2017

Primary Care Provider Adherence to the Canadian Diabetes Association Clinical Practice Guideline for Chronic Kidney Disease

Dawn O. Chubbs Ms.

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Dawn Olive Chubbs

UMass College of Nursing

Capstone Chair:	Dr. Lisa Chiodo
Capstone Committee Member:	Dr. Deborah Rosenbloom
Capstone Mentor:	Dr. Barbara Bell
Date of Submission:	April 18, 2017

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Abstract

Background: Diabetes mellitus is the leading cause of chronic kidney disease (CKD) requiring dialysis and contributes to one-half of all new dialysis cases each year in Canada. Despite the ability to stop or slow the progression of CKD through early detection and intervention, CKD continues to rise, in part, due to providers' lack of knowledge of and adherence to established national clinical practice guidelines (CPGs). *Methods:* A quality improvement project was implemented in a rural, primary care clinic to enhance provider knowledge of the current CPG recommendations for CKD screening before and after a provider-specific educational intervention. *Results:* The educational intervention improved provider knowledge of and confidence in screening for renal disease in diabetic patients. The average numbers of diabetic patients screened for renal disease improved each year, with 85.5% being screened in 2015-2016, resulting in a net increase of 31.5%. In addition, modifiable risk factor screening by providers also improved in the same period, including measures of weight, blood pressure, lipids, and glycosylated hemoglobin levels. *Conclusion:* Increasing primary provider awareness and knowledge, through education, can foster early recognition and management of CKD in diabetes and ultimately improve renal health outcomes in the diabetic population.

Keywords: Type 2 diabetes, chronic kidney disease, primary care, provider adherence, clinical practice guidelines, quality improvement

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The rapidly increasing rate of diabetes mellitus has become a major public health issue worldwide with latest estimates identifying 9% of the global population affected by the disease (World Health Organization, 2014). In Canada, rates are slightly higher, with 9.4% (3.4 million) of the population having diabetes (Canadian Diabetes Association [CDA], 2015). Improved therapies have increased life expectancy, and, subsequently, amplified the incidence of sequelae, including progressive kidney failure and chronic kidney disease (CKD) (Lloyd & Komenda, 2015; Packham, et al., 2012). Diabetes is the leading cause of kidney failure requiring dialysis and contributes to one-half of all new dialysis cases each year (CDA, 2013; Canadian Institute for Health information [CIHI], 2012; Public Health Agency of Canada, 2011). Further, studies show that 50% of diabetics will demonstrate renal markers of kidney damage, also known as diabetic nephropathy, in their lifetime (CDA, 2013). Diabetes-related CKD has significant individual and societal costs impacting mortality, patient quality of life and healthcare system costs (CDA, 2013; CIHI, 2009; McFarlane, Gilbert, MacCallum & Senior, 2015; Nova Scotia Renal Program, 2015; Pyram, Kansara, Banerji & Loney-Hutchinson, 2011).

Comprehensive clinical practice guidelines (CPGs) for the prevention and management of diabetes and related co-morbidities, including chronic kidney disease, have been developed by the Canadian Diabetes Association. These guidelines, developed by an expert panel using peer-reviewed evidence, have been recognized nationally and internationally as being rigorous and of high quality (CDA, 2013) (Appendix A). However, there has been varied success in the uptake of and adherence to renal protective recommendations by primary care providers (PCPs) which

has contributed to a delay in the early detection and management of diabetes-related chronic kidney disease (CDA, 2013; CIHI, 2009, 2012; Eilat-Tsanani, et al, 2014; Kastner, et al., 2015; Malcolm, et al., 2013).

Problem Statement

Screening for early chronic kidney disease by primary care providers, using the Canadian Diabetes Association guideline, is part of the nationally recommended management of the diabetic patient to achieve optimal renal health (CDA, 2013). However, there has been varied success in the uptake and adherence to the CDA guidelines by PCPs to prevent and manage chronic kidney disease. Prevention and at a minimum early detection of clinically-significant changes in renal function can lead to early intervention and potentially delay the progression of renal disease. Increasing PCPs knowledge of these guidelines has the potential to increase adherence and lead to earlier detection and management of CKD to slow or even halt its development and progression.

Review of the Literature

This review was conducted using the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, and Medline, utilizing the Medical Subject Headings (MeSH) of "type 2 diabetes," "chronic kidney disease," "primary care providers," "clinical practice guidelines," and "adherence." Initial inclusion criteria consisted of articles that focused on PCP adherence to diabetes-related renal guidelines in primary care that were published in peer-reviewed, English-language journals within the preceding five years (i.e., 2011-2016). Exclusion criteria included commentary and opinion articles and studies of late chronic renal disease involving renal dialysis, where early detection is no longer applicable. As there was extreme paucity of research specific to these criteria, the search was expanded to include general studies surrounding

adherence to CPGs in primary care, as well as older publications having relevant content and significant findings.

Clinical Practice Guidelines Adherence

Clinical practice guidelines are developed to assist providers in clinical decision-making by providing evidenced-based care pathways on up-to-date therapies and interventions, with the overall aim to reduce inappropriate patient harm and improve patient outcomes (Pronovost, 2013). Given the large number of CPGs to guide primary care practice, it is extremely challenging for providers to be aware of all evidence aimed at improving practice. Even when aware, becoming familiar and knowledgeable of CPGs is not guaranteed, which can negatively influence provider behavior in adopting and adhering to CPGs.

Throughout the literature, there has been a multitude of barriers to providers' adoption of and adherence to CPGs, including environmental, professional practice, guideline-specific, and behavioral factors (Abdel-Kader, et al., 2014; Cabana, 1999; Ennis, et al., 2015; Fox, et al., 2013; Kortteisto et al., 2010; Lutenberg, Burgers, Besters, Han & Westert, 2011; Szczech, et al., 2014; Taba, et al., 2012). Provider barriers are widely varied and include such factors as limited knowledge and lack of familiarity with the CPG, skepticism about the value and use of CPGs, and shortage of both time and resources with which to implement (Ennis et al., 2015; Kilpatrick, Pichette & Jabbour, 2014; Taba et al, 2012). To better understand these influences, the work of Cabana (1999) will be referenced, which separates barriers into three domains having the most significant influence on adherence to CPGs, namely provider knowledge, attitudes, and behavior.

Provider knowledge. Several knowledge-based factors on impacting the uptake of CPGs were identified in the literature, including PCP degree of familiarity with guidelines and

quality indicators. Given the large number of CPGs to guide primary care practice, it is extremely challenging for providers to be aware of all the evidence aimed at improving practice; even with awareness, becoming familiar and knowledgeable of CPGs is not guaranteed. PCPs who valued the use of CPGs related to CKD identified general lack knowledge and expertise on how to diagnose and manage CKD and were less familiar with specific measures which indicated renal abnormalities (Abdel-Kader, et al., 2014; Crinson, Gallagher, Thomas & de Lusignan, 2010). Those parameters familiar to general practitioners (i.e., measures of blood pressure and glycosylated hemoglobin testing), were measured and treated at a higher rate compared to those that were not well-known (i.e., kidney-related management activities, including nephrology referral for proteinuria) (Eilat-Tsanani et al., 2014).

Provider attitude. Attitudinal barriers relate to the way providers perceive the content and applicability of guidelines, as well as personal belief in the ability to implement the guideline and maintain a practice change (Cabana, 1999; Crinson et al., 2010). In their work, Lugtenberg, Zegers-van Schaick, Westert and Burgers (2009) identified lack of agreement with a guideline, due to lack of evidence or lack of applicability to the patient, as the most significant barrier to provider adherence. Other researchers found more significant differences in uptake and adherence based on years of primary care provider clinical experience, in that providers practicing in outpatient setting or for more than 25 years were the most likely group to have difficulty using guidelines, although most denied that guidelines were too complex or difficult to access (Taba, et al., 2012).

Provider behavior. Behavioural barriers include external factors largely out of the perceived control of the provider, such as guideline-related, patient-related, environmental issues (i.e., lack of time, human, and financial resources). Lack of time was the most common barrier

to lack of use of CPGs, followed by lack of medical resources needed to implement the guideline (Abdel-Kader, et al., 2014; Taba, et al, 2012). Primary care providers also expressed concerns assigning a diagnosis of CKD using one specific measure (i.e., eGFR), the potential psychological impact of CKD diagnosis on patients, and difficulty in approaching patients to explain CKD (Crinson et al., 2010).

Approaches to Improve Adherence

To address the challenges and barriers to integrating CPGs by primary care providers, approaches and models of care have been proposed and trialed throughout the literature. The following is a brief review of literature surrounding these interventions related to CKD.

Alternate care providers. Methods to improve uptake of CPGs have involved integration of other health professionals in CKD care delivery, albeit with varied success. Researches have sought to improve renal outcomes with the addition of advanced practice professionals (i.e., advanced practice nurses/nurse practitioners) to the routine care provided by physicians (Barrett, et al., 2011; Peeters, et al., 2014). While studies have supported that the use of a multifactorial intervention directed at multiple treatment targets, the effect was only modest in improving renal outcomes and reducing renal decline. Further, the use of a nurse-led team did not significantly affect the rate of decline in kidney function or provide control of CV risk factors when compared to the findings from the control groups receiving usual care across the studies.

Clinical processes and tools. Other approaches have involved modification of clinical processes and introduction of clinical tools to improve efficiency, work flow, and team work. One group sought to improve adherence to evidence-based care pathways for patients with diabetes and CKD by developing a framework that included six team processes proposed to be im-

proved by the additional of a nurse practitioner, which included communication, decision-making, cohesion, problem-solving, care coordination and focus on patients and families (Kilpatrick et al., 2014). Results supported several strategies that helped in integrating CPGs, including development of complementary roles within the team, actively involving patients in their care, using EBP guidelines adapted to individual patients, communication, and coordination of complex care.

To improve efficiency, other methods have focused on implementing clinical protocols, tools and flowsheets. Researchers introduced several interventions to improve adherence to CPG in managing diabetes compare to usual clinical care, including increasing appointment time, creating patient reminders, and use of a standardized diabetic flow sheet (Lin, Haler & Kirby, 2007). These results showed an improvement in clinically significant outcome measures, in addition, the interventions proved easy to implement and supported improved clinical outcomes.

These studies demonstrated improved renal outcomes with the addition of other health professionals and highlighted the importance of team processes in improving communication, decision-making, cohesion, problem-solving, care coordination and focus on patients and families (Kilpatrick et al., 2014). Strategies that helped the integration of CPGs included development of complementary roles within the team, actively involving patients in their care, using evidence-based practice guidelines adapted to individual patients, enhancing communication, and coordinating complex care (Lin et al., 2007; Peeters et al., 2014). Other clinical models and processes have been developed increase screening and improve quality outcome measures supporting the use of a multimodal approach to screening for CKD. Studies in this area have identified the importance of both a multidisciplinary team approach and use of specific clinical protocols in improving health outcomes (Ennis, et al., 2015). Still others focus refining processes, such as

utilizing specific clinical protocols and flowsheets to improve efficiency and quality outcomes in renal diabetes care.

The importance of quality initiatives to improve diabetes management via primary care clinics cannot be overstated, yet remains a challenge for providers. Review of the research identified several methods with which to negate the many obstacles encountered by PCPs in screening for CKD in diabetes, including lack of provider time. Also recognized are process barriers, such as financial and time constraints, and lack of key persons to coordinate or drive this work. Numerous clinical models and processes have been developed that are directed at increasing screening and improving quality measures with more recent evidence supporting the use of a multimodal approach to screening for CKD. Newer models include integration of advanced practice nurses and other health professionals to lead the change process; other models focus on refining processes, such as utilizing specific clinical protocols and flowsheets, to improve efficiency and, ultimately, quality outcomes. Incorporation of CPGs specific to screening for CKD in diabetes using established flowsheets and protocols provides a fitting and appropriate framework for continuous quality improvement and evaluation of provider processes and patient outcomes.

Theoretical Framework

The Theory of Planned Behavior (TPB) provided the foundation for the design of this capstone project (Appendix B). It has been used throughout the literature with health care providers to better understand the influences on behavior change, including attitudes and beliefs around adoption and use of clinical practice guidelines (Ceccato, Ferris, Manuel & Grimshaw, 2007; Kortteisto, Kaila, Komulainen, Mantyranta & Rissanen, 2010). The premise of the TPB is that the constructs of personal attitudes, social norms, perceived behavioral control, and behavioral

intention are all influencing factors on behavior change, the greatest of which is intention (Ajzen, 1991). The theory proposes that the three concepts of: 1) intention (i.e., personal attitude towards the behavior), 2) subjective norm (i.e., social pressure and normative beliefs about the behavior), and 3) perceived behavioral control (i.e., ability to control and perform the behavior) combine to determine the strength of the intention to perform the behavior. By using this model to underpin this project, it is projected that there will be an improved understanding of influences on provider behavior to use CPGs as well as identification of factors to improve adherence.

Project Design and Methods

Goals, Objectives, and Expected Outcomes

The goal of this project was to improve provider rates of screening for early chronic kidney disease in diabetics. To achieve this, this capstone project aimed to increase provider knowledge and awareness, through education, of nationally-established clinical practice guidelines that detailed the parameters for renal screening and reassessment in diabetics. Expected outcomes included increased provider awareness of and adherence to the renal-diabetes CPG as well as improvement in the numbers of diabetic patients screened for CKD using recommended screening tests. Secondary outcomes were evaluated using the reporting system of the electronic medical record (EMR) database. With assistance from the provincial EMR data analyst, data were generated on numbers of diabetic patients screened with estimated glomerular filtration rate (eGFR), creatinine, albumin-creatinine ratio (ACR) or urine for microalbumin (MAU) in the three-year period from 2014 through 2016 preceding implementation of this project. This information was used to compare the effectiveness of the project educational intervention on improving provider screening practices.

Setting and Resources

This project was implemented in a small, rural primary health care clinic in Guysborough township located in Guysborough County, the largest and most geographically dispersed county in the province of Nova Scotia, Canada. A large proportion of patients registered with the clinic are elderly with limited income and resources. There are also three surrounding communities of African Nova Scotians, who are at increased risk for diabetes due to their ethnicity and the co-morbid condition of CKD.

Description of the group, population or community. The project participants consisted of the primary health care collaborative practice team, comprised of two family practice physicians, one family nurse practitioner, and the diabetes education team (i.e., registered nurse and registered dietitian) who work closely with the collaborative team in providing diabetes-specific care.

The patient population was comprised of all adult Type 2 diabetics ages eighteen and older who received care from the collaborative care team physicians. All patients presenting for a clinical appointment who had not received renal screening in the past twelve months were eligible for screening, consisting of a measure of estimated glomerular filtration rate (eGFR), serum creatinine, microalbuminuria (MAU), or albumin-creatinine ratio (ACR).

Organizational analysis of project site. Prior to implementing this project, an informal review of the electronic medical records of a random selection of twenty-five adult diabetic patients under the care of the two primary care providers was conducted. From this data, a random review of laboratory results was reviewed to determine the extent to which renal laboratory screening was completed. This review included both the type of renal laboratory testing as well as the frequency and accuracy of repeated screening. The information obtained from this review

provided support for the project as less than 52% of this select group of patients had electronic documentation of renal screening in the previous year (i.e., 2013-2014). Fewer still had repeat laboratory measures within the recommended time frame or at all. Data generated from the EMR by the provincial data analyst supported this conclusion finding that on average only 54% of diabetic patients were screened for renal measures during that time.

Primary health care team members recognized the need for continuous quality improvement in delivery of renal-diabetes care and were instrumental in early discussions on improving individual and group clinical screening practices. To promote engagement and to standardize the approach across all providers, clinical practice guidelines on the screening, detection, monitoring and treatment of chronic kidney disease in diabetes as well as the provincial guidelines from the Nova Scotia Renal Program (Province of Nova Scotia, 2013) were shared with primary care providers through a nationally-developed PowerPoint presentation (CDA, 2015). Providers were encouraged to hold discussions with diabetic patients during their regular appointment times to inform them of the recommendation for renal screening as part of routine diabetes care. A brochure on the importance of awareness and monitoring of renal health in diabetes was made available to providers to be shared with patients.

To evaluate intervention success, the provider questionnaire was administered immediately prior to and one week after delivery of the educational intervention. There was a total of 26 questions - the first 17 questions measured provider confidence in (1) knowledge of the renal screening guideline, and (2) ability to apply the guideline in clinical practice. An additional nine questions evaluated specific knowledge components of the guideline.

Evidence of stakeholder support. This project received wide-reaching stakeholder support, not only from the primary care collaborative physician group who recognized the clinical

benefits of the project to their practice and their patients, but also from both the Nova Scotia Eastern Health Authority Zone Primary Health Care Manager and Director.

Implementation. A pre-project questionnaire was administered to the providers and diabetes educators to gauge the level of knowledge of the most recent clinical practice guideline as well as their confidence in integrating the recommendations into practice (Appendix C). An educational intervention, consisting of a thorough review of the clinical practice guideline on screening for, and management of, CKD using a nationally-prepared and approved presentation (CDA, 2015), was then delivered. This presentation was supplemented with a provider toolkit containing nationally-recognized print resources for quick reference during patient appointments. Toolkit items included: 1) the complete Clinical Practice Guideline for Chronic Kidney Disease (2013), 2) Guideline for Therapeutic Management of Diabetic Medications in CKD, 3) the Nova Scotia Renal Program Guideline (2016) (including laminated poster for office reference), and 4) a patient education pamphlet outlining the importance of routine renal screening in diabetes (Kidney Foundation of Canada, 2009) (Appendix D). Post completion of the educational intervention, the provider questionnaire was again administered to assess change in knowledge and intent to change practice behaviors. The project was implemented over a 3-month period beginning in October, 2016. Data were extracted from the EMR at several points before, during and on completion of the project to assess for change in provider screening rates.

Ethics and Human Subjects Protection

A human subjects' determination form was submitted to the UMASS IRB before beginning the project to determine if IRB approval was necessary; additional review by the Nova Scotia Health Authority Research Ethics Board was completed for similar determination. Both entities concluded that as a quality improvement project, additional ethical review was not required.

Data collected from the patient EMR, including measures of renal function, were de-identified and analyzed in the aggregate in terms of overall rates to maintain patient confidentiality. No other personal identifiers were linked to the extracted information. To protect the identities of the individual providers, pre-and post-test questionnaires were assigned individual codes by an administrative support team member. Any information used in the project was kept in a locked cabinet and only accessed by those directly involved in the project.

Data Analysis

Pre- and post-intervention provider questionnaires were administered to four primary health care team members, including two family physicians, a dietitian, and a registered nurse. The latter two participants were diabetic educators directly involved in the care, education, and management of diabetic patients of the primary health care clinic. Data from both the pre- and post-intervention questionnaires were used to determine change in providers' knowledge of the CPG as well as confidence in using the recommended testing to evaluation renal function of their diabetic patients.

Information was extracted from the patient electronic medical records (N=163) to determine whether there had been a change in provider screening rates over time. Screening for five modifiable risk factors in diabetes were included in this analysis, including blood pressure (BP), cholesterol levels/lipids, body weight/obesity), glycoslated hemoglobin/A1c,, and kidney function (renal lab values).

Results

Data were analyzed using dependent group t-tests, to compare pre- and post-intervention knowledge scores. Because of the small sample size, resulting in a low power, a one-tail test was completed. Overall, findings demonstrated that there was a significant improvement ($t(3) = 2.6$,

p = 0.039) in provider knowledge of the clinical practice guideline before (M=2.3; SD=1.0) compared to after (M=4.5; SD=1.7) the educational intervention. Specifically, providers were more confident in using urine protein screening to manage their diabetic patients; more confident in identifying conditions that can cause transient albuminuria; more confident in identifying the stages of nephropathy using urinary albumin measures; and more confident in identifying non-diabetic causes of CKD in diabetics (see Table 1).

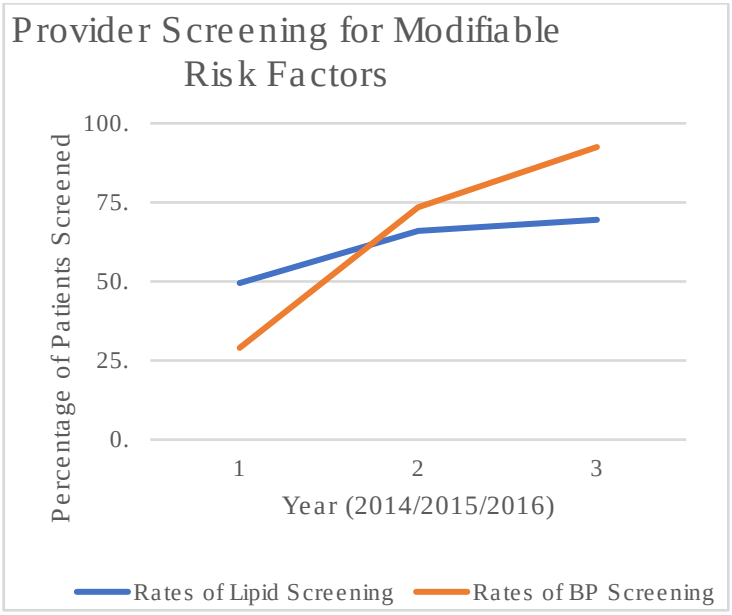
Table 1 Change in Provider Confidence Post-Questionnaire Results

	Pre-test	**Post-test**	**SD**	**One-tailed *p***
Knowledge of CPG	3.4	4.0	1.73	-2.6
Use of Urine Protein Screening	3.0	3.8	.500	-3.0
Identifying Causes of Transient Albuminuria	2.5	3.8	.957	-2.6
Identifying Stages of Nephropathy	2.7	4.0	.957	-2.6
Identifying non-diabetic causes of CKD	2.5	3.8	.957	-2.6

To examine differences between provider type (i.e., physician, registered nurse, dietitian) in screening for the modifiable risk factors of blood pressure (BP), lipids, obesity, A1c and renal function, an independent *t*-test was conducted comparing physicians to non-physicians. Results showed that there were no significant differences observed in rates of screening for any of the five modifiable risk factors by provider type.

To examine changes in screening across time, several repeated measures ANOVAs were performed comparing the three years of screening rates from 2014 – 2016. Results identified changes in provider screening for modifiable risk factors over time. Specifically, over time there was a significant increase in blood pressure screening (F=34.45; *p*=.0045) and measures of lipids (F=7.36; *p*=.035) (Figure 1). However, while there was a modest improvement in provider screening for obesity (F=1.953; *p*=.143), glycolated hemoglobin (A1c) (F=1.785; *p*=.154), and renal measures (F=1.904; *p*=.146) over time, results did not reach statistically significance.

Figure 1 Rates of Provider Screening for Modifiable Risk Factors



One of the most important changes to note resulting from this project is the change in screening rates over the two-year period. Prior to the project specific dates (Oct. – Dec. 2016), there were many team discussions regarding the proposed quality improvement initiative. As a result of these discussions which increased provider awareness, the average numbers of diabetic

patients screened by providers for modifiable risk factors, including renal disease, improved in each consecutive year. Specifically, overall rates of screening for CKD increased from 54% (2014) to 85.5% (2016), resulting in a net increase of 31.5%. Rates of screening for other diabetic risk factors improved in the same time period, including measures of blood pressure, lipids, weight, and A1c (Table 2).

Table 2 Average Screening Rates Over Time for Modifiable Risk Factors

Year	%BP	%Lipids	%Obesity	%A1c	%Renal
2013-2014	29.0	49.5	14.5	23.7	54.0
2014-2015	73.5	66.0	25.0	46.0	81.0
2015-2016	92.2	69.5	40.5	67.0	85.5

Facilitators and Barriers

There were several facilitators that assisted with implementation of this project. Primary care providers recognized the need to improve clinical practice in renal-diabetes care. There were also other primary health care team members (i.e., nurse practitioner and diabetes educators), who were knowledgeable of diabetes and well-positioned to support the physicians in coordinating patient follow-up. These team members also had longer appointment times in which to complete more detailed patient chart reviews to identify whether renal screening and follow-up were up-to-date. The project was implemented onsite within the existing clinic space during regularly scheduled appointment times; thus, there was not a significant increase in provider work demands, patient appointment times, or a notable impact on clinic processes.

There were several challenges in implementing this project. In relation to work-flow, there was not a clinic-specific diabetic patient database in which to organize care or to track chronic disease management. There was also significant variation in documentation and diagnostic coding in the electronic medical record (EMR) among providers, which created a challenge in collecting and analyzing data. In relation to practice-based barriers, the project site was a busy primary health clinic servicing over 3000 patients, most of whom were elderly and who had multiple, complex comorbidities. Large patient volumes and limited time allotted for appointments challenged providers to have ample time to educate patients on the importance of screening for CKD. Limited clinical appointment time also challenged providers to retrospectively review the renal history of diabetic patients to identify those at risk for progression of CKD and in need of further follow-up screening.

Discussion

Screening for chronic kidney disease can help providers achieve optimal renal health for their diabetic patients. The greatest barriers that prevent guidelines from being followed are lack of awareness of and familiarity with the guideline (Cabana, 1999; Ennis et al., 2015; Misra & Barth, 2016). The goal of this project was to increase provider knowledge and awareness of national clinical practice guidelines so as to positively influence screening rates to ultimately delay or prevent chronic kidney disease. Delivering an educational intervention aimed at increasing provider awareness of these evidence-based practice guidelines, including recommended laboratory tests, clinical parameters, and appropriate time-to-follow-up and referral to specialists, significantly improved provider confidence in making clinical decisions in the care of diabetic patients.

The findings from this project underscore the importance of educational initiatives that promote positive change in provider clinical practice. In comparing pre- and post-intervention questionnaire responses, providers demonstrated a significant improvement in confidence in (1) using recommended laboratory tests to manage the renal health of their diabetic patients, (2) interpreting results of renal testing to appropriately manage their patients, (3) identifying stages of nephropathy, and (4) recognizing non-diabetic causes of CKD. This may be attributed to an increase in general knowledge of the specifics of the guideline including recommended laboratory tests and screening intervals for renal disease in diabetes.

Also, it is important to note the continued increase over time in provider rates of screening for all five modifiable diabetes risk factors. This can be explained, in part, by recurring discussions with providers early in the project of the importance of screening for renal disease in diabetes. Creating awareness through informal discussions likely had a positive influence on the clinical decisions of providers prior to the formal implementation of the quality improvement project.

The Theory of Planned Behavior was used to better understand the influences on provider behavior change, including attitudes and beliefs around adoption and use of clinical practice guidelines and guided the approach to this project. Through this project, it was shown that increasing provider knowledge of the guideline significantly improved confidence in the ability to perform screening for modifiable risk factors in diabetes, which translated into increases in screening rates. Through application of this model, a greater understanding of the influences on provider behavior to use clinical practice guidelines was gained.

Limitations

There were several factors that may have limited rates of provider screening. The sample size of participating providers was small which creates difficulty in seeing statistically significant change between the pre- and post-test results of some of the parameters. Data on screening rates were gathered from the number of laboratory test results received into the electronic medical record. For clarity, this would reflect the number of tests *completed* by patients versus number of screening tests *ordered* by providers. So, while providers may have ordered laboratory screening tests according to the guidelines, patient compliance, or even delay in attending the laboratory, may have negatively influenced the calculations of rates of screening. It is entirely possible that provider rates of screening could have been much higher. The duration of the project may also have limited findings in that laboratory measures relevant to this project are usually repeated every two to three months and may not have been captured in the short span of the project. As well, the recommended time-to-appointment for diabetic patients is generally three months and this may not have been enough time to allow for patients to attend for follow-up and potential repeat laboratory testing.

Implications for Clinical Practice

As with any quality improvement project, it is hoped that the change in clinical practice will be enduring and lead to improved outcomes for all patients. It is anticipated that the provider knowledge gained from participating in this project will translate into use in the general patient population, most whom are seniors with multiple chronic conditions, including hypertension and diabetes. It is hoped that provider awareness and confidence resulting from this project will have a lasting effect on the general health of all patients.

Conclusion

The importance of quality initiatives to improve diabetes management via primary care clinics cannot be overstated yet remains a challenge for providers. Globally, early detection, through projects such as this, include the potential for positive behavioral change in providers by creating awareness of the risk of renal disease through dialogue and education. Increasing provider knowledge and awareness of CPGs specific to screening for CKD in diabetes provides a fitting framework for continuous quality improvement through the evaluation of provider processes on patient outcomes. This project demonstrates that a relatively simple quality improvement project aimed at enhancing provider knowledge and awareness of clinical practice guidelines can improve patient outcomes. It also shows how projects of this size and nature are both feasible and sustainable with very little system cost. Projects such as this can begin to create awareness of the need for a defined approach to assist providers in understanding, monitoring and managing other chronic diseases to improve overall health outcomes for their patients.

References

Abdel-Kader, K., Greer, R.C., Boulware, L.E., and Unruh, M.L. (2014). Primary care physicians' familiarity, beliefs, and perceived barriers to practice guidelines in non-diabetic CKD: a survey study. *BMC Nephrology, 15*(64): 1-9.

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2): 179–211.

Barrett, B.J., Garg, A.X, Goeree, R., Levin, A., Molzahn, A., Rigatto, C., Singer, J., Soltys, G., Soroka, S., Ayers, D. & Parfrey, P.S. (2011). A nurse-coordinated model of care versus usual care for Stage 3/4 chronic kidney disease in the community: A randomized controlled trial. *American Society of Nephrology, 6*, 1241-47.

Cabana, M.D., Rand, C.S., Powe, N.R., Wu, M.H., Wilson, M.H., Abboud, P-A.C. & Rubin, H.R. (1999). Why don't physicians follow clinical practice guidelines? *JAMA, 282*(15): 1458-1465.

Canadian Diabetes Association Clinical Practice Guidelines Expert Committee (2015). *Chronic kidney disease in diabetes* [PowerPoint slides]. Retrieved from *http://guidelines.diabetes.ca/CDACPG_resources/pptx_slides/Ch29_CKD.pptx*

Canadian Diabetes Association Clinical Practice Guidelines Expert Committee (2013). Canadian Diabetes Association 2013 clinical practice guidelines for the screening and management of diabetes in Canada. *Canadian Journal of Diabetes, 31*: S1-S212.

Canadian Institute for Health Information (2012). *Canadian organ replacement register annual report: Treatment of end-stage organ failure in Canada, 2002 to 2011*. Ottawa, ON.

Canadian Institute for Health Information (2009). *Diabetes care gaps and disparities in Canada*. Ottawa, ON.

Ceccato, N.E, Ferris, L.E., Manuel, D. & Grimshaw, J.M. (2007). Adopting health behavior change theory through the clinical practice guidelines process. *Journal of Continuing Education in the Health Professions, 27*(4): 201-207.

Crinson, I., Gallagher, H., Thomas, N. & de Lusignan, S. (2010). How ready is general practice to improve quality chronic kidney disease? A diagnostic analysis. *British Journal of General Practice, 60:* 403-409.

Eilat-Tsanani, S., Reitman, A., Daya, M., Mualem, Y. & Shostak, A. (2014). Management of kidney disease in patients with diabetes in the primary care setting. *Primary Care Diabetes, 8*: 159-163. doi:10.1016/j.pcd.2013.11.004

Ennis, J., Gillen, D.G., Rubenstein, A., Worcester, E., Brecher, M.E., Aspli, J. & Coe, F. (2015). Clinical decision support improves physician guidelines adherence for laboratory monitoring of chronic kidney disease: A matched cohort study. *BMC Nephrology, 16*(163): 1-11. doi:10.1186/s12882-015-0159-5

Fox, C.H., Vest, B.M., Kahn, L.S., Dickinson, L.M., Fang, H., Pace, W., Kimminau, K., Vassalotti, J., Loskutova, N. & Peterson, K. (2013). Improving evidence-based primary care for chronic kidney disease: study protocol for cluster randomized controlled trial for translating evidence into practice (TRANSLATE CKD). *Implementation Science, 8*(88), 1-9.

Kastner, M., Bhattacharyya, O., Hayden, L., Makarski, J., Estey, E., Durocher, L., Chatterjee, A., Perrier, L., Graham, I.D., Straus, S.E., Zwarenstein, M. & Brouwers, M. (2015). Guideline uptake is influenced by size, implementability domains or creating and communicating guidelines: A realist review. *Journal of Clinical Epidemiology, 68*: 498-509.

Kidney Foundation of Canada (2009). *Diabetes and Kidney Disease* [Brochure]. Montreal, QC. Author.

Kilpatrick, K., Pichette, V. & Jabbour, M. (2014). An interprofessional team that includes a nurse practitioner and patients with diabetes and chronic kidney disease. *The CANNT Journal, 24*(4): 11-18.

Kortteisto, T., Kaila, M., Komulainen, J., Mantyranta, T. & Rissanen, P. (2010). Healthcare professionals' intentions to use clinical guidelines: a survey using the theory of planned behaviour. *Implementation Science, 5:*51-61.

Lin, D., Hale, S. & Kirby, E. (2007). Improving diabetes management: structured clinic program for Canadian primary care. *Canadian Family Physician, 53*: 73-77.

Lloyd, A. & Komenda, P. (2015). Optimizing care for Canadians with Diabetic Nephropathy in 2015. *Canadian Journal of Diabetes, 39*: 221-228.

Lugtenberg, M., Burgers, J.S., Besters, C.F, Han, D. & Westert, G.P. (2011). Perceived barriers to guidelines adherence: A survey among general practitioners. *BMC Family Practice, 12*: 98-107.

Lugtenberg, M., Zegers-van Schauck, J.M., Westert, G.P. & Burgers, J.S. (2009). Why don't physicians adhere to guidelines recommendations in practice? An analysis of barriers among Dutch general practitioners. *Implementation Science, 4*: 54-63 doi: 10.1186/1748-5908-4-54

Malcolm, J.C., Maranger, J., Talijaard, M., Shah, B., Tailor, C., Liddy, C., Keely, E. & Ooi, T.C. (2013). Into the abyss: diabetes process care indicators and outcomes of defaulters from a Canadian tertiary care multidiciplinary diabetes clinic. *BMC Health Services Research, 13*: 303-312.

McFarlane, P., Gilbert, R.E., MacCallum, L., & Senior, P. (2015). Canadian Diabetes Association 2013 Clinical Practice Guidelines: Chronic kidney disease in diabetes [Powerpoint slides]. Retrieved from http://guidelines.diabetes.ca/browse/chapter29

McFarlane, P., Gilbert, R.E., MacCallum, L., & Senior, P. (2013). Canadian Diabetes Association 2013 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada: Chronic kidney disease in diabetes. *Canadian Journal of Diabetes, 37*(Suppl 1): S129-136.Nova Scotia Renal Program (2016). *CKD prevention and early detection*. Nova Scotia Renal Program: Province of Nova Scotia. Retrieved from http://www.nsrp.gov.ns.ca/ckd-prevention-and-early-detection

Misra, S. and Barth, J.H. (2016). Guidelines are written, but are they followed? *Annals of Clinical Biochemistry, 50*(5): 400-402. DOI: 10.1177/0004563213498712

Nova Scotia Renal Program (2013). *CKD prevention and early detection.* Nova Scotia Renal Program: Province of Nova Scotia. Retrieved from http://www.nsrp.gov.ns.ca/ckd-prevention-and-early-detection

Packham, D.K, Alves, T.P., Dwyer, J.P., Atkins, R., deZeeuw, D., Cooper, M., Shahinfar, S., Lewis, J.B. & Lambers-Heerspink, H.J. (2012). Relative incidence of ESRD versus cardiovascular mortality in proteinuric type 2 diabetes and nephrology: Results from the DIAMETRIC (Diabetes Mellitus Treatment for Renal Insufficiency Consortium) database. *American Journal of Kidney Disease, 59*(1): 75-83.

Peeters, M.J., van Zuilen, A.D., van der Brand, J., Bots, M.L., van Buren, M., ten Dm, M., Kaasjager, K., Ligtenberg, G., Sijpkens, Y., Sluiter, H.E., van de Ven, P., Vervoort, G., Vlem-

ing, L.J., Blankesijn, P.J. & Wetzels, J. (2014). Nurse practitioner care improves renal outcomes in patients with CKD. *Journal of the American Society of Nephrology, 25*:390-398. doi 10.1055/s-0029-1240976

Pronovost, P.J. (2013). Enhancing physicians' use of clinical guidelines. *JAMA,310*(23): 2501-2502.

Public Health Agency of Canada (2011). *Diabetes in Canada: Facts and figures from public health perspective.* Author: Ottawa, ON.

Pyram, R., Kanasara, A., Banerji, M., & Loney-Hutchinson, L. (2011). Chronic kidney disease and diabetes. *Maturitas, 71*: 94-103.

Szczech, L.A., Stewart, R.C., Su, H-L., DeLoskey, R.J., Astor, B.C., Fox, C.H., McCollough, P.A. & Vassalotti, J.A. (2014). Primary care detection of chronic kidney disease in adults with Type-2 diabetes: The ADD-CKD Study (Awareness, Detection and Drug Therapy in Type 2 Diabetes and Chronic Kidney Disease). *PLoS ONE, 9*(11): e110535 doi: 10.137/journal.pone.0110535

Taba, P., Rosenthal, M., Habicht, J., Tarien, H., Mathiesen, M., Hill, S. & Bero, H.L. (2012). Barriers and facilitators to the implementation of clinical practice guidelines: A cross-sectional survey among physicians in Estonia. *BMC Health Services Research, 12*: 455-461.

Tahir, M.A., Hassan, S., de Lusignan, S. & Dmitrieva, O. (2014). Development of a questionnaire to evaluate practitioners' confidence and knowledge in primary care in managing chronic kidney disease. BMC Nephrology, *15*(1):73. doi: 10.1186/1471-2369-15-73.

World Health Organization (2014). *Global status report on non-communicable disease*. WHO: Geneva, Switzerland.

Appendix A

CDA Clinical Practice Guideline - Chronic Kidney Disease

Can J Diabetes 37 (2013) S129–S136

Contents lists available at SciVerse ScienceDirect

Canadian Journal of Diabetes

journal homepage: www.canadianjournalofdiabetes.com

Clinical Practice Guidelines

Chronic Kidney Disease in Diabetes

Canadian Diabetes Association Clinical Practice Guidelines Expert Committee

The initial draft of this chapter was prepared by Philip McFarlane MD, FRCPC, Richard E. Gilbert MBBS, PhD, FACP, FRACP, FRCPC, Lori MacCallum BScPhm, PharmD, Peter Senior MBBS, PhD, MRCP

KEY MESSAGES

- Identification of chronic kidney disease (CKD) in diabetes requires screening for proteinuria, as well as an assessment of renal function.
- All individuals with CKD should be considered at high risk for cardiovascular events and should be treated to reduce these risks.
- The progression of renal damage in diabetes can be slowed through intensive glycemic control and optimization of blood pressure. Progression of diabetic nephropathy can be slowed through the use of medications that disrupt the renin-angiotensin-aldosterone system.

PRACTICAL TIPS

Management of Potassium and Creatinine During the Use of Angiotensin-Converting Enzyme (ACE) Inhibitor or Angiotensin II Receptor Blocker (ARB) or Direct Renin Inhibitor (DRI)

- Check serum **potassium** and **creatinine** at baseline and within 1 to 2 weeks of initiation or titration of therapy AND during times of acute illness.
- If potassium becomes elevated or creatinine increases by more than 30% from baseline, therapy should be reviewed and serum creatinine and potassium levels should be rechecked.
- Mild-to-moderate stable hyperkalemia:
  - Counsel on a low-potassium diet.
  - If persistent, non–potassium-sparing diuretics and/or oral sodium bicarbonate (in those with a metabolic acidosis) should be considered.
  - Consider temporarily holding renin-angiotensin-aldosterone system (RAAS) blockade (i.e. ACE inhibitor, ARB or DRI).
- Severe hyperkalemia:
  - In addition to emergency management strategies, RAAS blockade should be held or discontinued.

Introduction

Diseases of the kidney are a common finding in people with diabetes and can significantly affect length and quality of life (5,6). A variety of forms of kidney disease can be seen in people with diabetes, including diabetic nephropathy, ischemic damage related to vascular disease and hypertension, as well as other renal diseases that are unrelated to diabetes (Figure 1) (7,8). In this chapter, we will discuss how to screen for and diagnose chronic kidney disease (CKD) in people with diabetes, how to treat them with an aim to slow progression of CKD and discuss the impact of CKD on other aspects of diabetes management.

Diabetic Nephropathy

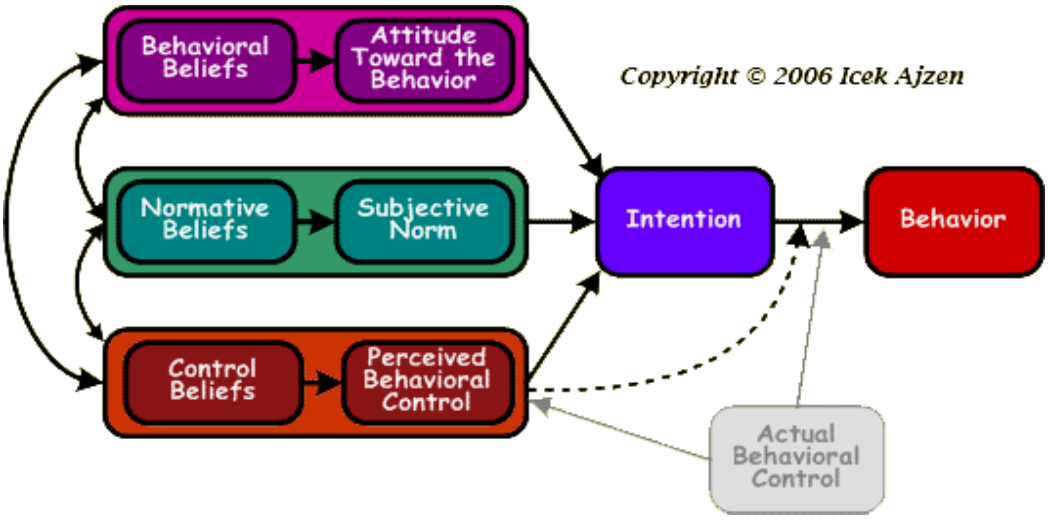
The classic description of diabetic nephropathy is of a progressive increase in proteinuria in people with longstanding diabetes followed by declining function that eventually can lead to end stage renal disease (ESRD) (Figure 2) (1,9,10). Key risk factors for diabetic nephropathy include long duration of diabetes, poor glycemic control, hypertension, male gender, obesity and cigarette smoking. Many of these factors are modifiable.

The earliest stage of diabetic nephropathy is hyperfiltration, where the glomerular filtration rate (GFR) is significantly higher than normal. Identification of hyperfiltration is not clinically useful, as it is difficult to determine from routine testing. Persistent albuminuria is considered the earliest clinical sign of diabetic nephropathy (Table 1). Initially, small amounts of albumin are leaked, below the detection threshold of a urine dipstick. This stage is referred to as "microalbuminuria." This can worsen so that the urinary albumin excretion is sufficiently high to be detectable by a urine dipstick, a stage known as "overt nephropathy." The rate of progression from normoalbuminuria to microalbuminuria then to overt nephropathy usually is slow, typically taking 5 years or longer to progress through each stage (11,12). During the early stages of diabetic nephropathy, the rate of loss of renal function is relatively slow (1 to 2 mL/min/1.73 m^2 per year) and not impressively higher than what is seen in the general population (0.5 to 1 mL/min/1.73 m^2 per year). However, late in the overt nephropathy phase, the rate of decline of renal function can accelerate (5 to 10 mL/min/1.73 m^2 per year). Thus, significant renal dysfunction is not usually

Canadian Diabetes Association Clinical Practice Guidelines Expert Committee (2013). Canadian Diabetes Association Clinical Practice Guidelines – Chronic Kidney disease in Diabetes. *Canadian Journal of Diabetes, 37*: S129-S136.

Appendix B

Theory of Planned Behavior



Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*(2): 179–211.

Appendix C

Primary Care Provider Pre- and Post-Questionnaire

Questionnaire: Evaluating Primary Care Practitioners' Confidence and Knowledge in Identifying and Managing Chronic Kidney Disease in Type 2 Diabetes

This questionnaire is part of a student quality improvement intervention improve primary care provider knowledge and application of the Canadian Diabetes Clinical Practice Guideline for Screening for Chronic Kidney Disease in Type 2 diabetes. All questions relate to your care approach in management of adult Type 2 diabetic patients.

Please complete all the questions. Some questions ask about your confidence in management of Type 2 diabetic patients with CKD; others assess knowledge of specific aspects of the guideline.
The information provided by you is strictly confidential and will be submitted directly to the DNP student's advisor for coding. You or your practice will not be identified in any reports or publications that may result from this study. **Respond using the following scale:**

1 = 'Not at all confident', 2 = 'Not confident', 3 = 'Neither confident nor not confident', 4 = 'Confident', 5 = 'Very confident'

QUESTION	1 Not at all confident	2 Not confident	3 Neither confident nor not confident	4 Confident	5 Very Confident
1. How confident are you with monitoring eGFR in Type 2 diabetic patients?	1	2	3	4	5
2. How confident are you at interpreting eGFR to stage CKD?	1	2	3	4	5
3. How confident are you at knowing the time interval for repeat testing of eGFR in Type 2 diabetic patients with reduced eGFR?	1	2	3	4	5
4. How confident are you in identifying significant proteinuria in patients with Type 2 diabetes?	1	2	3	4	5

5. How confident are you at using urine protein results to manage Type 2 diabetes?	1	2	3	4	5
6. How confident are you at identifying conditions that can cause transient albuminuria?	1	2	3	4	5
7. How confident are you in identifying the stage of nephropathy, by level of urinary albumin, of Type 2 diabetic patients?	1	2	3	4	5
8. How confident are you in making a diagnosis of CKD using ACR and/or eGFR in Type 2 diabetic patients?	1	2	3	4	5
9. How confident are you at knowing when to appropriately refer to Nephrology for Type 2 diabetic patients with reduced eGFR?	1	2	3	4	5
10. How confident are you at identifying non-diabetic causes of CKD in Type 2 diabetic patients?	1	2	3	4	5
11. How confident are you at managing hypertension in Type 2 diabetic patients?	1	2	3	4	5
12. How confident are you that you can achieve lowered blood pressure in Type 2 diabetic patients?	1	2	3	4	5
13. How confident are you in using ACEI (angiotensin-converting enzyme inhibitor) and/or ARB (angiotensin II receptor blocker) medications in Type 2 diabetic patients with CKD?	1	2	3	4	5
14. How confident are you in using other anti-hypertensives in Type 2 diabetic patients with CKD?	1	2	3	4	5

15. How confident are you at adjusting common oral medication therapies (i.e., gliclazide, sitagliptin, statins) in Type 2 diabetic patients with reduced kidney function?	1	2	3	4	5
16. How confident are you at initiating therapy to lower lipid levels in patients with ischemic heart disease and Type 2 diabetes?	1	2	3	4	5
17. How confident are you at initiating therapy to lower lipid levels in Type 2 Diabetes patients with CKD?	1	2	3	4	5

1. What level of **Diastolic** Blood pressure control do you typically aim to achieve in Type 2 diabetic patients with CKD without proteinuria?

_____ (insert answer here)

2. What level of **Systolic** Blood pressure control do you typically aim to achieve in Type 2 diabetic patients with CKD without proteinuria?

_____ (insert answer here)

3. What is the **lowest necessary** level of ACR (albumin-creatinine ratio) needed to indicate chronic kidney disease? (circle one answer)

a. ≥ 1.0 mg/mmol
b. ≥ 2.0 mg/mmol
c. ≥ 3.0 mg/mmol
d. ≥ 4.0 mg/mmol

4. What is the **lowest necessary** level of random urine ACR (albumin-creatinine ratio) with which to diagnose chronic kidney disease? (circle one answer)

a. ≥ 10 mg/mmol
b. ≥ 20 mg/mmol
c. ≥ 30 mg/mmol
d. ≥ 40 mg/mmol

5. When the lowest random urine ACR level has been identified in a patient, what is the next recommended action? (circle one answer)

a. order serum Cr for eGFR in 6 months AND repeat random urine ACR in 1 month
b. order serum Cr for eGFR in 3 months AND repeat random urine ACR twice over the next 3 months
c. order serum Cr for eGFR in 3 months AND repeat random urine ACR twice over the next 6 months
d. order serum Cr for eGFR in 6 months AND repeat random urine ACR in 3 months

6. Once the serum Cr and eGFR have been repeated, which results infer the diagnosis of chronic kidney disease? circle one answer)

a. eGFR 60-90 **and** 2 or more ACRs $\geq$ 3.0 mg/mmol
b. eGFR 60-90 **or** 2 or more ACRs $\geq$ 3.0 mg/mmol
c. eGFR <60 **and** 2 or more ACRs $\geq$ 2.0 mg/mmol
d. eGFR < 60 **or** 2 or more ACRs $\geq$ 2.0 mg/mmol

7. Once CKD has been diagnosed, what is the next recommended investigation? (circle one answer))

a. Order urine routine and microscopic (R&M) and urine dipstick immediately
b. Order urine routine and microscopic (R&M) and urine dipstick in 3 months
c. Order urine routine and microscopic (R&M) and urine dipstick in 6 months
d. Order urine routine and microscopic (R&M) and urine dipstick in 12 months

8. If repeat measures of serum creatinine for eGFR and random urine ACRs are now normal, when is it recommended to rescreen for CKD in your Type 2 diabetic patient?

a. In 3 months
b. In 6 months
c. In 9 months
d. In 12 months

9. Over the past **six months** in my practice, I have used the Canadian Diabetes Association Clinical Practice Guideline for Chronic Kidney Disease:

a. never
b. 1-3 times
c. 4-6 times
d. 7-9 times
e. > 10 times

Note:

This questionnaire was adapted, in part, from http://www.implementationscience.com/content/4/1/39. The complete QICKD confidence and knowledge questionnaire (QICKD-CCQ) is accessible here: http://www.clininf.eu/qickd_ccq

Reference:

Tahir, M.A., Hassan, S., de Lusignan, S. & Dmitrieva, O. (2014). Development of a questionnaire to evaluate practitioners' confidence and knowledge in primary care in managing chronic kidney disease. *BMC Nephrology, 15*(1):73. DOI: 10.1186/1471-2369-15-73.

Appendix D

Provider Toolkit: Executive Summary – Chronic Kidney Disease in Diabetes

Can J Diabetes 37 (2013) S329–S331

Contents lists available at SciVerse ScienceDirect

Canadian Journal of Diabetes

journal homepage: www.canadianjournalofdiabetes.com

Executive Summary

Chronic Kidney Disease in Diabetes

KEY MESSAGES

- Identification of chronic kidney disease (CKD) in diabetes requires screening for proteinuria, as well as an assessment of renal function.
- All individuals with CKD should be considered at high risk for cardiovascular events and should be treated to reduce these risks.
- The progression of renal damage in diabetes can be slowed through intensive glycemic control and optimization of blood pressure. Progression of diabetic nephropathy can be slowed through the use of medications that disrupt the renin-angiotensin-aldosterone system.

Highlights of Revisions

- The chapter includes a new, simplified definition of microalbuminuria of albumin to creatinine ratio (ACR) ≥2.0 mg/mmol for both men and women (Table 1 and Table 2).
- The chapter includes a new algorithm for screening for chronic kidney disease in adults (Figure 1).
- Added a "Sick Day Management" list for acute illness (p. S357).

PRACTICAL TIPS

Management of Potassium and Creatinine During Use of an Angiotensin-Converting Enzyme (ACE) Inhibitor, Angiotensin II Receptor Blocker (ARB) or Direct Renin Inhibitor (DRI)

- Check serum **potassium** and **creatinine** at baseline and within 1 to 2 weeks of initiation or titration of therapy AND during times of acute illness.
- If potassium becomes elevated or creatinine increases by more than 30% from baseline, therapy should be reviewed and serum creatinine and potassium levels should be rechecked.
- Mild-to-moderate stable hyperkalemia:
  - Counsel on a low-potassium diet.
  - If persistent, non–potassium-sparing diuretics and/or oral sodium bicarbonate (in those with a metabolic acidosis) should be considered.
  - Consider temporarily holding renin-angiotensin-aldosterone system (RAAS) blockade (i.e. ACE inhibitor, ARB or DRI).
- Severe hyperkalemia:
  - In addition to emergency management strategies, RAAS blockade should be held or discontinued.

RECOMMENDATIONS

1. In adults, screening for CKD in diabetes should be conducted using a random urine ACR and a serum creatinine converted into an eGFR [Grade D, Consensus]. Screening should commence at diagnosis of diabetes in individuals with type 2 diabetes and 5 years after diagnosis in adults with type 1 diabetes and repeated yearly thereafter. A diagnosis of CKD should be made in patients with a random urine ACR ≥2.0 mg/mmol and/or an eGFR < 60 mL/min on at least 2 of 3 samples over a 3-month period [Grade D, Consensus].
2. All patients with diabetes and CKD should receive a comprehensive, multifaceted approach to reduce cardiovascular risk (see Vascular Protection chapter, p. S322) [Grade A, Level 1A (1,2)].
3. Adults with diabetes and CKD with either hypertension or albuminuria should receive an ACE inhibitor or an ARB to delay progression of CKD [Grade A, Level 1A, for ACE inhibitor use in type 1 and type 2 diabetes, and for ARB use in type 2 diabetes; Grade D, Consensus, for ARB use in type 1 diabetes (3–12)].
4. People with diabetes on an ACE inhibitor or an ARB should have their serum creatinine and potassium levels checked at baseline and within 1 to 2 weeks of initiation or titration of therapy and during times of acute illness [Grade D, Consensus].
5. Adults with diabetes and CKD should be given a "sick day" medication list that outlines which medications should be held during times of acute illness (see Appendix 7) [Grade D, Consensus].
6. Combination of agents that block the renin-angiotensin-aldosterone system (ACE inhibitor, ARB, DRI) should not be routinely used in the management of diabetes and CKD [Grade A, Level 1 (13,14)].
7. People with diabetes should be referred to a nephrologist or internist with an expertise in CKD in the following situations:
   a. Chronic, progressive loss of kidney function
   b. ACR persistently >60 mg/mmol
   c. eGFR < 30 mL/min
   d. Unable to remain on renal-protective therapies due to adverse effects such as hyperkalemia or >30% increase in serum creatinine within 3 months of starting an ACE inhibitor or ARB
   e. Unable to achieve target blood pressure (could be referred to any specialist in hypertension) [Grade D, Consensus]

Abbreviations:
ACE, angiotensin-converting enzyme; *ACR*, albumin-to-creatinine ratio; *ARB*, angiotensin II receptor block; *CKD*, chronic kidney disease; *DRI*, direct renin inhibitor; *eGFR*, estimated glomerular filtration rate.

1499-2671/$ – see front matter © 2013 Canadian Diabetes Association
http://dx.doi.org/10.1016/j.jcjd.2013.02.029

Table 1
Stages of Diabetic Nephropathy by Level of Urinary Albumin Level

Stages of Diabetic Nephropathy by Level of Urinary Albumin Level			
Stage of nephropathy	Urine dipstick for protein	Urine ACR (mg/mmol)	24 hour urine collection for albumin
Normal	Negative	<2	<30 mg/day
Microalbuminuria	Negative	2–20	30–300 mg/day
Overt nephropathy	Positive	>20	>300 mg/day
		>67	>1000 mg/day
Values are for urinary albumin, not total urinary protein, which will be higher than urinary albumin levels. ACR results may be elevated with conditions other than diabetic nephropathy (see text and Table 4)			

Please note, Table 4 listed in the above table can be viewed in the full 2013 guidelines.

Table 2
Conditions that can cause transient albuminuria

Potential Causes for Transient Albuminuria
Recent major exercise
Urinary tract infection
Febrile illness
Decompensated congestive heart failure
Menstruation
Acute severe elevation in blood glucose
Acute severe elevation in blood pressure

References

1. Gaede P, Vedel P, Larsen N, et al. Multifactorial intervention and cardiovascular disease in patients with type 2 diabetes. N Engl J Med 2003;348:383–93.
2. Gaede P, Lund-Andersen H, Parving HH, et al. Effect of a multifactorial intervention on mortality in type 2 diabetes. N Engl J Med 2008;358:580–91.
3. Lewis EJ, Hunsicker LG, Bain RP, et al. The effect of angiotensin-converting-enzyme inhibition on diabetic nephropathy. The Collaborative Study Group. N Engl J Med 1993;329:1456–62.
4. Strippoli GF, Craig MC, Schena FP, et al. Role of blood pressure targets and specific antihypertensive agents used to prevent diabetic nephropathy and delay its progression. J Am Soc Nephrol 2006;17:S153–5.
5. Lewis EJ, Hunsicker LG, Clarke WR, et al. Renoprotective effect of the angiotensin-receptor antagonist irbesartan in patients with nephropathy due to type 2 diabetes. N Engl J Med 2001;345:851–60.
6. Brenner BM, Cooper ME, de Zeeuw D, et al. Effects of losartan on renal and cardiovascular outcomes in patients with type 2 diabetes and nephropathy. N Engl J Med 2001;345:861–9.
7. Parving HH, Lehnert H, Brochner-Mortensen J, et al. The effect of irbesartan on the development of diabetic nephropathy in patients with type 2 diabetes. N Engl J Med 2001;345:870–8.
8. Laffel LM, McGill JB, Gans DJ. The beneficial effect of angiotensin-converting enzyme inhibition with captopril on diabetic nephropathy in normotensive IDDM patients with microalbuminuria. North American Microalbuminuria Study Group. Am J Med 1995;99:497–504.
9. ACE Inhibitors in Diabetic Nephropathy Trialist Group. Should all patients with type 1 diabetes mellitus and microalbuminuria receive angiotensin-converting enzyme inhibitors? A meta-analysis of individual patient data. Ann Intern Med 2001;134:370–9.
10. Ravid M, Savin H, Jutrin I, et al. Long-term stabilizing effect of angiotensin-converting enzyme inhibition on plasma creatinine and on proteinuria in normotensive type II diabetic patients. Ann Intern Med 1993;118:577–81.
11. Mathiesen ER, Hommel E, Hansen HP, et al. Randomised controlled trial of long term efficacy of captopril on preservation of kidney function in normotensive patients with insulin dependent diabetes and microalbuminuria. BMJ 1999;319:24–5.
12. Viberti G, Wheeldon NM. Microalbuminuria reduction with valsartan in patients with type 2 diabetes mellitus: a blood pressure-independent effect. MicroAlbuminuria Reduction With VALsartan Study Investigators. Circulation 2002;106:672–8.
13. Tobe SW, Clase CM, Gao P, et al. Cardiovascular and renal outcomes with telmisartan, ramipril, or both in people at high renal risk: results from the ONTARGET and TRANSCEND studies. Circulation 2011;123:1098–107.
14. Parving H, Brenner BM, McMurray JJV, et al. Cardiorenal end points in a trial of aliskiren for type 2 diabetes. N Engl J Med 2012;367:2204–13.

Provider Toolkit: Screening for CKD Algorithm

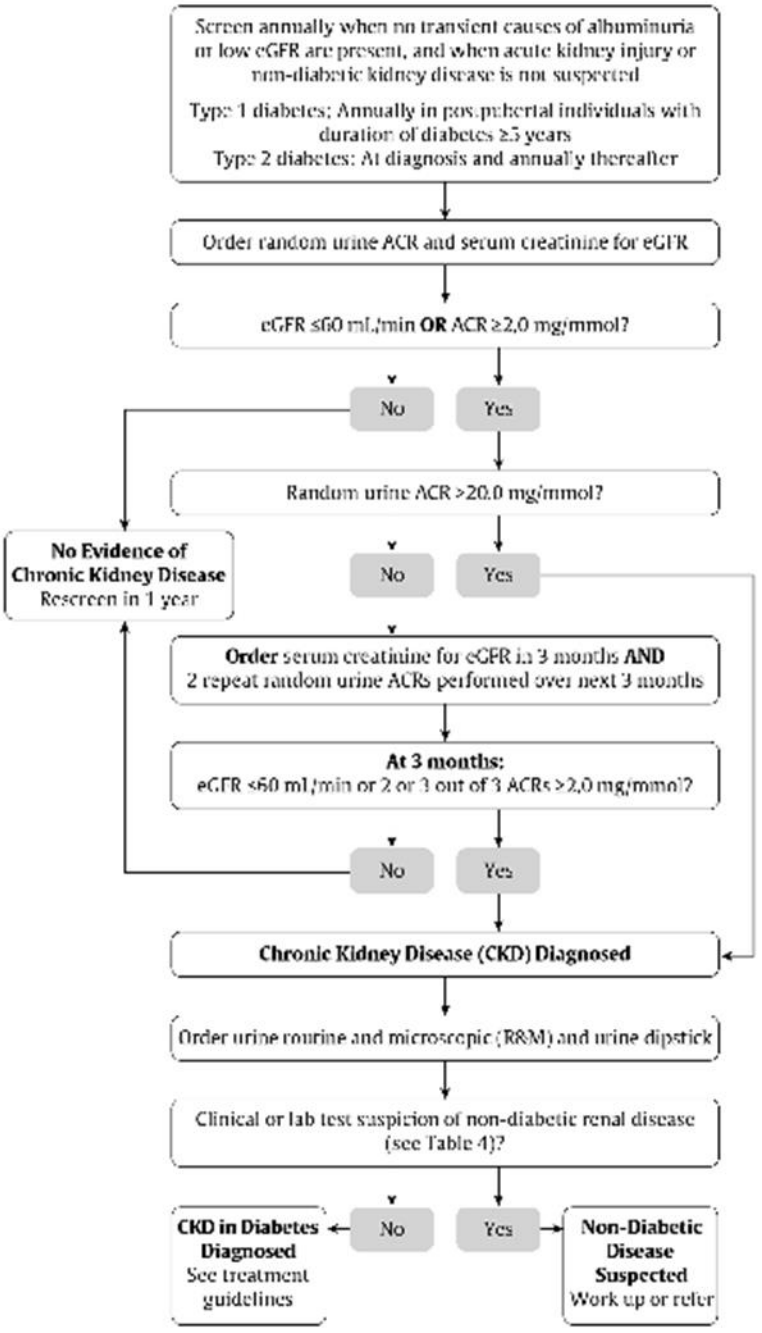


Figure 1. Screening for chronic kidney disease in people with diabetes. Please note, Table 4 listed in the above figure can be viewed in the full 2013 guidelines.

Provider Toolkit: 2015 Interim Update

Can J Diabetes 39 (2015) 440

Contents lists available at ScienceDirect

Canadian Journal of Diabetes

journal homepage: www.canadianjournalofdiabetes.com

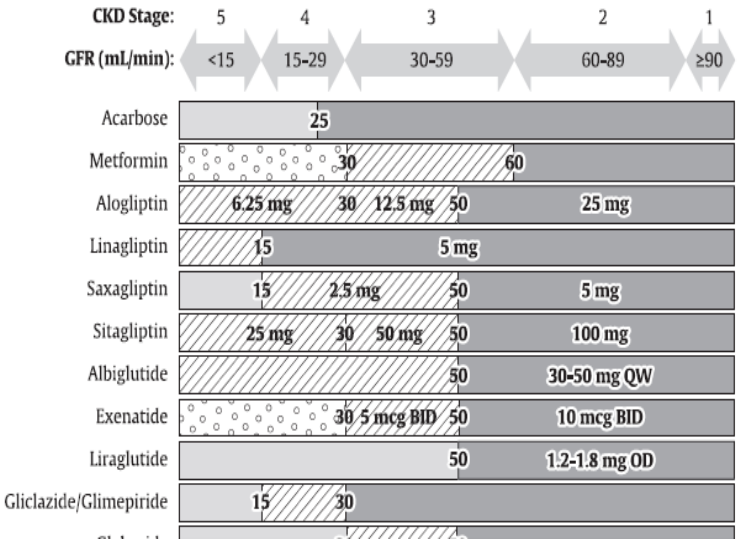
Addendum to Policies, Guidelines and Consensus Statements: Pharmacologic Management of Type 2 Diabetes: 2015 Interim Update

An interim update of the chapter titled Pharmacologic Management of Type 2 Diabetes in the 2013 Clinical Practice Guidelines was recently published in *Canadian Journal of Diabetes*; it incorporates the sodium glucose linked transporter 2 (SGLT2) inhibitor class (1). Since the publication of the update, another SGLT2 inhibitor has received notice of compliance from Health Canada (2). The article's Figure 2, which shows the antihyperglycemic medications and considerations for renal function, has been updated.

References

1. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, Harper W, Clement M, Goldenberg R, Hanna A, Main A, et al. Policies, guidelines and consensus statements: pharmacologic management of type 2 diabetes: 2015 interim update. Can J Diabetes 2015;39:250–2.
2. Health Canada notice of compliance database. http://webprod5.hc-sc.gc.ca/noc-ac/index-eng.jsp. Accessed August 13, 2015.

Antihyperglycemic Medications and Renal Function

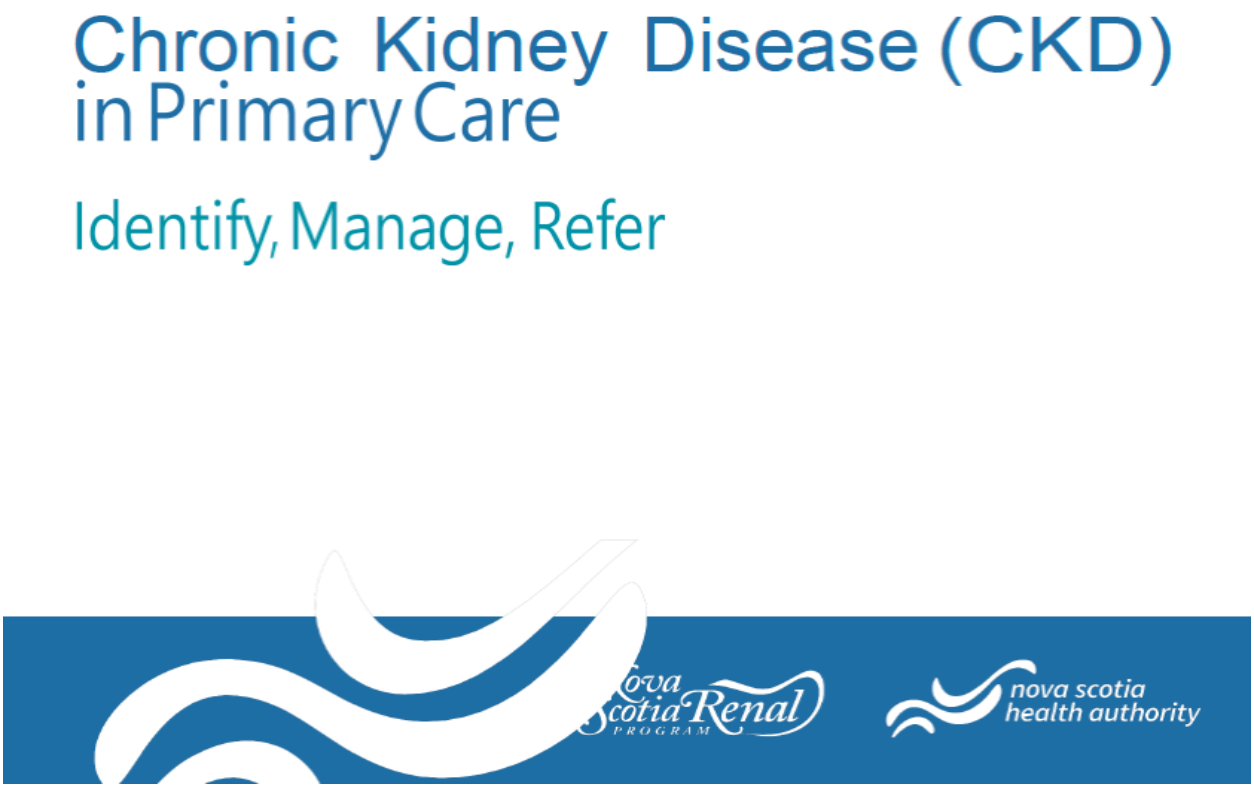


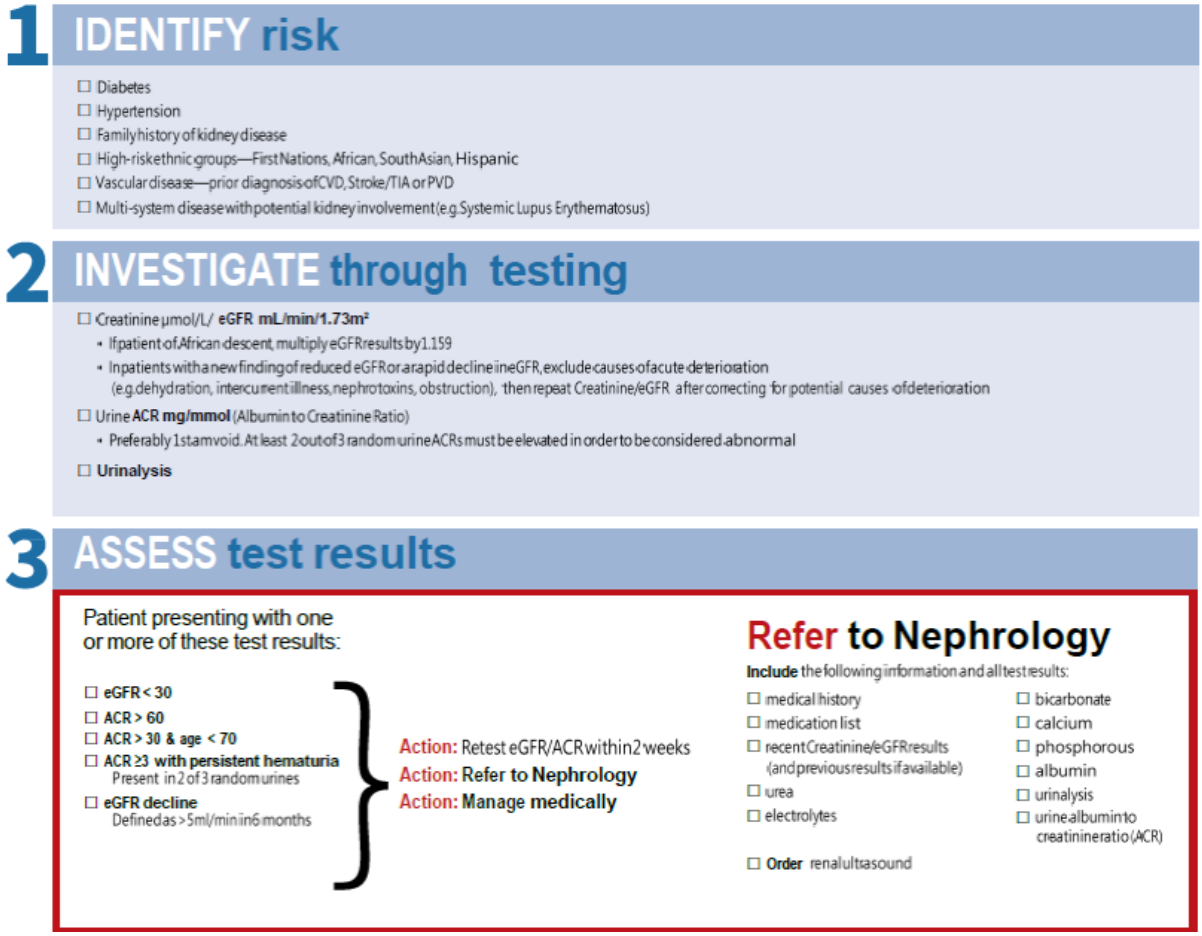
Provider Toolkit: Therapeutic Considerations in Renal Impairment

Therapeutic considerations when using common therapies in patients with diabetes with varying degrees of renal impairment

Antihyperglycemic Therapies	CKD 1 & 2 eGFR ≥60 mL/min	CKD 3 eGFR 30-59 mL/min	CKD 4 eGFR 15-29 mL/min	CKD 5 eGFR <15 mL/min or dialysis	Comments
Metformin	No dose adjustment	Reduce dose	Use alternative agent		See "Sick Day Medication List" (Appendix 7). Risk of drug accumulation with declining renal function, especially if acute.
Alpha-glucosidase Inhibitor					
Acarbose	No dose adjustment	No dose adjustment	Use alternative agent		
DPP4-Inhibitors					
Alogliptin	No dose adjustment	Lower dose to 12.5 mg daily (<50 mL/min)	Use lowest dose (6.25 mg daily)		
Linagliptin	No dose adjustment required				Experience in patients with ESRD or on dialysis is limited. Use with caution in these patients.
Saxagliptin	No dose adjustment	Lower dose 2.5 mg once daily (<50 mL/min)		Use alternative agent	Should not be used in patients on dialysis.
Sitagliptin	No dose adjustment	Lower dose (50 mg daily) (30-49 mL/min)	Use lowest dose (25 mg daily)		Risk of accumulation.
GLP-1 Receptor Agonists					
Albiglutide	No dose adjustment required				Use caution when initiating or escalating doses in patients with renal impairment
Exenatide	No dose adjustment	Lower dose (5 mcg BID)	Use alternative agent		
Liraglutide	No dose adjustment	Use alternative agent (<50 mL/min)			
Insulin Secretagogues					
Gliclazide	No dose adjustment		Risk of hypoglycemia, consider lower dose	Risk of hypoglycemia, consider alternative agent	
Glimepiride	No dose adjustment		Risk of hypoglycemia, consider lower dose	Max 1 mg daily, consider alternative agent	Both pharmacokinetics and pharmacodynamics are altered, increasing risk of hypoglycemia.
Glyburide	No dose adjustment	Use alternative agent			Increased risk of prolonged hypoglycemia due to accumulation of parent drug and active metabolites.
Nateglinide	No dose adjustment required				
Repaglinide	No dose adjustment required				

Provider Toolkit: 2016 Nova Scotia Renal Program Guidelines




1 IDENTIFY risk
☐ Diabetes
☐ Hypertension
☐ Family history of kidney disease
☐ High-risk ethnic groups—First Nations, African, South Asian, Hispanic
☐ Vascular disease—prior diagnosis of CVD, Stroke/TIA or PVD
☐ Multi-system disease with potential kidney involvement (e.g. Systemic Lupus Erythematosus)
2 INVESTIGATE through testing
☐ Creatinine µmol/L/ eGFR mL/min/1.73m²
• If patient of African descent, multiply eGFR results by 1.159
• In patients with a new finding of reduced eGFR or a rapid decline in eGFR, exclude causes of acute deterioration (e.g. dehydration, intercurrent illness, nephrotoxins, obstruction), then repeat Creatinine/eGFR after correcting for potential causes of deterioration
☐ Urine ACR mg/mmol (Albumin to Creatinine Ratio)
• Preferably 1st am void. At least 2 out of 3 random urine ACRs must be elevated in order to be considered abnormal
☐ Urinalysis
3 ASSESS test results
Patient presenting with one or more of these test results:
☐ eGFR < 30
☐ ACR > 60
☐ ACR > 30 & age < 70
☐ ACR ≥3 with persistent hematuria
Present in 2 of 3 random urines
☐ eGFR decline
Defined as > 5ml/min in 6 months
Action: Retest eGFR/ACR within 2 weeks
Action: Refer to Nephrology
Action: Manage medically
Refer to Nephrology
Include the following information and all test results:
☐ medical history
☐ medication list
☐ recent Creatinine/eGFR results (and previous results if available)
☐ urea
☐ electrolytes
☐ bicarbonate
☐ calcium
☐ phosphorous
☐ albumin
☐ urinalysis
☐ urine albumin to creatinine ratio (ACR)
☐ Order renal ultrasound

☐ eGFR 30–59 & ACR < 3	Action: **Manage medically** Action: Retest eGFR/ACR 2 times per year
☐ eGFR 30–59 & ACR 3–30 with no hematuria	Action: **Manage medically** Action: Retest eGFR/ACR 3 times per year
☐ eGFR 60–89 & ACR < 30 with no hematuria	Action: **Manage medically** Action: Retest eGFR/ACR annually, unless clinical circumstances indicate more frequent testing
☐ eGFR ≥ 90 & ACR < 3	Action: **Manage medically** Action: *For patients with diabetes,* retest eGFR/ACR annually Action: *For all others,* retest eGFR/ACR every 1–2 years, unless clinical circumstances indicate more frequent testing

4 MANAGE medically

Assess patient for reversible causes of renal failure

☐ Volume depletion, obstruction, nephrotoxic drugs (NSAIDs, Lithium, Aminoglycosides, Tacrolimus, Cyclosporine, and Contrast Media)

Slow Progression of CKD and Modify Cardiovascular Risk Factors

☐ BP management
- Diabetes target < 130/80
- Non diabetes target < 140/90
- Use ACEi or ARB as 1st line for CKD and add other agents as required
- Restrict sodium to < 2 gm/day

hypertension.ca/en/chep

☐ ACR management
- If ACR ≥ 3 in diabetics: start ACEi/ARB as tolerated (even if BP at target)

☐ Glycemic control
- Target A1C as per Canadian Diabetes Association Guidelines: guidelines.diabetes.ca/fullguidelines

☐ Lipid control
- Use statins as per Canadian Cardiovascular Society and Canadian Diabetes Association Guidelines: onlinecjc.ca/article/S0828-282X(12)01510-3/abstract and guidelines.diabetes.ca/fullguidelines

☐ Lifestyle modification
- Stop smoking
- Increase physical activity
- Manage weight

Medication Considerations and Patient Safety

- Nephrotoxic medications should be avoided or used with caution in patients with any degree of CKD, as indicated by eGFR. Regular monitoring of kidney function is required.
- Contrast media dye poses a risk of acute kidney injury (AKI) in patients with CKD. If procedure is medically necessary, monitor renal function pre and post dye. Cessation of ACEi, ARB, diuretics as well as metformin are recommended prior to procedure.
- Be aware of common drugs excreted by the kidneys that may require renal dose adjustments (Novel Anticoagulants, Antihyperglycemics, Antimicrobials, Antifungals, Antivirals, Opioids, Antihyperlipidemics, Psychotropics and Miscellaneous [gabapentin, digoxin, spironolactone, allopurinal, colchicine, ranitidine, metoclopramide]) and ensure all renally excreted medications are dose adjusted as per Cockcroft Gault equation or use alternative treatment.

  Cockcroft Gault Equation
  CrCl (mL/min) = [(140 − age) x weight (kg) x 1.2] / SCr (μmol/L) For women, multiply the result by 0.85

- Patients with CKD are at risk of AKI with volume depletion (e.g., severe nausea, vomiting and diarrhea lasting > 24 hours). If unable to maintain adequate fluid intake during an illness, withholding medications is recommended based on the acronym SADMANS: S (sulfonylureas), A (ACEi), D (diuretics, direct renin inhibitors), M (Metformin), A (ARB), N (NSAIDs), S (SGLT2 inhibitors)
  guidelines.diabetes.ca/Browse/Appendices/Appendix7

CKD Notes

Definition of Kidney Disease
Kidney Disease Improving Global Outcomes (KDIGO) defines CKD as abnormalities of kidney structure or function, present for > 3 months, with implications for health.

Criteria for CKD are any of the following present for > 3 months:

- ☐ Albuminuria ACR ≥3 mg/mmol
- ☐ Urine sediment abnormalities (e.g. RBC casts, RBCs, WBC casts and WBCs)
- ☐ Electrolyte and other abnormalities due to tubular disorders
- ☐ Abnormalities detected by histology
- ☐ Structural abnormalities detected by imaging
- ☐ History of kidney transplantation
- ☐ eGFR <60 mL/min/1.73m²

kdigo.org./clinical_practice_guidelines/pdf/CKD/KDIGO_2012_CKD_GL.pdf

Important information regarding eGFR

- eGFR will automatically be reported on all Adult (≥18yrs) outpatient Creatinines (except emergency and renal dialysis units)
- eGFR will be calculated using the CKD-EPI equation, multiply the eGFR results by 1.159 if patient is of African descent
- eGFR results greater than 90 will be reported as > 90
- CKD-EPI eGFR has not been extensively validated for drug dosing
- eGFR serial monitoring is crucial when diagnosing CKD, one reading alone is not useful
- eGFR should not be used in pregnant woman and situations where creatinine is changing rapidly (acute kidney injury or acute illness requiring hospitalization)

Interpret eGFR with caution

- High or low muscle mass (athletes, malnourished, paraplegics)
- Specific diets with unusually high or low protein, such as high dietary creatine intake (creatine supplements)

Interpreting ACR

- Albumin or protein in the urine is a marker of both progression of kidney disease and increased risk of CV events
- A random urine ACR is preferred (vs. 24 hour) to detect proteinuria (ideally first morning void)
- ACR ≥3.0 mg/mmol is clinically significant

CKD Clinical Decision Support Tools
Chronic Kidney Disease (CKD) Clinical Pathway, University of Calgary:
ckdpathway.ca

Kidney Wise Toolkit: Identification, Detection and Management of CKD, Ontario Renal Network (ORN)
kidneywise.ca

Prognosis of CKD by GFR and Albuminuria Catagories: KDIGO 2012

GFR categories (mL/min/1.73m²)			Persistent albuminuria categories: A1 Normal to mildly increased <3mg/mmol	A2 Moderately increased 3-30mg/mmol	A3 Severely increased >30mg/mmol
G1	Normal or high	≥90			
G2	Mildly decreased	60–89			
G3a	Mildly to moderately decreased	45–59			
G3b	Moderately to severely decreased	30–44			
G4	Severely decreased	15–29			
G5	Kidney failure	<15			

Adapted from: kdigo.org/clinical_practice_guidelines/pdf/CKD/KDIGO_2012_CKD_GL.pdf

-low risk, if no other markers of kidney disease, no CKD
-moderately increased risk
-high risk
-very high risk

Acknowledgements
The Nova Scotia Renal Program would like to acknowledge and thank the Nova Scotia Algorithm Development Committee and the many reviewers for their comments and suggestions.

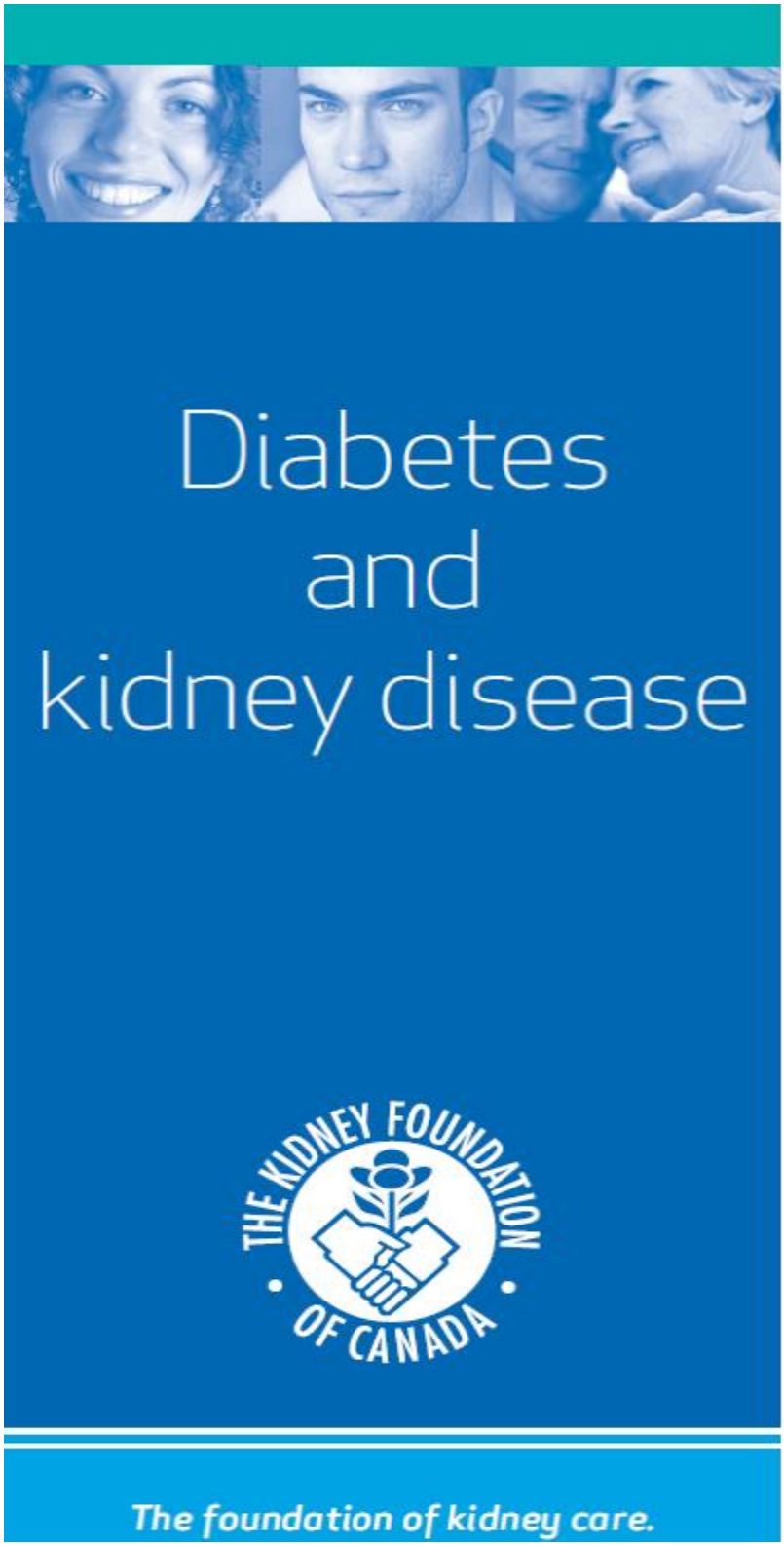
Disclaimer
This algorithm is intended as a guide only and cannot replace clinical judgment. The recommendations may be inappropriate for specific clinical situations. When in doubt, please consult a Nephrologist.

For more information contact:
Nova Scotia Renal Program
Bethune Building, Room 539
1276 South Park Street
Halifax, Nova Scotia, B3H 2Y9
Phone: 902-473-5656
Fax: 902-425-1752
Email: info@nsrp.gov.ns.ca
Website: nsrp.gov.ns.ca

To access electronic copies of this document: nsrp.gov.ns.ca/ckd-prevention-and-early-detection

April 2016

Provider Toolkit: Patient Information Brochure



Reference: The Kidney Foundation of Canada (2009). *Diabetes and Kidney Disease* [Brochure]. Montreal, QC. Author.