidney transplant patients are also part of the CKD population, patients are managed by (CKD) programs and transplant centres when they are referred and while they wait on the wait list. For most transplant patients, their transplant journey begins at the CKD program, where they are informed of their treatment options for end stage kidney disease and where they continue to receive treatment until their transplant.

CKD programs are responsible for referring patients to a transplant centre for assessment. To support referrals, TGLN has developed a *Provincial Kidney Transplantation Referral and Listing Criteria* (available on the TGLN website <https://www.giftoflife.on.ca/en/professionals.htm>). The criteria lists conditions that constitute absolute contraindications to kidney transplantation and was developed as a tool for both renal and transplant programs. In order to submit a referral, CKD programs are required to complete all the tests and assessments outlined in *The Kidney Transplant Referral Form* (available on the TGLN website <https://www.giftoflife.on.ca/en/professionals.htm>). The CKD programs are responsible for liaising with transplant programs and referring all appropriate patients.

### ***Pre-Transplant Before Listing: Referral and Initial Assessment***

This phase begins when a referral is received at the transplant centre until the decision to list a patient on the transplant wait list is made. It includes the referral package completed by CKD programs and the services required by transplant programs during the transplant assessment.

*The Kidney Transplant Referral Form* includes the patient information, medical history, and lab and diagnostic testing results required for a transplant referral. Once a referral is received, the referral package is reviewed by transplant centres to determine whether candidates are eligible for a transplant assessment. Candidates will undergo further testing and consultation to evaluate their eligibility for transplant. The evaluation is aimed at assessing the chances of recovery from surgery, maximizing short- and long-term survival, and assessing the potential impact of transplantation on quality of life. Evaluation of the suitability of kidney transplant candidates includes medical, surgical, immunologic, and psychosocial assessments.

As part of the transplant assessment, a complete blood count and a chemistry panel is obtained along with a prothrombin time and partial prothrombin time (17). Blood is drawn for serological and infectious disease testing as patients should be free of active infection, whether of viral, bacterial or fungal origin (18). Testing of HBV and HCV serology is particularly important, because viral hepatitis is the major cause of liver disease after kidney transplantation and contributes to post-transplant morbidity and mortality (19). All patients should also be screened for HIV, CMV, and a history of or active TB (19).

To reduce co-morbidities and improve transplant outcomes, all candidates should receive consultations including physical examinations and assessments for cardiac disease and liver disease. Since cardiovascular disease is the leading cause of death after kidney transplantation (20), guidelines on transplantation indicate that cardiac assessments should include an electrocardiogram and chest x-ray, with further testing where results are inconclusive (21). Liver disease is also a significant cause of late morbidity and mortality among kidney transplant recipients and patients should receive liver function tests and serological tests for hepatitis B and hepatitis C (18).

Screening for other common risks to transplantation should also be completed during the transplant assessment. For example, active malignancy is an absolute contraindication to transplant and patients should be screened for cancer at the time of evaluation (20). In addition, hyperparathyroidism is common in patients with ESRD and should be screened by measuring calcium, phosphorous and parathyroid hormone (20).

Given the importance of adherence to therapy in transplant outcomes, all patients should have a pre-transplant psychosocial evaluation to assess for cognitive impairment, mental illness, non-adherence to therapy and drug or alcohol abuse (18). Patients should also receive transplant education so that they can make an informed decision about whether or not to proceed with transplant. Education should include the risks of the operation, side effects, and immunosuppression.

A full list of consultations, diagnostics and lab tests for patients undergoing assessment is outlined in the service bundle for pre-transplant before listing: referral and initial assessment. The referral and transplant assessment process is carried out at both referring centres and outpatient transplant clinics, and may take several months to complete.

### ***Pre-Transplant After Listing: Wait List Period***

This phase refers to the time period after placement on the wait list, but before the transplant operation.

Once the transplant team has agreed to pursue transplantation, patients are placed on the Ontario Kidney and Pancreas Transplant Wait List. Donor organs are allocated on principles of equity and fairness, taking into consideration blood type, medical urgency, organ suitability, and allocation points.

As the waiting time for a kidney transplant is typically several years long, patients will continue to be monitored by both the CKD and transplant programs. A full list of consultations, diagnostics and lab tests is outlined in the service bundle for pre-transplant after listing: wait list period. While on the wait list, patients continue to be managed by CKD programs, which are responsible for ongoing CKD treatment, blood testing and other diagnostics. Testing completed by CKD programs are sent to and reviewed by members of the multidisciplinary transplant team.

If a patient develops a new medical issue or is temporarily unable to receive a transplant while on the wait list, they will be placed on hold. For example, if a patient develops an infection that is a contraindication to transplant, they will be placed on hold until it has been resolved. Candidates with an on hold status are not eligible for organ allocation, but will continue to accrue wait time.

### ***Preoperative Assessment and Transplant Surgery***

This phase refers to the time period from when the patient is called in for the transplant operation, to the pre-operation assessment and the surgical procedure.

TGLN notifies the candidate's transplant program of potential deceased organ donor matches, and the transplant program contacts the patient once a match has been found. Patients will be asked about the current state of their health and if no new medical problems have developed, they will be instructed to come to the centre. Once admitted, they will receive a final assessment for medical suitability before being admitted for



transplant surgery. The final assessment for transplant surgery will involve surgical, nephrology and anesthesia consultations as well as lab and diagnostic testing.

A full list of consultations, diagnostics and lab tests is outlined in the service bundle for preoperative assessment and transplant surgery. A multidisciplinary clinical team completes the patient assessment, prepares the patient for transplant, and performs the transplant surgery. A typical kidney transplant surgery takes around three hours to complete, but may vary depending on the complexity of the procedure.

### ***Adult Post-Transplant: During Hospital Admission***

This phase refers to the time period following the transplant surgery while the patient is in hospital before discharge.

Transplant programs are responsible for patient management during the post-transplant, hospital admission phase. During this phase, clinical teams closely monitor patients to ensure the necessary testing and interventions are completed. A full list is outlined in the service bundle for adult post-transplant: during hospital admission.

Diet is increased as tolerated when intestinal activity is re-established and patients also begin their immunosuppression therapy. Immunosuppression therapy is based on the transplant recipient's immunological risk and donor factors. Agents are used in combination to achieve sufficient immunosuppression, while minimizing the toxicity associated with individual agents. Since the risk for acute rejection is highest in the first 3 months after transplantation, higher doses are used during this period, and then reduced thereafter in stable patients to minimize toxicity (22). Patients will usually remain in hospital between five and seven days, and will only be discharged after their vital signs are stable, the new kidney is functioning, and they no longer require constant hospital care.

### ***Post-Transplant: After Discharge***

This phase refers to the time period following hospital discharge.

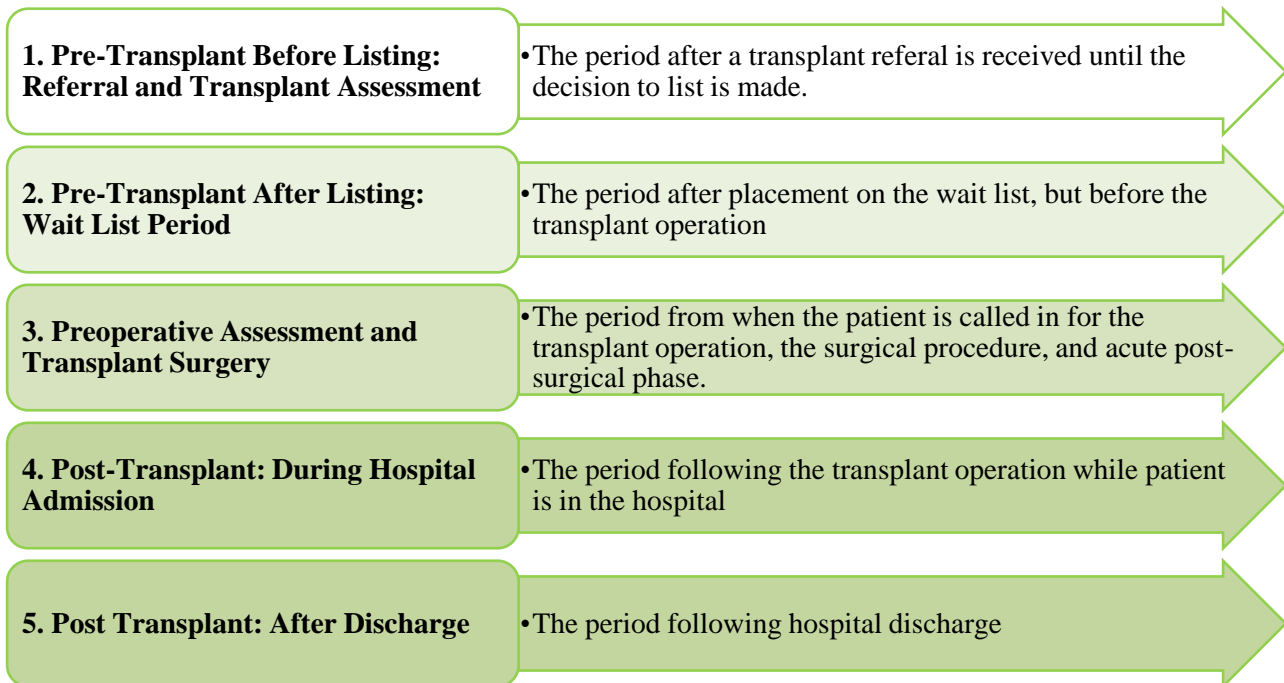
Following discharge from hospital, patients receive ongoing monitoring for immunosuppression and signs of organ rejection. The intensity of monitoring is greatest immediately following transplant, when patients are required to regularly complete lab and diagnostic testing and attend outpatient clinics at transplant centres. Some patients will continue to attend clinics at their transplant centres for the duration of their functioning grafts, while others may have their care transferred to the community nephrologist. In such cases, day to day patient care will be carried out by the community nephrologist, with complex issues, such as changes in immunosuppression levels being carried out by the transplant centres.

Organ rejection is the major cause of graft failure. Therefore, it is important to diagnose acute rejection as soon as possible to initiate prompt antirejection therapy. Acute rejection is most commonly seen one week to three months after the transplant. Elevated creatinine levels may indicate a rejection episode, although other symptoms of rejection include fever, pain or tenderness around the transplanted kidney, and decrease in urine output. Screening tests should include creatinine and eGFR, urine protein, complete blood count, fasting glucose and lipid studies (22). If a decline in eGFR is found, then an allograft biopsy is generally warranted to detect the nature of a potentially treatable kidney injury.

Kidney transplant recipients should also be screened for infections. CMV infection is the most common serious viral infection affecting kidney transplant recipients and is associated with acute rejection and is an important cause of morbidity. Patients should also be screened for BK Polyoma virus, which is an important cause of kidney allograft dysfunction, as well as Epstein-Barr virus (EBV) (23). A full list of tests and diagnostics for this phase of care is outlined in the service bundle for adult post-transplant: after discharge.

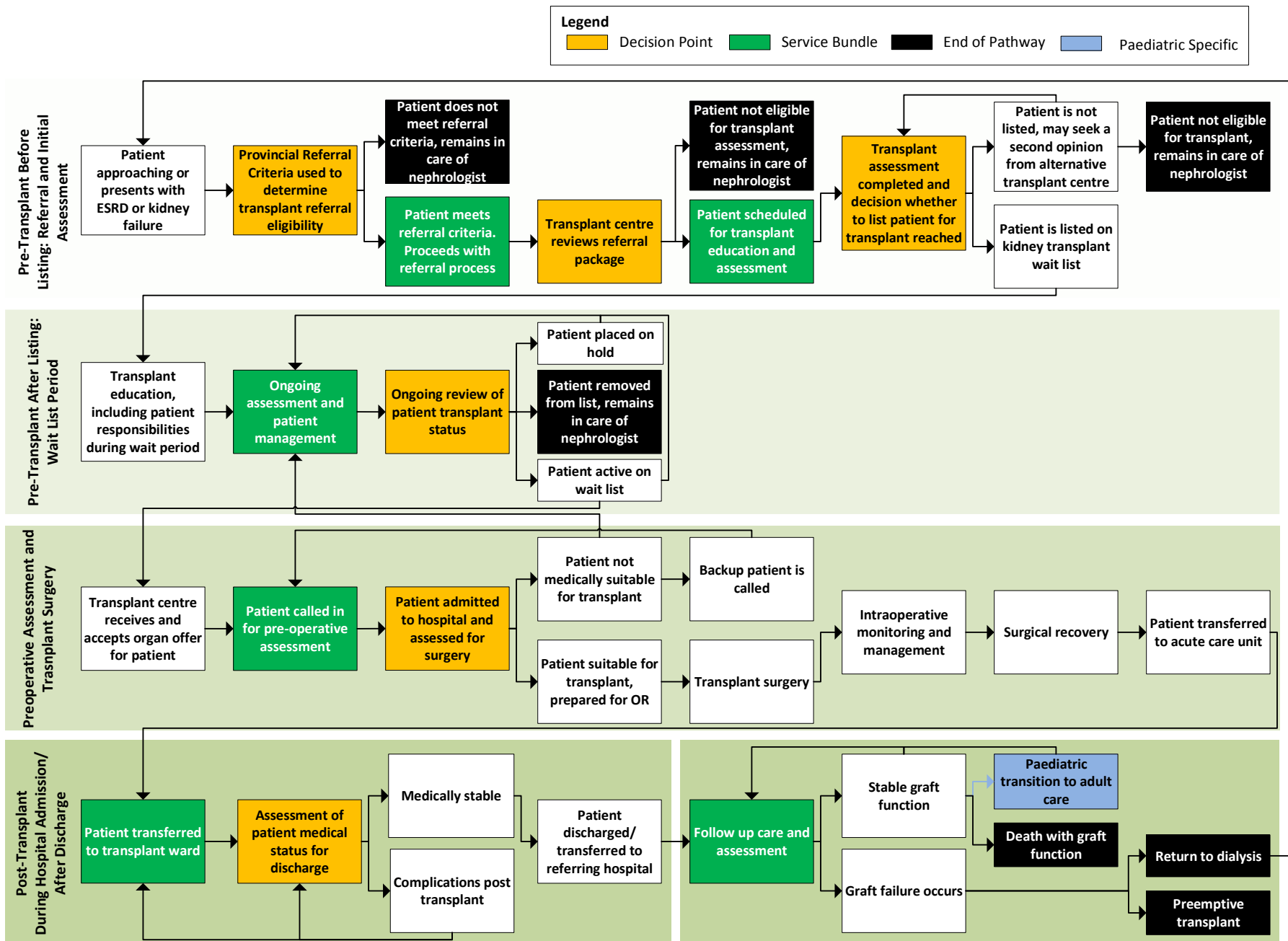
## VI. Clinical Pathway for Kidney Transplantation

The clinical pathway outlines the process that the typical Ontario patient can expect when moving through the transplant system. It is categorized into the following five key stages of the patient care continuum:



The pathway is intended to be a general guide to the transplant process and identify what patients can expect to receive during the specific time periods. It presents decision points and phases of treatment (service bundles) within an episode of care. The list of services for each service bundle are detailed in section VII.

The clinical pathway and service bundles should be used in tandem to guide the care of kidney transplant patients in Ontario.



## VII. Service Bundles

The Service Bundles outline the full scope of services and the frequencies with which they may be provided to the typical transplant patient at each stage of their transplant care continuum. The timing of when these services should be administered during the care continuum are indicated in the Clinical Pathway. Although all services will be provided as part of the transplant process, not all will be carried out at the transplant centre. Services highlighted in gray are part of the referral form and provided by the referring centre.

Because of differences in service needs for adult and paediatric patients, separate service bundles have been created for each group. Within each bundle the following three patient sub-populations have been identified with any distinct service requirements highlighted with blue text:

- **Standard Risk Patients:** patients without an abstracted hospital record with a diagnosis of heart disease or diabetes within 2 years before transplant.
- **High-Risk Patients:** determined by transplant centres based on recipient medical factors including heart disease, diabetes, liver disease or obesity.
- **Kidney-Pancreas patients:** patients who require a simultaneous kidney and pancreas transplant.

Unbundled services, which refer to services which cannot be predicted and/or do not have a standard frequency for a given patient population are not listed.

The Services Bundles do not to replace the professional skill and judgment of healthcare providers, but rather ensure minimum standards of care are met for all patients regardless of where care is being provided. They do not apply to all patients in all circumstances and cannot be used as a legal resource.

## Adult Kidney and Kidney/Pancreas Transplant Bundle

### Adult Pre-Transplant Before Listing: Referral and Initial Assessment

**Clinical Care:** Transplant programs are responsible for determining whether patients are medically suitable to receive a transplant. Once a referral is received, the transplant programs work to complete the required consultations, diagnostics, and lab testing to enable the multidisciplinary clinical team to assess the patient for transplant eligibility.

The assessment process is carried out at both referring centres and outpatient transplant clinics, and may take several months to complete. Patients who qualify for listing are registered on the Provincial Kidney Wait List. This phase is supported by the following personnel:

- RN and APN, NP, MD
- Health profession care (social work, respiratory, physiotherapy, occupational therapy, pharmacy, and nutrition)
- Administrative support
- The patient is monitored in the CKD clinics while they receive their dialysis.

#### Clinical Visits and Consultations

Transplant education	one time
Surgical/Urology	one time
Nephrology	one time
Anesthesia	one time
Cardiology	one time
Social work	one time
Dental	one time

#### Laboratory Testing: General Blood, Urine, Other

CBC	one time
Electrolytes: sodium, potassium, chloride, carbon dioxide	one time
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, uric acid, magnesium, glucose	one time
LFTs: Total bilirubin, direct bilirubin, albumin, total protein	one time
PTH	one time
Calcidiol levels (Vitamin D)	one time
Fasting lipid studies: total cholesterol, triglyceride, LDL, HDL	one time
PTT, INR	one time
Ferritin, iron, TIBC	one time
Fasting/random blood glucose, oral glucose tolerance test	one time
Urine C&S and Urine R&M	one time
<i>HbA1c: For K/P patients only</i>	
<i>Amylase, Lipase: For K/P patients only</i>	
<i>Fasting C- Peptide: For KP patients only</i>	

#### Laboratory Testing: Infectious Profile (serology)

CMV screening	one time
EBV screening	one time
HBcAb: hepatitis B core antibody	one time
HBsAb: hepatitis B surface antibody	one time
HBsAg: hepatitis B surface antigen	one time
Hepatitis C antibody	one time
HIV (I and II)	one time
HSV	one time
HTLV 1 and 2	one time
PPD: (Tuberculosis test)	one time
VDRL or Rapid Plasma Reagin (RPR)	one time
VZV antibody	one time
Measles, Mumps, Rubella antibody	one time

#### Immunologic Evaluation

ABO blood group determination	one time
HLA typing class I and II	one time
PRA test	one time
Anti A or Anti B titres	twice

*Services continued on next page*

### Adult Pre-Transplant Before Listing: Referral and Initial Assessment

Continued from previous page

Ultrasound	
Abdominal ultrasound	one time
Iliac doppler	one time
<i>Lower Extremity Arterial Doppler study: For high risk patients</i>	

Other	
Cancer screening	as per Ontario guidelines
Immunizations	as needed

Radiology	
Chest X-ray	one time
Electrocardiogram (ECG/ EKG)	one time
Echocardiogram	one time
MRI (for patients with polycystic kidney disease)	one time
Cardiac perfusion testing (Exercise Electrocardiogram or MIBI)	one time
<i>CT - Pelvic Blood Vessels: For high risk patients</i>	
<i>Coronary Arteriography: For his risk and K/P patients</i>	

### Adult Pre-Transplant After Listing: Wait List Period

**Clinical Care:** Transplant programs are responsible for determining whether patients remain medically suitable to receive a transplant while on the wait list. Programs will complete the required consultations, diagnostics, and lab testing to enable the multidisciplinary clinical team to assess patients for their ongoing transplant eligibility. Ongoing assessment is carried out at both referring centres and outpatient transplant clinics while patients are on the wait list. This phase is supported by the following personnel:

- RN and APN, NP, MD
- Health profession care (social work, respiratory, physiotherapy, occupational therapy, pharmacy, and nutrition)
- Administrative support
- The patient is also monitored in the CKD clinics while they receive their dialysis.

Clinical Visits and Consultations	
Transplant education	annual
Surgical/Urology	one time
Nephrology	one time

Laboratory Testing: General Blood, Urine, Other	
CBC	annual
Electrolytes: sodium, potassium, chloride, carbon dioxide	annual
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, uric acid, magnesium, glucose	annual
LFTs: Total bilirubin, direct bilirubin, albumin, total protein	annual
PTH	annual

Immunologic Evaluation	
PRA and anti-HLA antibody testing	4x/year

Laboratory Testing: Infectious Profile (serology)	
CMV screening	annual
EBV screening	annual
HBsAb: hepatitis B surface antibody	annual
Hepatitis C antibody	annual
HIV (I and II)	annual
VZV antibody	annual

Radiology	
<i>Cardiac perfusion testing: For all patients except the lowest risk groups (e.g. Age &lt;40 years, no DM)</i>	Every 1-2 years
<i>Echocardiogram: For high risk patients only</i>	

Clinic Visits	
Medical assessment for eligibility	annual

Other	
Cancer screening	as per Ontario guidelines

## Adult Preoperative Assessment and Transplant Surgery

**Clinical Care:** Transplant programs are responsible for patient management during the preoperative assessment and transplant surgery phase of the transplant process. Programs liaise with TGLN regarding potential deceased organ donor matches, and contact patients once a match has been found. Patients are admitted to the transplant hospital where they receive a final assessment for medical suitability before being admitted for surgery. The clinical team completes the patient assessment, prepares the patient for the transplant, and performs the procedure. Patient management and monitoring for the preoperative assessment and transplant surgery period is supported by the following personnel:

- RN and APN, Physicians
- Surgical team
- Health profession care
- Administrative support

### Consultations

Transplant education	one time
Surgical/Urology	one time
Nephrology	one time
Anesthesia	one time

### Immunologic Evaluation

Blood type and cross	one time
Flow cross matching	1-2x

### Radiology

Chest X-ray	one time
Electrocardiogram (ECG/ EKG)	one time

### Laboratory Testing: General Blood, Urine, Other

CBC	one time
Electrolytes: sodium, potassium, chloride, carbon dioxide	one time
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, uric acid, magnesium, glucose	one time
LFTs: Total bilirubin, direct bilirubin, albumin, total protein	one time
PTT, INR	one time
Fasting/Random blood glucose	one time
MRSA nasal swab	one time

### Transplant Surgery

Preoperative assessment and monitoring by surgical team  
 Transplant surgery including transplant surgeon, surgical team, anesthesiologist, operating room staff, and all other resources required during the surgery.

### Immediate post-transplant monitoring and management

Post-Anesthetic care (recovery phase)
Post-operative care unit
Diagnostic and laboratory assessment



**Adult Post-Transplant: During Hospital Admission**

**Clinical Care:** Transplant programs are responsible for patient management during the post-transplant, hospital admission phase. During this phase, clinical teams continue to monitor patients, ensuring necessary testing and interventions are completed. Patients also begin their immunosuppression therapy. Ongoing patient management, monitoring, education and nursing care is supported by the following personnel:

- RN and APN, NP, MD
- Health profession care (social work, respiratory, physiotherapy, occupational therapy, pharmacy, and nutrition)
- Administrative support

**Consultations**

Transplant education	one time
Nephrology	daily
Surgical	daily
Pharmacy	at least twice
Case manager	at least once

**Other Resources**

Acute care unit
Transplant ward
Rehabilitation

**Laboratory Testing: General Blood, Urine, Other**

CBC	
Electrolytes: sodium, potassium, chloride, carbon dioxide	every 6 hours
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, uric acid, magnesium, glucose	for first 48 hours, then daily
LFTs: Total bilirubin, direct bilirubin, albumin, total protein	
Fasting/Random blood glucose	daily
Immunosuppression levels	daily

**Ultrasound**

Transplant ultrasound	one time
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**Adult Post-Transplant: After Discharge**

**Clinical Care:** Transplant programs are responsible for patient management during the post-transplant after discharge from hospital phase. Transplant teams and appropriate healthcare providers monitor patients through outpatient clinic visits, ensure necessary testing is completed, interpret laboratory and diagnostic results, and collaborate with other members of the multidisciplinary transplant team as required. Transplant programs also monitor and adjust immunosuppression therapy to prevent organ rejection. Ongoing patient management and monitoring is completed by transplant programs and is supported by the following personnel.

- RN and APN, NP, MD
- Health profession care (social work, physiotherapy, occupational therapy, pharmacy, and nutrition)
- Administrative support

**Consultations**

Transplant education	every clinic visit
Surgical/Urology follow-up	one time
Nephrology follow-up	ongoing
Social work	one time
Dermatological assessment	every 1-2 years

*Cardiology - For high risk patients only*

**Laboratory Testing: General Blood, Urine, Other**

CBC	
Electrolytes: sodium, potassium, chloride, carbon dioxide	
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, uric acid, magnesium, glucose	2x per week: 0-1M 1x per week: 2-3M
LFTs: Total bilirubin, direct bilirubin, albumin, total protein	1x every 2 weeks: 4-6M 1x per month: 7-24M 1x per 2-3M: >24M
GGT	
Fasting/Random blood glucose	
Immunosuppression levels	
Amylase, Lipase	
Urine measurement	
PTH	q3M from 0-6 months;
Calcidiol levels (vitamin D)	q6M until 2 years; annually thereafter
HbA1c	
Fasting lipid studies: total cholesterol, triglyceride, LDL, HDL	every 6 months
PTT, INR	as needed

*Fasting C- Peptide: For KP patients only*

**Immunologic Evaluation**

PRA and anti-HLA antibody testing	as needed
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**Laboratory Testing: Infectious Profile (serology)**

CMV PCR	as needed
EBV PCR	as needed
BK PCR	monthly: 0-3 months q3 months until 1 year annually thereafter

**Pathology**

Allograft biopsy	one time
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**Radiology**

*Echocardiogram – For KP patients only*

**Ultrasound**

Abdominal ultrasound	one time
Transplant ultrasound	annual for first 5 years
BMD scan	1,2,5 year intervals

**Other**

Stent removal	One time
Catheter removal/flushing	If needed

**Testing for recipients receiving IRD kidneys**

HIV, HCV NAT	At 1 and 3 months
HBV NAT or HBsAg	
Anti-HBs, anti-HBc, and either HBV NAT or HBsAg	At 12 months

**Clinic Visits**

Medical assessment/patient monitoring	1x/week:0-1M
	q2weeks:1-2M
	Monthly:2-6M
	q2-3months: 6M-1Yr
	q4-6months:1-2YRS Annually thereafter

## Paediatric Kidney Transplant Bundle

### Paediatric Pre-Transplant Before Listing: Referral and Initial Assessment

**Clinical Care:** Transplant programs are responsible for determining whether patients are medically suitable to receive a transplant. Once a referral is received, transplant programs work to complete the required consultations, diagnostics, and lab testing to enable the multidisciplinary clinical team to assess the patient for transplant eligibility.

The assessment process is carried out at both referring centres and outpatient transplant clinics, and may take several months to complete. Patients who qualify for listing are registered in the TGLN registry. This phase is supported by the following personnel:

- RN, APN, NP, Nephrologist, Urologist and other specialists as needed
- Health profession care (social work, respiratory, physiotherapy, occupational therapy, pharmacy, nutrition, adolescent medicine, and developmental assessment)
- Administrative support

Patients will continue to receive treatment from their existing healthcare providers during this phase of the transplant process.

Clinical Visits and Consultations	
Transplant education	one time and as needed
Surgical/Urology	one time and as needed
Nephrology	one time and as needed
Anesthesia	one time
Dietician or Nutritionist	one time
Dental	one time, within past 6 months
Social Work	one time
Psychological evaluation/ transplant psychologist/ neuropsychologist/ child life specialist	one time, and as needed

Laboratory Testing: Infectious Profile	
CMV antibody (IgM and IgG)	one time
CMV PCR	one time
EBV antibody (IgM and IgG) (EA VCA)	one time
EBV PCR	one time
Hepatitis A antibody	one time
HBcAb: Hepatitis B core antibody	one time
HBsAb: Hepatitis-B surface antibody	one time
HBsAg: Hepatitis-B surface antigen	one time
Hepatitis C antibody	one time
HIV (I and II)	one time
HSV	one time
HTLV 1 and 2	one time
PPD (2 step)	one time
Treponema pallidum test - VDRL or Rapid Plasma Reagin	one time
VZV antibody	one time
BK serum & urine	one time

*Services continued on next page*

**Paediatric Pre-Transplant Before Listing: Referral and Initial Assessment**

*Continued from previous page*

<b>Laboratory Testing: General Blood, Urine, Other</b>	
CBC	one time
Electrolytes: sodium, potassium, chloride, carbon dioxide	one time
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, uric acid, magnesium, glucose	one time
Total bilirubin, direct bilirubin, albumin, total protein, ALP, AST, ALT	one time
GGT	one time
PTH	one time
Calcidiol levels (vitamin D)	one time
HgbA1C	one time
Factor V Leiden mutation	one time
Prothrombin gene mutation	one time
Protein C, Protein S	one time
PTT, INR	one time
Antithrombin III	one time
Urine and serum for oxalate	as needed
Fasting lipid studies (total cholesterol, triglyceride, LDL, HDL)	one time
Ferritin, iron, TIBC	one time
Random blood glucose	one time
Urine C&S and Urine R&M	one time
Urinalysis ACR, PCR	one time
24 hour urine	one time

<b>Laboratory Testing and Therapies: Immunological Evaluation</b>	
ABO blood group determination	one time
HLA typing class I and II	one time
PRA Test	one time
Anti A or Anti B titres	as needed

<b>Ultrasound</b>	
Abdominal ultrasound	one time
Pelvic ultrasound	one time
Iliac doppler (at transplant centre)	one time

<b>Diagnostic Imaging</b>	
Bone age/ROD series	one time
EEG	as needed
Audiometry	as needed
Chest X-ray	one time
Electrocardiogram (ECG/ EKG)	one time
Echocardiogram	one time

**Paediatric Pre-Transplant After Listing: Wait List Period**

**Clinical Care:** Transplant programs are responsible for determining whether patients remain medically suitable to receive a transplant. Programs complete the required consultations, diagnostics, and lab testing to enable the multidisciplinary clinical team to assess patients for their ongoing transplant eligibility. Ongoing assessment is carried out at both referring centres and outpatient transplant clinics while patient are on the wait list. This phase is supported by the following personnel:

- RN, APN, NP, Nephrologist, Urologist and other specialists as needed
- Health profession care (social work, respiratory, physiotherapy, occupational therapy, pharmacy, dietician, nutrition, adolescent medicine, and developmental assessment)
- Administrative support

Patients will continue to receive treatment from their existing healthcare providers during this phase of the transplant process.

**Clinical Visits and Consultations**

Transplant education	multiple times as needed
Surgical/Urology	multiple times as needed
Nephrology	multiple times as needed
Anesthesia	annual
Dental	every 6 months
Social Work	multiple times as needed
Psychological evaluation/ transplant psychologist/ neuropsychologist/child life specialist	annual and as needed

**Laboratory Testing: Infectious Profile**

CMV antibody (IgM and IgG)	as needed
CMV PCR	every 3-4 months if negative
EBV antibody (IgM and IgG)	as needed
EBV PCR	every 3-4 months if negative
Hepatitis A antibody	annual
HBcAb: Hepatitis B core antibody	annual
HBsAb: Hepatitis B surface antibody	annual
HBsAg: Hepatitis B surface antigen	annual
Hepatitis C antibody	annual
HIV (I and II)	annual
HSV	annual
Treponema pallidum test - VDRL or Rapid Plasma Reagin	annual
VZV antibody	annual
HTLV 1 and 2	annual

**Laboratory Testing: General Blood, Urine, Other**

CBC	annual
Electrolytes: sodium, potassium, chloride, carbon dioxide	annual
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, uric acid, magnesium, glucose	annual
Total bilirubin, direct bilirubin, albumin, total protein, ALP, AST, ALT	annual
GGT	annual
PTH	annual
HgbA1C	annual
Protein C, Protein S	annual
24 hour urine - protein volume and protein creatinine	annual
PTT, INR	annual
Fasting lipid studies (total cholesterol, triglyceride, LDL, HDL)	annual
Urine C&S and Urine R&M	annual
Urinalysis ACR, PCR	annual

**Laboratory Testing: Immunological Evaluation**

PRA test	every 3 months
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**Clinic Visits**

Medical assessment for eligibility	annual or as needed
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**Paediatric Preoperative Assessment and Transplant Surgery**

**Clinical Care:** Transplant programs are responsible for patient management during the preoperative assessment and transplant surgery phase of the transplant process. Programs liaise with TGLN regarding potential deceased organ donor matches, and contact patients once a match has been found. Patient are admitted to the transplant hospital where they receive a final assessment for medical suitability before being admitted for surgery. The clinical team completes the patient assessment, prepares the patient for the transplant, and performs the procedure. Patient management and monitoring for the preoperative assessment and transplant surgery period is supported by the following personnel:

- RN, APN, NP, Nephrologist, specialty consultants as needed
- Surgical team
- Administrative support

<b>Consultations</b>	
Surgical/Urology	one time
Nephrology	one time
Anesthesia	one time
Interventional Radiologist	as needed

<b>Laboratory Testing: General Blood, Urine, Other</b>	
CBC	one time
Electrolytes: sodium, potassium, chloride, carbon dioxide (CO2)	one time
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, uric acid, magnesium, glucose	one time
Total bilirubin (T-bili), direct bilirubin, albumin, total protein, ALP, AST, ALT	one time
GGT	one time
PTH	one time
Blood type and cross	one time
PTT, INR	one time
Urine C&S and Urine R&M	one time
Pregnancy test (females ≥12 years of age)	one time

<b>Laboratory Testing: Immunologic evaluation</b>	
ABO blood group determination	one time
PRA test	one time

<b>Laboratory Testing: Infectious Profile</b>	
CMV antibody (IgM and IgG)	one time
CMV PCR	one time
EBV antibody (IgM and IgG) (EA VCA)	one time
EBV PCR	one time
Hepatitis A antibody	one time
HBcAb: Hepatitis B core antibody	one time
HBsAb: Hepatitis B surface antibody	one time
HBsAg: Hepatitis B surface antigen	one time
HCV Ab: Hepatitis C test	one time
HIV (I and II)	one time
HSV	one time
HTLV 1 and 2	one time
Treponema pallidum test - VDRL or Rapid Plasma Reagin	one time
VZV antibody	one time
Bacterial and anaerobic culture	one time
Serum and urine for BK	one time
West Nile Virus antibody	as needed

<b>Radiology</b>	
Chest X-ray	one time
Abdominal X-ray	as needed
Electrocardiogram (ECG/EKG)	one time
Echocardiogram	as needed

**Transplant Surgery**

Intra-operative assessment and monitoring by surgical team  
 Transplant surgery including transplant surgeon, anesthesia, surgical team, operating room staff, and all other resources required during the surgery.  
 Abdominal ultrasound, as needed

**Paediatric Post-Transplant: During Hospital Admission**

**Clinical Care:** Transplant programs are responsible for patient management during the post-transplant, hospital admission phase. During this phase, clinical teams continue to monitor patients, ensuring necessary testing and interventions are completed. Patients also begin their immunosuppression therapy. Ongoing patient management, monitoring, education and nursing care is supported by the following personnel.

- RN, APN, NP, Nephrologist, Urologist and other specialists as needed
- Health profession care (social work, respiratory, physiotherapy, occupational therapy, pharmacy, and nutrition)
- Administrative support

**Consultations**

Surgical	daily
Transplant education	one time, then as needed
Nephrology	daily
Anesthesia	one time, then as needed
Pharmacy	daily
Dietician or Nutritionist	one time, then as needed
Occupational/physiotherapist	one time, then as needed
Social work	one time, then as needed
Child life specialist	one time, then as needed
Intensivist	daily

**Laboratory Testing: Infectious Profile**

CMV PCR	once (at 2 weeks)
EBV PCR	once (at 2 weeks)
Serum and urine for BK	once (at 2 weeks)

**Radiology**

Renal ultrasound	once (day 1), then as needed
Nuclear scan	as needed

**Other Resources**

ICU/CCU
Transplant ward
Rehabilitation
Discharge planning/CCAC liaison

**Laboratory Testing: General Blood, Urine, Other**

CBC and Differential	Every 6 hours first 48 hours, then daily
Electrolytes: sodium, potassium, chloride, carbon dioxide	Every 6 hours first 48 hours, then daily
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, magnesium, glucose	Every 6 hours first 48 hours, then daily
Total bilirubin, direct bilirubin, albumin, total protein, ALP, AST, ALT	every 3 days
Uric acid	as needed
GGT	daily
PTT, INR	as needed
Cultures (access lines, catheters etc)	once
Urine culture	weekly
Urinalysis ACR, PCR	daily
Urine protein	daily
Immunosuppression levels	daily
Pharmacokinetic laboratory testing	once, then as needed
PCR serum for CMV, EBV	once (at 2 weeks)

**Paediatric Post-Transplant: After Discharge**

**Clinical Care:** Transplant programs are responsible for patient management during the post-transplant after discharge from hospital phase. Transplant teams and appropriate healthcare providers monitor patients through outpatient clinic visits, ensure necessary testing is completed, interpret laboratory and diagnostic results, and collaborate with other members of the multidisciplinary transplant team as required. Transplant programs also monitor and adjust immunosuppression therapy to prevent organ rejection. Ongoing patient management and monitoring is completed by transplant programs and is supported by the following personnel.

- RN, APN, NP, Nephrologist, Urologist and other specialists as needed
- Health profession care (social work, respiratory, physiotherapy, occupational therapy, pharmacy, nutrition, transplant education, developmental assessment, psychologist/psychiatrist/neuropsychologist)
- Administrative support

**Clinical Visits and Consultations**

Surgical/Urology	annual
Nephrology	ongoing to transition
Adolescent Medicine Physician	one time, then 3-6 months
Dietician or Nutritionist	one time, then ongoing
Occupational/physiotherapist/ exercise counselling	one time, then as needed
Dental	6-9 months
Social work	once, then ongoing
Interventional Radiologist	one time, then as needed
Transplant education	ongoing

**Laboratory Testing: Immunologic evaluation**

PRA test	one time then as needed
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**Laboratory Testing: Infectious Profile**

CMV PCR	2x a month for first 3 months, then once a month to 1 year, then every 3 months after year 1
EBV PCR	
BK PCR	
Serum and urine for BK	
CMV antibody (IgM and IgG)	annual
EBV antibody (IgM and IgG)	annual
HBcAb: Hepatitis B core antibody	annual
HBsAb: Hepatitis B surface antibody	annual
HBsAg: Hepatitis B surface antigen	annual
Hepatitis C antibody	annual
HIV (I and II)	as needed
HSV	as needed
HTLV 1 and 2	as needed
VZV antibody	annual

*Services continued on next page*



**Paediatric Post-Transplant: After Discharge**

*Services continued from previous page*

<b>Laboratory Testing: General Blood, Urine, Other</b>	
CBC	
Random blood glucose	
Electrolytes: sodium, potassium, chloride, carbon dioxide	2x per week: 0-3M 1x per week: 3-6M
Multiscreen panel: calcium, phosphate, LDH, urea, creatinine, uric acid, magnesium	1x every 2 weeks: 6-9M 1x per month-9M: 2YRS 1x per 3 months: 2YRS
ALP, AST, ALT	
Urinalysis ACR, PCR, Immunosuppression levels	
HgbA1C	every 6 months
PTT, INR	as needed
Fasting lipid studies (total cholesterol, triglyceride, LDL, HDL)	every 6 months
Other cultures	as needed
Urine C&S and Urine R&M	weekly for 3 months, every 2 weeks up to 6 months, monthly to 1 year, every 3 months after year 1
PTH	2x/year for first year, at least one year thereafter

<b>Other</b>	
CVL removal	one time
PD catheter removal	one time
G-tube removal and/or closure	one time
Stent removal	one time
Ambulatory blood pressure monitoring	annual

<b>Diagnostic Imaging</b>	
Bone age/ROD series, BMD	annual
Electrocardiogram (ECG/EKG)	annual
Echocardiogram	annual
BMD scan	annual

<b>Ultrasound</b>	
Transplant ultrasound	annual, then as needed
Native kidney ultrasound	annual

<b>Home Care</b>	
Home care nursing visits	weekly, if needed x 3 months then PRN

<b>Pathology</b>	
Allograft biopsy	6 wks, 6 mths, annual and as needed

<b>Clinic Visits</b>	
Medical assessment/patient monitoring	Weekly: <3M q2weeks:3-6M Monthly:6-12M q3 months:>1 year As needed thereafter
Transition clinic	as needed

<b>Testing for recipients receiving IRD kidneys</b>	
HIV, HCV NAT	At 1 and 3 months
HBV NAT or HBsAg	
Anti-HBs, anti-HBc, and either HBV NAT or HBsAg	At 12 months

## VIII. Implementation

The Clinical Handbook is a compendium of evidence-based and clinical consensus guidelines created with the goal of improving quality of transplant care delivery and patient outcomes as measured through performance indicators. This toolkit is not intended to replace the professional skill and judgement of healthcare providers, nor inhibit the development of new and innovative transplant solutions.

Successful implementation of the Handbook can be facilitated by leveraging the following components:

- **Building a shared vision for clinical practice:** The Clinical Handbook is an opportunity to share clinical consensus guidelines that will allow the system to provide even better quality care, while increasing system efficiencies.
- **Engaging leadership for change:** Senior leaders can support the vision for change by providing a clear message about the implications of implementation.
- **Supporting clinical engagement:** From the outset, staff, physicians and other clinicians should be provided with sufficient information that will help them understand the importance of this initiative, especially its impact on patient care.

To achieve a shared vision for clinical practice, transplant centres are encouraged to review their current processes in relation to the clinical pathway and identify any variation that exists. As transplantation is a complex system, when a variation is identified, transplant centers are encouraged to work within their centers to understand the variation in developing their local clinical pathway. To help with the review process the following roadmap to implementation has been suggested.

Roadmap to Kidney Transplant Clinical Pathway and Service Bundles Implementation

**Current State Assessment**

- Review processes for each stage of care for the patient groups outlined in the Handbook

**Clinical Practice Assessment**

- Review Clinical Handbook

**Gap Analysis**

- Conduct pathway and services bundles gap analysis
- Identify improvement opportunities

**Closing the Gap**

- Develop implementation plan

**Ongoing Evaluation**

- Use performance indicators to monitor implementation and identify areas for further improvement.

The Clinical Handbook provides an opportunity to build a shared vision for clinical practice for kidney transplantation to improve quality of care, while maximizing the effective use of available resources. In order to make informed and accurate decisions, the importance of high-quality data cannot be emphasized enough. As outlined in section III, TGLN has developed a list of quality indicators that can be used to evaluate each stage of the patient care continuum. Such indicators will enable centres to track, audit, and evaluate the implementation of the clinical pathway and service bundles at organizational level. Through such monitoring, variances can be identified, progress monitored, and practices refined over time to improve patient outcomes.

The Kidney and Pancreas Working Group will utilize performance metrics to review clinical practices and make recommendations to support practice changes where notable variations in practice have been identified. The Clinical Handbook will be reviewed regularly by the Working Group and when appropriate, updated with new recommended practices, evidence, and policy changes.

## IX. Appendix A. Existing Kidney Transplant Guidelines

There are currently several best practice guidelines which are utilized in the management of kidney transplantation throughout the world. Although ranging in scope and detail, all are based on scientific evidence and expert opinion. While the unique nature of Ontario's transplant population and healthcare system necessitate separate guidelines, a review of existing best practice has been an important aspect of developing this Clinical Pathway and Best Practice Handbook.

- ***International Guidelines***

- Kidney Disease: Improving Global Outcomes (KDIGO)

- *Kidney Disease: Improving Global Outcomes (KDIGO)* is an initiative to develop and implement clinical practice guidelines. Amongst other topics, to date it has produced guidelines on Acute Kidney Injury, Blood Pressure in CKD, CKD Evaluation and Management, and Hepatitis C in CKD. The guidelines are developed by independent, international, multidisciplinary work groups made up of experts with clinical and technical knowledge of the topic, and process and methodological expertise. As part of its review process, KDIGO invites individuals and organizations to provide feedback on the basis of their expertise or interest in the guideline topic.

- In November 2009, KDIGO published comprehensive guidelines for the management of kidney transplant recipients. The guidelines were written for transplant-care providers throughout the world and as such, address issues that are important to the care of transplant recipients in both developed and developing countries.(22)

- ***European Guidelines***

- European Association of Urology (EAU)

- The *European Association of Urology (EAU)* represents the leading authority within Europe on urological practice, research and education. It has a membership of over 16,000 medical professionals who are committed to raising the level of urological care by delivering training, stimulating research and broadcasting information.

- The *EAU Guidelines on Renal Transplantation* were developed by a working panel made up of international experts, including both urologists and non-urologists to ensure a balanced and representative view. First published in 2003 and most recently updated in 2009, the guidelines consider both the technical aspects of kidney transplantation, as well as the ethical, social, and political issues involved. Where possible, the guidelines provide a level of evidence, indicating the type of evidence on which the recommendation is based and a grade of recommendation ranging from A (based on clinical studies of good quality and consistency addressing the specific recommendations and including at least one randomized trial) to C (made despite the absence of directly applicable clinical studies of good quality). The guidelines are

comprehensive in scope, covering kidney donation policies and kidney donor selection and refusal criteria, through to transplantation techniques and post-transplant care.(19)

European Renal Association-European Dialysis Transplant Association (ERA-EDTA)

The *European Renal Association-European Dialysis Transplant Association* (ERA-EDTA) is an association of physicians with over 7000 members, committed to the advancement of medical science and of clinical work in nephrology, dialysis, kidney transplantation, and related subjects. It aims to provide up-to-date knowledge, exclusively based on scientific data, independent from governments' policies and from any influence of the industry.

Published in 1998, the *European Best Practice Guidelines* (EBPG) were primarily based on randomized control trials and large open trials, and were produced to represent the optimal management in the field of kidney transplantation inside the European Union. The EBPG's were published in two parts, the first of which is devoted to the evaluation, selection and preparation of potential transplant recipients, the evaluation and selection of donors, and the management of the transplant recipient in the first year, and the second, to long-term management of kidney transplant recipients.(24,25)

UK Renal Association

The *UK Renal Association* is a professional organization of nephrologists and renal scientists. In 2007 it published assessment guidelines for kidney transplantation, which were most recently revised in 2010. Where there was a lack of evidence from high-quality studies, recommendations were based on the best available evidence taking into account North American and the EBPG guidelines.(2) In 2011 it also published guidelines covering the period after kidney transplantation, specifically from initial hospital discharge until graft failure or patient death.(23)

- ***North American Guidelines***

American Society of Transplantation

The *American Society of Transplantation* has a membership of more than 3000 professionals dedicated to advancing the field of transplantation and improving patient care by promoting research, education, advocacy, and organ donation. Its guidelines were developed using the expertise of its Clinical Practice Guidelines Committee members and the results of a literature review. A draft was sent to societies and individuals for review, including the American Society of Nephrology, the Renal Physicians Association, the American Society of Pediatric Nephrology, and the National Kidney Association.

Published in 2000, the guidelines are applicable to all adult and pediatric kidney transplant recipients, and include outpatient screening for and prevention of diseases and complications that commonly occur after kidney transplantation. As much as possible, the guidelines are evidence-based, and each recommendation has a subjective grade to indicate the strength of evidence that supports the recommendation. In addition to improving the care of kidney transplant recipients, the guidelines were intended to provide a framework for additional discussion and research.(26)

Canadian Society of Transplantation

Within Canada, the *Canadian Society of Transplantation* formed a committee to develop consensus guidelines on eligibility criteria in an effort to outline which patients in the growing population with end-stage renal disease are currently suitable for transplantation.(18) These guidelines were published in 2005 and were used to derive the Provincial Kidney & Pancreas Working Group Kidney Transplantation Referral and Listing Criteria.

BC Transplant (BCT)

In British Columbia clinical guidelines have been produced by BC Transplant (BCT) covering the whole pre- to post-transplant process.(27) The guidelines are a statement of consensus of BCT professionals regarding their views of currently accepted approaches to treatment in adult patients.

Developed for and by kidney transplant professionals, these guidelines represent current best practice standards in the field of kidney and kidney/pancreas transplantation. Utilizing the latest reputable research and expert clinical opinion from around the world, these recommendations were used to support the development of services that are included in this Handbook.

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