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Enhancing primary care capacity in chronic kidney disease management: a quality improvement educational initiative

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ABSTRACT

Background Gaps in identification, medical management and appropriate referral for patients with chronic kidney disease (CKD) are evident.

Objective We designed and implemented an interactive educational intervention (accredited workshop) to improve primary care providers' awareness of tools to support guideline-concordant CKD management.

Design We used the Kern method to design the educational intervention and targeted the accredited workshops to primary care team members (physicians, nurses and allied health) in Alberta, Canada. We conducted anonymous pre-workshop and post-workshop surveys to identify practice-specific barriers to care, identify potential solutions, and evaluate provider confidence pre-intervention and post-intervention. We used non-parametric statistics to analyse Likert-type survey data and descriptive content analysis to categorise responses to open-ended survey questions.

Results We delivered 12 workshops to 114 providers from September 2017 through March 2019. Significant improvements (p<0.001) in confidence to appropriately identify, manage and refer patients with CKD were observed. Participants identified several patient-level, provider-level, and system-level barriers and potential solutions to care for patients with CKD; the majority of these barriers were addressed in the interactive workshop.

Conclusions The Kern model was an effective methodology to design and implement an educational intervention to improve providers' confidence in managing patients with CKD in primary care. Future research is needed to determine if these perceived knowledge and confidence improvements affect patient outcomes and whether improvements are sustained long term.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Broad geographical participation, with a focus on rural regions.
⇒ Use of the comprehensive Kern model for educational curriculum development and delivery.
⇒ The pre-workshop and post-workshop surveys were anonymous, so it was not possible to pair survey responses.
⇒ There was a lower response rate for the post-workshop survey.
⇒ The educational intervention was targeted to providers in a single Canadian province, which may limit generalisability to other settings.

INTRODUCTION

Chronic kidney disease (CKD) affects approximately 11% of adults in Canada and is associated with adverse clinical outcomes, poor quality of life and high healthcare costs.[1] The majority (>90%) of patients with CKD are managed by primary care providers (PCPs) in the community.[2] Despite therapies proven to reduce the adverse consequences associated with CKD, significant gaps in delivering optimal care still exist.[3] For instance, literature would suggest that ~50% of older adults with CKD are not on guideline-recommended cardioprotective medications, and only 20% who meet the criteria to see a nephrologist are referred.[4] Moreover, less than 20% of patients in Canada received a urine albumin–creatinine test within the recommended time frame following CKD diagnosis.[5] PCPs have identified several barriers to optimal care delivery for patients with CKD, including limited awareness regarding referral criteria for specialist care, absence of readily available guidelines at point of care and uncertainty about when to test for proteinuria (a key prognostic marker for kidney and cardiovascular risk).[6]

In an effort to improve care for patients with CKD in Alberta, Canada, several resources were developed and tailored for PCPs to facilitate guideline-concordant care for this patient group, with the aim of improving early identification and appropriate management as well as timely referral to specialists when indicated. These tools include an online clinical pathway for CKD (www.ckdpathway.ca), a provincial electronic specialist referral and

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advice portal, and patient management tools embedded within the predominant primary care electronic medical record (EMR) platform.[7–9] In this quality improvement initiative, we aimed to develop and implement an interactive educational intervention (accredited workshop) to improve the capacity (knowledge and awareness) of CKD management in primary care.

METHODS

Setting and participants

Healthcare in Canada is provided through a single-payer, universal system that provides comprehensive coverage, with no out-of-pocket cost, for physician and hospital services to all residents.[10] In Alberta, healthcare delivery is organised by a single provincial body, Alberta Health, through five geographical zones (South, Central, Calgary, Edmonton and North) (online supplemental file 1). Several province-wide Strategic Clinical Networks (SCNs) were created by Alberta Health Services in 2012 to implement and coordinate novel solutions to improve care for Albertans; while much of this work is hospital based, the SCNs also work with PCPs, through the Primary Health Integration Network to improve primary–secondary care integration.[11] Primary Care Networks (PCNs) operate within the province with an aim to provide care following a team-based model (including physicians, nurses and allied health providers). Currently, approximately 3700 PCPs provide care through 41 PCNs in Alberta.[12 13] Most patients with CKD are cared for in primary care settings in Alberta (>90%),[2] therefore the educational intervention was targeted to primary care team members.

Interactive educational intervention

We developed and delivered an interactive continuing medical education (CME) programme through a series of workshops across Alberta. This was designed to meet the identified needs of PCPs for CKD management, and improve guideline-concordant care for patients with CKD in primary care settings. We used the six-step Kern model to guide educational content development and delivery (figure 1).[14] The Kern model, developed at the Johns Hopkins University School of Medicine, is a learner-centred systematic approach that explicitly links curriculum to identified healthcare needs; each of the six steps reinforces each other in a cycle and can be used to inform continuous curriculum improvement.[14] The Kern model was developed specifically for medical education and has been applied successfully in a number of settings for over 20 years.[14 15] It has been widely applied to evaluate knowledge gaps and needs assessments for educational interventions. The model was selected to guide curriculum development and delivery in this project as it incorporates many components shown to positively impact clinical practice following CME activities. It afforded opportunities for highly interactive sessions using multiple teaching methods/exposures, and is based on learner-focused needs and outcomes.[16]

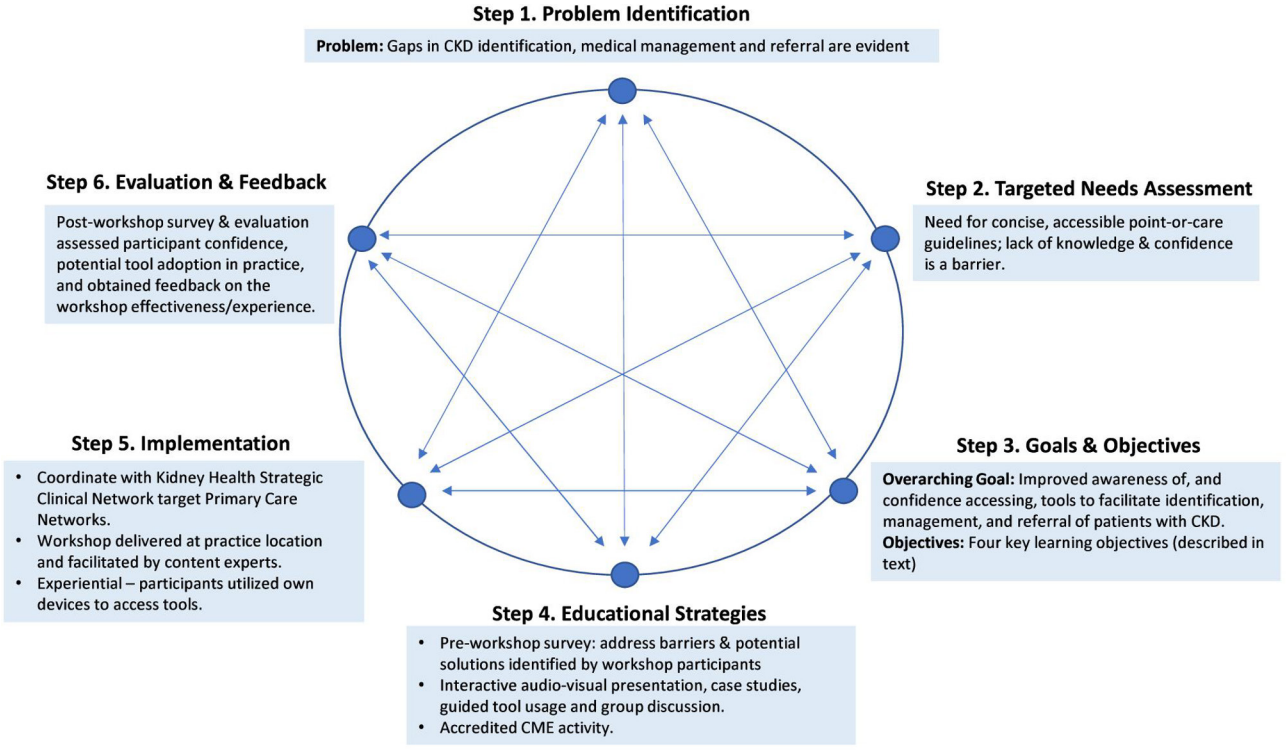

Figure 1 Application of Kern's six-step model to curriculum development and implementation for this intervention. CKD, chronic kidney disease; CME, continuing medical education.

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Workshop development

Workshop development encompassed the first three steps of the Kern model:

Step 1: Problem Identification and General Needs Assessment. Despite availability of clinical practice guidelines,[17–19] there remain gaps in CKD identification, medical management and referral for patients with CKD treated in primary care environments in Alberta.[3 5]

Step 2: Targeted Needs Assessment. Previous work identified insufficient access to concise guidelines and lack of confidence by providers to care for patients with CKD as leading barriers to appropriate care[6 8] and identified an online clinical pathway as a desired tool to improve guideline uptake;[20] consequently, the CKD clinical pathway (CKD-P) (www.ckdpathway.ca) was designed and implemented in 2014 to support guideline-concordant care.[21] One of the needs stemming from this work was a desire for continued dissemination of the CKD-P and related tools, in primary care environments.

Step 3: Goals and Objectives. The educational workshop was designed to align with the Royal College of Physicians and Surgeons of Canada *CanMEDS Physician Competency Framework*.[22] The framework encompasses a set of thematic roles physicians require to effectively meet the healthcare needs of the people they serve.[22] At the completion of the workshop, PCPs would have greater awareness of, and confidence accessing, tools to facilitate appropriate identification, guideline-concordant medical management and timely referral of patients with CKD.

The key learning objectives were:

1. Access the online CKD-P[8] and identify, medically manage, and appropriately refer patients with CKD, based on evidence-based guidelines.[17]
2. Access the Nephrology eReferral system through the Alberta Health Services Netcare portal and understand when to initiate a referral or specialist advice request and how to complete one.[7 23]
3. Use EMR database query features, such as a complex disease management dashboard, to proactively identify and recall patients with CKD and facilitate ongoing monitoring using the Comprehensive Annual Care Plan (CACP) (the CACP is a provincially developed tool used to support the care of patients with specific chronic diseases, including CKD, using a formal care plan).
4. Access and use an enhanced CACP template, with embedded clinical decision support, to streamline workflow and ensure guideline-concordant care delivery for patients with CKD.

Pre-workshop survey and workshop implementation

This phase encompassed steps 4–5 of the Kern model:

Step 4: Educational Strategies. The curriculum included a pre-workshop survey and a 1-hour interactive workshop:

1. Pre-workshop survey: the pre-workshop survey was sent to workshop participants via email link approximately 1 week prior to the workshop (online supplemental file 2). The purpose was to assess participants' confidence and barriers and facilitators to caring for patients with CKD using a combination of Likert and open-ended response questions. The survey questions were derived directly from the clinical practice gaps and targeted needs assessment identified in steps 1 and 2 of the model. The purpose of this survey was to encourage individual reflection and to identify unique barriers in the participants' clinical setting that could be addressed during the workshop, in addition to the planned curriculum. The survey results and barriers were aggregated for each practice group and presented during the workshop, which allowed for targeted discussion.
2. Interactive workshop: the interactive educational intervention was facilitated by a nephrologist (BH) or primary care physician (DZ) with expertise in nephrology. The facilitator used several techniques to engage learners, including an interactive audio-visual presentation, case studies, guided tool usage and group discussion. Workshop content was developed and reviewed by two nephrologists (BH, AKB), three primary care physicians (DZ, KM, TN) and one nurse practitioner (EN) with expertise in nephrology. The educational programme was accredited by the College of Family Physicians of Canada for up to 2.0 MAINPRO + continuing educational credits.

Step 5: Implementation. The accredited education sessions were advertised by the Kidney Health SCN from September 2017 through March 2019. The workshop advertisements were targeted to PCPs throughout the province with an emphasis on rural areas, where barriers to care are heightened and clinical outcomes are poorer compared with urban regions.[5 24 25] Workshops were primarily delivered in person at or near providers' clinic locations, with one workshop delivered via an interactive video-conference format. Due to the experiential nature of the workshops, that required direct access to relevant online tools, attendees were asked to bring a laptop or tablet that could connect to these tools to fully participate in the workshop.

Post-workshop survey and evaluation

Step 6: Evaluation and Feedback. A post-workshop survey was implemented to assess participants' confidence and evaluate workshop effectiveness. The survey used questions from the pre-workshop survey and also asked participants how likely they would be to use the tools accessed during the workshop in their routine clinical practice (online supplemental file 3). The survey included a combination of Likert and open-ended response questions and was initially collected via an online link, which was transitioned to paper surveys immediately following the workshop to increase response rates.

Analysis

Quantitative data analysis

Non-parametric statistics were used for the Likert-type survey data;[26] pre-implementation and

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post-implementation differences in survey responses were compared using the Wilcoxon Mann-Whitney rank-sum test for unmatched data.[27 28] Analyses were performed using Stata V.14 (StataCorp, College Station, Texas, USA).

Qualitative data analysis

We used a descriptive content analysis approach to identify categories and summarise responses to open-ended questions.[29 30] Descriptive content analysis approaches are used to describe and categorise text data and identify common trends, but with a low-level of interpretation (that is, the analysis stays 'close to the data'); consequently, we did not use theory to guide analysis of barriers and facilitators to CKD care.[30 31] Text data were imported into NVivo V.12 software to facilitate data analysis (QSR International, Doncaster, Australia). One investigator (MDS) with expertise in qualitative analysis reviewed the text responses to open-ended questions, categorised the response data, and discussed the raw and categorised data with two investigators (BH, MD) to ensure completeness and achieve consensus on the final categories and interpretation.

Patient and public involvement

Because this was an accredited continuing medical education workshop targeted to PCPs and developed by content experts, we did not consult with patients or the public in the design, conduct or dissemination of this initiative.

RESULTS

Twelve accredited workshops were delivered to 114 participants throughout Alberta from September 2017 through March 2019. Overall, 32% of workshop participants were from the North zone, 24% from the Central zone, 22% from the Edmonton zone, 16% from the South zone and 7% from the Calgary zone (). Over 70% of workshop participants were practising in rural locations at the time of the workshop. Approximately 76% of participants completed the pre-workshop survey and 42% completed the post-workshop survey. The majority of survey participants were physicians (63% pre; 67% post) followed by nurses/nurse practitioners (16% pre; 17% post) (table 1).

Of those who completed the pre-workshop survey, 79% had previously heard about the online CKD-P, although only 37% had used the tool. Overall, 62% had heard of the eReferral portal and 9% had used the tool, while 25% had used dashboard features in their EMR to proactively identify and manage patients with CKD.

Qualitative results

In the pre-workshop survey, participants were asked to list key risk factors and barriers to management of patients with CKD in primary care. In the pre-workshop survey, participants also identified a number of patient-level, provider-level, and system-level challenges and potential solutions to management in a primary care setting; the relationships between workshop educational components and these challenges and proposed solutions are depicted in figure 2. Participant responses to practice-specific challenges and potential solutions are listed in online supplemental file 4.

Table 1 Participant roles and workshop locations

	Pre-survey n (%)	Post-survey n (%)
Clinic role		
Clinic staff	7 (7.9)	4 (8.3)
Dietitian	6 (6.7)	1 (2.1)
Pharmacist	4 (4.5)	2 (4.2)
Exercise specialist	1 (1.1)	0 (0)
Nurse	10 (11.2)	5 (10.4)
Nurse practitioner	4 (4.5)	3 (6.3)
Physician assistant	1 (1.1)	0 (0)
Physician	56 (62.9)	32 (66.7)
Other	0 (0)	1 (2.1)
Total	89 (100)	48 (100)
Workshop clinic locations by AHS zone		
North	32.30%	
Edmonton	21.50%	
Central	23.70%	
Calgary	6.50%	
South	16.10%	

AHS, Alberta Health Services.

Patient-level

Workshop participants identified several important patient-level barriers that they perceived may impact optimal care delivery. The most common patient-level barriers identified included travel distance, self-efficacy and following recommended treatments, and overall health literacy. Workshop participants identified a number of strategies to help overcome these barriers, including a patient-centred approach, education and goal setting, regular follow-up, help for changes in lifestyle (such as weight loss programmes and diabetes management support), and financial support for medications. For example, one nurse suggested they 'try to set small achievable goals with patient[s] to make a healthy change' and another suggested 'patient education, goal setting, regular follow up [and] increased financial support for medications would be beneficial' for patients with CKD. Existing programmes to support patients with complex health needs were also suggested to be beneficial: one physician noted that a 'locally run diabetic nephropathy prevention clinic has been super helpful' and another recommended an 'expansion of service provided by [the] diabetic

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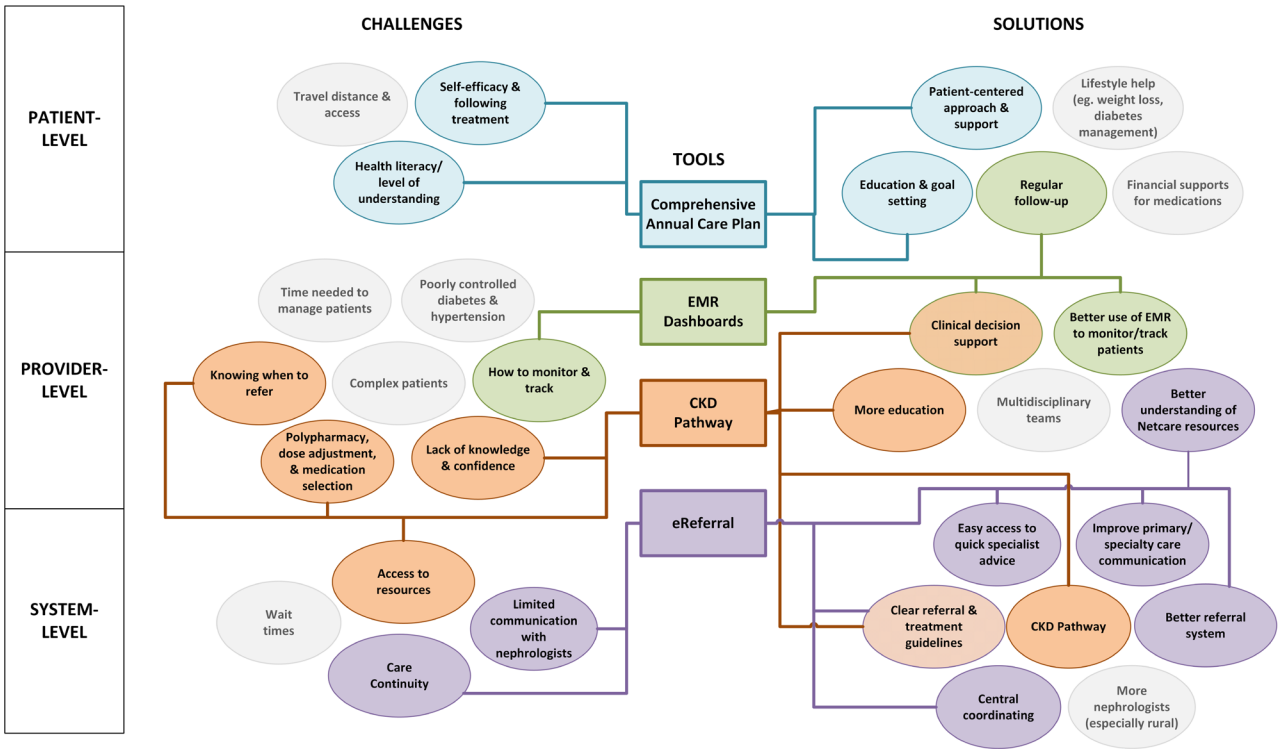

Figure 2 Relationship between workshop educational components/tools and CKD management challenges and potential solutions identified by workshop participants prior to educational intervention. Grey boxes denote challenges and solutions that are unrelated to the workshop educational components. CKD, chronic kidney disease; EMR, electronic medical record.

nephropathy prevention clinic to become more of a nephropathy prevention clinic (include non-diabetics with nephropathy as well as diabetics who do not yet have nephropathy)'. With respect to travel distance, some participants also indicated that use of telehealth has helped to overcome access-related challenges: 'More use is now being made of telemedicine, the closest actual out reach clinic is 1.5 hrs away, which is a huge issue for the commonly elderly and debilitated patients' (physician).

Provider-level

The most common provider-level barriers included a perceived lack of knowledge and confidence to manage patients with CKD in general; limited awareness about indications for referral to nephrology; complexity with prescribing medicines in the context of multimorbidity and low kidney function, poorly controlled diabetes and hypertension; and the time needed to care for patients adequately. The primary solutions included the need for more education for providers: 'participate in educational opportunities' (nurse practitioner), 'more education regarding [CKD] and a resource to refer to as needed' (pharmacist), 'more education/training' (physician) and a belief that the workshop would be helpful: '[I] anticipate this educational session will be very helpful' (physician). Other potential solutions identified by participants included clinical decision support, more effective use of EMRs to proactively monitor and track patients, incorporating a multidisciplinary team approach to care, and developing a better awareness and understanding of the resources and tools available through Alberta Health Services' Netcare portal. For example, some participants indicated that 'utilization of reminders for patients to follow-up' (physician) and 'setting a pop up in the EMR to remind me to consider renal clearance when writing any prescription for a patient' (physician) would be helpful while others suggested that 'understanding the CKD pathway and system, and better utilizing the resources available on Netcare' (pharmacist) and 'learn[ing] more about the Netcare eReferral and eAdvice' portals would be helpful (physician).

System-level

The primary system-level challenges identified by participants include limited communication with nephrologists, care continuity, access to resources (including issues accessing wi-fi-dependent portals in rural settings) and specialist wait times. Participants identified several potential solutions to overcome these challenges, such as 'better online guidelines about CKD and comorbidities' (physician), 'clear guidelines for referrals' (dietitian), 'more guidance from specialists' (physician) and 'facilitating communication lines between specialist clinics and PCN clinic staff' (dietitian), 'getting advice faster' (physician), and an ability to obtain 'quick access to nephro[logy] for non-urgent advice'. Other potential solutions included central coordinating, a better referral system and 'more nephrologists in the country' (physician), especially in rural locations.

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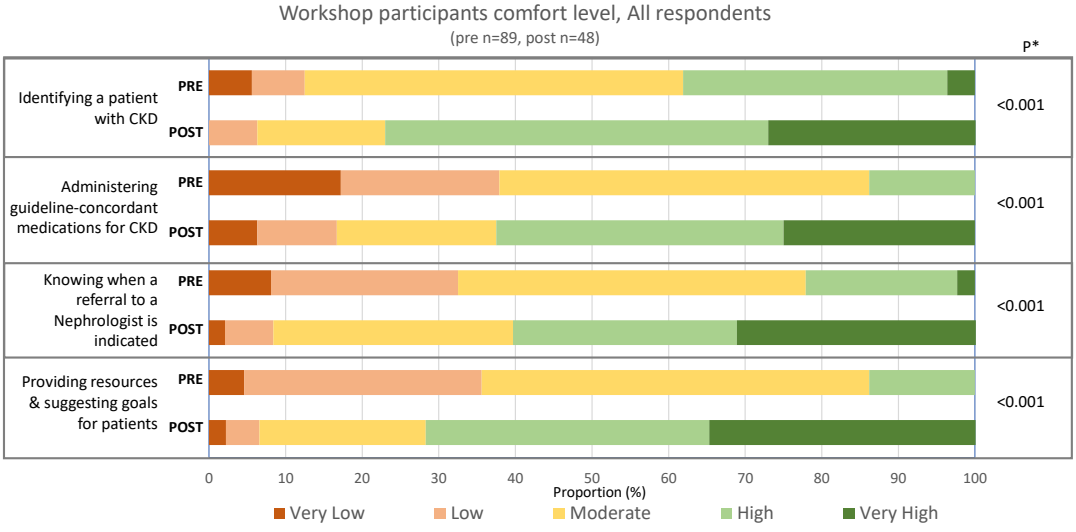
Quantitative results

Of the common risk factors for CKD[32] identified in the pre-workshop survey, 91% of participants identified diabetes, 48% identified hypertension and cardiovascular disease, 10% identified older age and less than 5% identified other risk factors, such as acute kidney injury, nephrotoxins, family history, smoking, obesity and ethnicity. Participants were also asked to rate their comfort level in four areas relating to knowledge and confidence managing patients with CKD in both the pre-workshop and post-workshop surveys: (1) identifying a patient with CKD; (2) administering guideline-concordant medication therapies for patients with CKD; (3) knowing when a referral to a nephrologist is indicated; and (4) providing resources and suggesting guideline-recommended goals for patients with CKD. When comparing the pre-survey and post-survey responses, there were significant improvements (p<0.001) in the comfort level reported by all participants (for all four areas measured) in the post-workshop survey (figure 3A) and these significant differences were retained when analysing physician-only responses (figure 3B).

Following the workshop, the majority of participants indicated that they planned to use the tools introduced in the educational session; approximately 90% indicated they planned to use the CKD-P and approximately 70% planned to use the eReferral portal to either refer patients to nephrology or submit an electronic specialist advice request. In the workshop evaluation, over 90% of participants agreed that the content was relevant, the session enhanced their knowledge and that they intend to use the information learnt in their primary care practice (online supplemental file 5).

A) Workshop participants comfort level, All respondents (pre n=89, post n=48)



B) Workshop participants comfort level, Physicians only (pre n=56, post n=32)

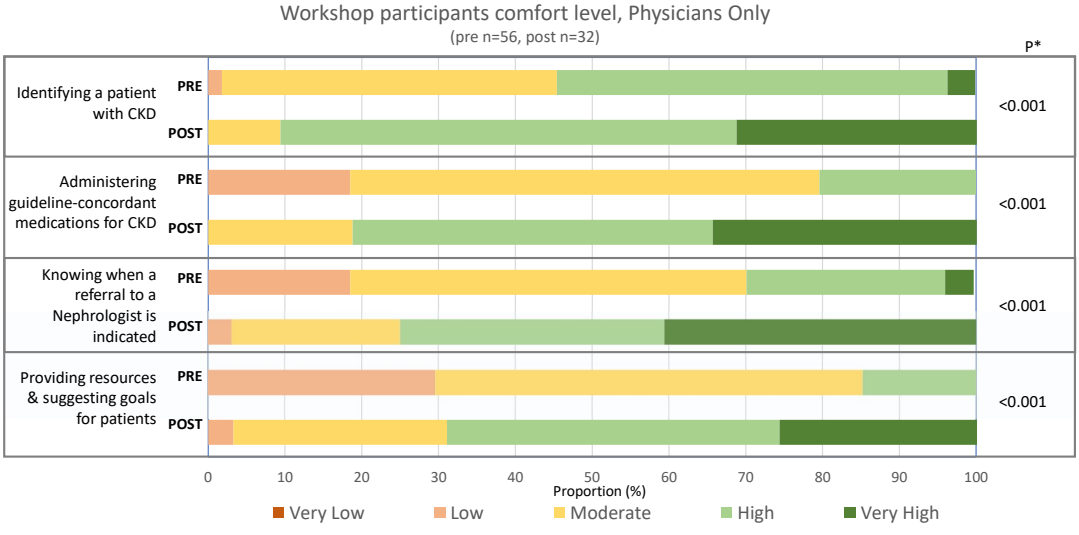


Figure 3 Pre/post-survey responses for (A) all workshop participants and (B) physician participants only. CKD, chronic kidney disease.

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DISCUSSION

The aim of this quality improvement study was to design and implement an educational intervention to address important gaps in CKD care and improve healthcare providers' perceived knowledge and confidence to manage patients with CKD in primary care. Prior to participating in the interactive workshop, participants identified a number of patient-level, provider-level and system-level challenges, and potential solutions to managing CKD in the primary care setting. Following the educational intervention, participants indicated that the workshop was relevant to their practice, and significant improvements in knowledge and confidence to identify, treat, and refer patients with CKD were observed.

Pre-workshop survey results identified a gap in the awareness of CKD risk factors among participants. While diabetes was commonly identified as a significant risk factor for CKD, other important risk factors, including hypertension, cardiovascular disease, advanced age, nephrotoxins (such as non-steroidal anti-inflammatory drugs), family history and previous acute kidney injury, were not well recognised, suggesting an important knowledge gap. This is especially relevant considering that the early stages of CKD are commonly 'silent' and early diagnosis, which is dependent on laboratory testing, is key to initiating kidney protective therapies and preventing disease progression.[3 5]

Our study also identified several important patient-level, provider-level and system-level challenges to CKD management in primary care. Many of these challenges are at least partially remedied by tools that are available to primary care physicians in Alberta, Canada (such as the CKD-P, eReferral portal, CACP and EMR dashboards), and were introduced to participants during the educational intervention. Many participants were aware of these tools, but had not used them in clinical practice, suggesting that a concerted effort to disseminate these tools is needed to improve awareness and uptake in primary care. Several challenges identified by participants were beyond the scope of this education intervention, such as travel distance and access for patients, time constraints, specialty wait times, internet wi-fi reliability in rural locations and financial support for medications. These system-level challenges deserve further attention and may serve to better support CKD management in primary care in Alberta. Many of these challenges have also been reported in the literature.[5 24 33–35] The time required to care for patients with chronic conditions is a significant challenge in primary care,[33] and the density and ratio of nephrologists to patients (14:1000) in Canada is one of the lowest in the Organisation for Economic Co-operation and Development,[24 36] though it is not clear how this low ratio may, or may not, affect patient outcomes.[37] Additionally, inadequate financial support for medications has been reported as a common reason for poor medication adherence, poorer clinical outcomes and increased healthcare utilisation over the long term.[38–40] As clinical tools designed to support PCPs are increasingly dependent on internet wi-fi access, the lack of infrastructure in rural and remote regions presents a significant barrier to PCPs' uptake of these tools.[41]

We used an interactive small-group educational intervention to improve PCPs' knowledge and confidence in managing CKD patient care in a community setting. Educational outreach has been reported to be an effective knowledge translation methodology for healthcare provider audiences[16 42] and our previous research suggests that small-group in-person activities are effective means for increasing the use of an online clinical pathway in primary care.[43] By using the structured Kern model to design the educational intervention, we were able to adapt content to the local, primary care context and target three identified knowledge gaps: early identification of CKD, administration of guideline-concordant drug therapies and identifying when referral to a nephrologist is indicated. This approach was ultimately successful, with significant improvements evident in the pre/post-survey, although it is unclear if this new knowledge was sustained or translated into practice changes as the study did not evaluate the effectiveness of the curriculum in enhancing CKD management beyond participants' participation in the continuing medical education session.

Strengths of this study include broad geographical participation across the province of Alberta, with a focus on rural regions, and use of a comprehensive model for educational curriculum development and delivery. However, there are limitations that should be recognised when interpreting the results. The pre-workshop and post-workshop surveys were anonymous, so it was not possible to pair survey responses. There was also a lower response rate for the post-workshop survey, however, the response rate improved when the administration method was modified to a paper-based survey, rather than electronic, following the workshop. It is also important to note that we used qualitative descriptive methodology, specifically conventional content analysis, to summarise perceived barriers and facilitators to CKD care; we did not use theory to guide analysis. Finally, the educational intervention was targeted to providers in a single Canadian province, which may limit generalisability to other settings.

In summary, we implemented a robust quality improvement-based educational intervention, using the Kern model to improve the capacity of PCPs in the management of CKD. Educational interventions leveraging this approach may effectively improve knowledge and confidence among PCPs and improve clinical care for patients with CKD. More research is needed to understand if these knowledge improvements affect clinical practice, and whether improvements are sustained long term.

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Contributors All authors in this study have contributed to this manuscript and approve of this submission. MDS, AKB, DZ, KM, KN, EN and BH contributed to the educational initiative design and delivery. MDS, AKB, MD and BH drafted the article. All authors contributed to the quality improvement project and provided critical revisions to this manuscript. BH is the guarantor for the study.

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Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Not applicable. This educational initiative was reviewed by the University of Calgary Conjoint Health Research Ethics Board and deemed a quality improvement project. Data were collected as a required component of the College of Family Physicians of Canada MAINPRO+ continuing education accreditation for this educational activity.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. All data relevant to the study are included in the article or uploaded as supplemental information. The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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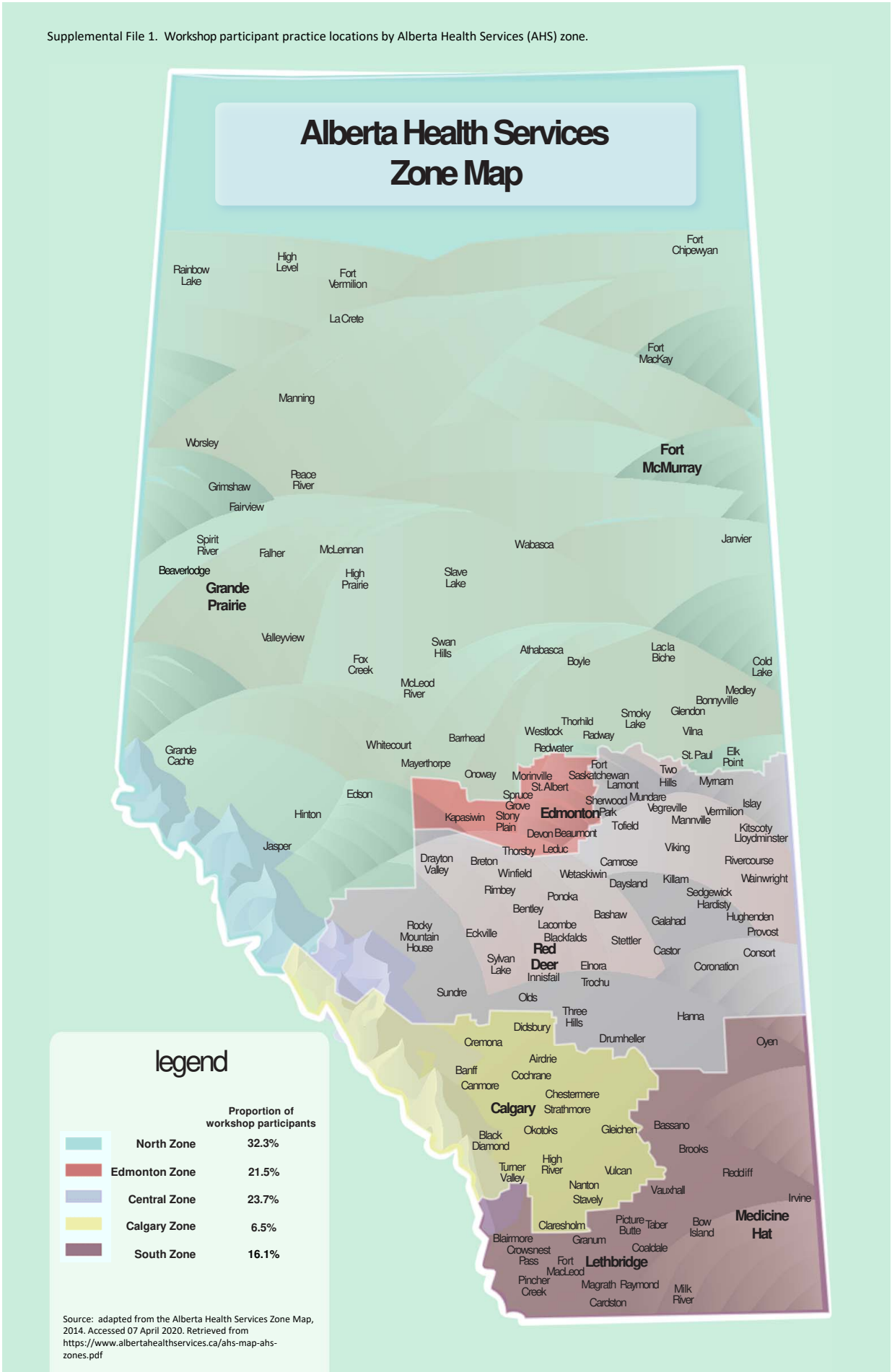
Supplemental File 1. Workshop participant practice locations by Alberta Health Services (AHS) zone.



Source: adapted from the Alberta Health Services Zone Map, 2014. Accessed 07 April 2020. Retrieved from https://www.albertahealthservices.ca/ahs-map-ahs-zones.pdf

Chronic Kidney Disease Management: Pre-workshop Questionnaire

Improving chronic kidney disease (CKD) care in the community using health information technology: The CKD Pathway, Nephrology eReferral, and enhanced electronic Comprehensive Annual Care Plan (CACP)

This reflective tool is intended to be completed individually, prior to the workshop. Please record your responses to the following questions:

This questionnaire is anonymous

1. Please rate how comfortable you are able to:

	Very Low	Low	Moderate	High	Very High
Identify a patient with CKD	○	○	○	○	○
Administer guideline-concordant medication therapies for CKD patients	○	○	○	○	○
Know when a referral to a Nephrologist is indicated	○	○	○	○	○
Provide resources and suggest guideline recommended goals for CKD patients	○	○	○	○	○

2. Have you:

	Yes	No
a) Heard of the CKD Pathway	○	○
b) Utilized the CKD Pathway	○	○
c) Heard about NetCare eReferral	○	○
d) Utilized NetCare eReferral	○	○
e) Heard about Netcare eReferral Advice Request	○	○
f) Utilized NetCare eReferral Advice Request	○	○
g) Utilized dashboard features with your EMR to identify and manage patients in your practice	○	○

3. If you have utilized eReferral Consult or Advice Request in the past, for which specialties:

Thank you for completing this questionnaire

Chronic Kidney Disease Management: Post-workshop Questionnaire

Improving chronic kidney disease (CKD) care in the community using health information technology: The CKD Pathway, Nephrology eReferral, and enhanced electronic Comprehensive Annual Care Plan (CACP)

This reflective tool is intended to be completed individually, immediately following the workshop. Please record your responses to the following questions:

This questionnaire is anonymous

1. Please rate how comfortable you are able to:

	Very Low	Low	Moderate	High	Very High
Identify a patient with CKD	○	○	○	○	○
Administer guideline-concordant medication therapies for CKD patients	○	○	○	○	○
Know when a referral to a Nephrologist is indicated	○	○	○	○	○
Provide resources and suggest guideline recommended goals for CKD patients	○	○	○	○	○

2. How likely are you to:

	Very Unlikely	Unlikely	Neutral	Likely	Very Likely
Use the CKD Pathway	○	○	○	○	○
Use eReferral Consult Request	○	○	○	○	○
Use eReferral Advice Request	○	○	○	○	○

Continued on reverse -->

Reflective Questions:

4. Describe opportunities for improvement that you have identified during the program:

5. Describe an action plan to implement improvements, noted above, including overcoming any anticipated barriers:

Thank you for completing this questionnaire

Participant Evaluation Form: Improving chronic kidney disease (CKD) care in the community using health information technology: The CKD Pathway, Nephrology eReferral, and enhanced electronic Comprehensive Annual Care Plan (CACP)
Date: _____ Location: _____

EDUCATIONAL OBJECTIVES: The program met the stated objectives.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1. Access the online CKD Pathway and identify, medically manage, and appropriately refer patients with CKD, based on evidence-based guidelines	○	○	○	○	○
2. Access the Nephrology eReferral portal through NetCare and understand when to initiate a referral request and how to complete one.	○	○	○	○	○
3. Use the Complex Disease Management (CDM) EMR dashboard to proactively identify and recall Comprehensive Annual Care Plan (CACP) eligible patients.	○	○	○	○	○
4. Access and utilize the enhanced CACP template to streamline workflow and ensure guideline-concordant care delivery for patients with CKD.	○	○	○	○	○

PROGRAM CONTENT AND DELIVERY

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The content was relevant to family medicine	○	○	○	○	○
The content enhanced my knowledge	○	○	○	○	○
The content met my expectations	○	○	○	○	○
The content was well organized	○	○	○	○	○
Disclosure of potential conflicts of interest was clearly communicated	○	○	○	○	○
Faculty members were effective in delivering and facilitating the program	○	○	○	○	○
There were adequate opportunities to interact with program faculty	○	○	○	○	○
I will use the information I learned in my practice	○	○	○	○	○
	○	○	○	○	○

Please indicate which CanMEDS-FM roles you feel were addressed during this workshop:

- ☐ Family Medicine Expert
- ☐ Communicator
- ☐ Collaborator
- ☐ Manager
- ☐ Scholar
- ☐ Professional
- ☐ Health Advocate

Did you perceive any degree of commercial bias in any

☐ Yes ☐ No

Describe two ways in which you will change your practise as a result of attending this program:

What was the **least effective** part of this program? Why?

Please list any topics you would like to see in future programs:

Supplemental File 4. Challenges and potential solutions to CKD management identified by study participants by professional role categories

Professional role	**What are the biggest challenges you face in managing CKD patients in your practice?**	**How do you/could you overcome these challenges (i.e., types of supports that would be helpful)?**
Dietitian	Limited communication with the SARP team or nephrologist.	Facilitating communication lines between specialist clinics and PCN clinic staff for our mutual patients.
	Managing protein and fluid intake.	
	Communicating effectively with their family physician Understanding when a referral is necessary	Clear guidelines for referrals. Better communications with the physicians
	Getting patients to adhere to nutrition guidelines	Regular follow-ups; client-centered approach.
	Confidence in identifying those with; when a referral is necessary.	
Nurse Practitioner	patient compliance	patient education, goal setting, regular follow up, increased financial support for medications would be beneficial
	Lack of knowledge, lack of confidence in implementing the CKD pathway	Reading over the CKD pathway, critical thinking, further education (such as this workshop)
	BP monitoring, medication compliance	
	readiness of the patient to make changes, physician referral to nephrology when indicated according to the pathway.	I try to set small achievable goals with patient to make a healthy change. I quote the CKD pathway in my letters back to physician when needing to advocate for nephrology referral.
	Having physician's complete referral to nephrology when indicated.	More education for physicians on CKD Pathway.
	knowing the direction/path to follow and facilitating appropriate referrals by physicians	key phrases to include in letters to physicians supporting CKD pathway use?
	Pt information	More handouts regarding phosphorous and how often to monitor eGFR if abnormal

Nurse Practitioner	Distraction from other issues..ex hyperglycemia, tend to focus on optimal glycemic control; education-long term complications or self care.	Reviewing guidelines.
	Specifically medication dosages in regards to diabetes medications	The newly found CKD pathway and timed right. Online group of peers.
	Appropriate timely referrals	Participate in Educational Opportunities
	maintenance of patient continuity of care; patient returning to same provider time and time again, completing screening labwork, making recommended dietary and lifestyle modifications, medication compliance	establishment of a meaningful, therapeutic relationship with each CKD patient; making myself available for any questions or concerns, assisting with the booking of follow-up appointments with myself while patient is still in the examination room with me (vs. leaving patient responsible for initiation of follow-up visits)
Pharmacist	compliance and access to timely referral follow up. Timely consult info to be received from specialists	
	I manage warfarin therapy and CKD patients tend to be more unstable. I would like to spend more time to review the medications but am only involved with warfarin adjustment.	Access to a 'specialist' if there are any questions about drug therapy for patients in our acute care hospital
	Lack of thorough, in-depth knowledge of current guidelines to confidently manage/suggest medication adjustments.	More education re: same topic and a resource to refer to as needed.
	Helping patients get access to CKD care	Understanding the CKD pathway and system, and better utilizing the resources available on Netcare
Physician	Knowing when is best to refer to nephrology	Guidelines with this - sounds like this presentation will provide this
	need for diuretics, ace inhibitors	more guidance from specialists
	CONVINCING THEM TO ATTAIN GOOD CONTROL OF THEIR CONCURRENT DM, HTN	PCN DIABETIC CARE GROUP AND DNCP ARE OF GREAT HELP, THOUGH SOME PATIENT SIMPLY DO NOT CARE
	Distance needed to travel to see nephrology and to go for dialysis if required	Telehealth with nephrology, have a few dialysis units closer to home

Physician	medications, patient compliance	better online guidelines about CKD and comorbidities
	complex patients with multiple medical problems	pcn nurse, nephrologist, treatment guidelines
	getting advice from nephrologist, I would like to get recommendation on the first visit (and letter) then when I need, most of the time yearly or less frequently	I cannot, it is the system I have to live with
	knowing how adjust some of the medications as Crcl declines: ie metformin, ACE ARB, NOACs, antibiotics	good APPS, and Netcare info
	Time needed to manage their health care needs	Involvement of the PCN more in the renal failure
	lack of available timely referral to nephrology	central coordinating
	I am a locum now and do not see pts on a longitudinal basis, though I work in the same 2 clinics most of the time ...when I had my own practice here, a main problem was and still remains getting access to nephrology. our system had only one nephrologist and I did not find him helpful. The prov renal programme does follow pat's regularly and the nurse sends follow-up notes , very rarely from the nephrologist re his long term thinking or plans.	More use is now being made of tele med. the closest actual out reach clinic is 1.5 hrs away, which is a huge issue for the commonly elderly and debilitated pts. our local dialysis unit was removed.
	compliance	engage family members
	Knowing when to refer and most optimal monitoring and treatment	UpToDate reading and occasional referrals
	Compliance with disease modification strategies.	Education supports for patients in the form of healthy living education similar to what we have for obesity and diabetes or any other resources developed for the same purpose that have been successful.
	Long waiting times	More nephrologists in the country
	access to resources	better referral system locally
	timely access to nephrology	more nephrologists available in Red Deer
	Delayed referral	

Physician	adherence to therapy	Patient education for patients prior to deteriorating to the point of requiring referral to a nephrologist.
	Adjusting doses	would like to hear from you
	young population in our community means lower numbers of ckd patients which doesn't encourage development of expertise.	Locally rum Diabetic nephropathy prevention clinic has been super helpful.
	access to dialysis	move the patients to Calgary!
	keeping track of their renal function and ensure appropriate care	more clear guidelines in regards to appropriate referral
	Compliance	Have local PCN nurse follow up patients in this regard
	Identifying total risk	Learn
	Referral access to Nephrology Effective interventions	More specific criteria for acceptance for special populations
	Knowing how to manage their medications, remembering to titrate the doses of other medications	Setting a pop up in the EMR to remind me to consider renal clearance when writing any prescription for a patient would be helpful
	Providing care for patients on dialysis	Telehealth
	Not knowing exactly when to refer to nephrology as eGFR is slowly trending down.	Teachings!
	Helping them manage their chronic pain with limited choices of medications where NSAIDS are choice. Poorly controlled hypertension, poorly controlled hyperglycemia.	Identifying barriers to improving, barriers are multifaceted as well.
	medication, fluid	simple hand out easy access to specialist advise
	Controlling their risk factors	Our good health team
	Knowing when to refer. How to monitor	Guidelines

Physician	Control of diabetes/BP/phosphate intake, prevention/management of renal osteodystrophy and management of anemia.	Expansion of service provided by diabetic nephropathy prevention clinic to become more of a nephropathy prevention clinic (include non-diabetics with nephropathy as well as diabetics who do not yet have nephropathy).
	Getting too much diuretics from other sources (walk-in clinics, hospital ER doctors). Patients failed to follow up BP.	Educating the patients.
	Keeping the kidney function from declining even further	Referral to a nephrologist
	Lifestyle changes	Lifestyle help - weight loss / diabetes
	WHEN TO REFER AND BEST MEDICATION PRACTICES	ANTICIPATE THIS EDUCATIONAL SESSION WILL BE VERY HELPFUL
	long wait to see a specialist	means for getting advice faster
	Educating patients about what CKD is, motivating them to take medication or make lifestyle changes.	Easy access to nursing education support and help monitoring patients for adherence and follow up. Occasionally, quick access to Nephro for non-urgent advice.
	Losing patients to regular follow up.	Utilization of reminders for patients to follow up.
	managing other medications patients might be on	booklet of other drugs that may need dosage adjustments have one for antibiotics
	Figuring out what the cause of their CKD is to explain it to patients.	I'm not sure.
	diabetes management, compliance, patient understanding of their disease	PCN supports, specialist involvement, regular follow up
	Compliance to chronic medications	Bubble pack, support groups
	Identifying patients requiring specialist referral Preventing progression of CKD dose adjusting medication for patients with CKD	Better use of CKD pathway

Physician	Getting specialist input	Learn more about the Netcare ereferral and eadvice
	dose adjustments for common medications and what alternatives to use for comorbidities requiring NSAID treatment	
	time to manage, referral always out of town	Telehealth, more feedback from the specialists
	Lack of continuity as resident	Graduate and have my own practice
	little experience, knowledge of renal dosing of drugs	look it up! use the CKD pathway!
	Lack of resources in the community; unclear pathway-to refer or not to refer	more education/training regarding resources available; Patient education programs
	Rural location; Patient location-pt. on reserve	Dialysis in our own community; utilize our CDM Team
	poor diabetes control, traveling for dialysis-missed appt.	frequent contact with pt.
	pt. compliance; Delay in response of specialist	Training
Other Clinic staff	Understanding CKD, patient education. Accessing resources. Variable recommendations/ guidelines. Patient access (rural area) - pts lost to follow up.	Closer monitoring of patients - improve use of EMR database to track and monitor testing/follow ups etc. Clear and consistent guidelines Improved/timely access to specialist Improve my understanding and use of netcare resources
	One of the biggest challenges I have faced is waitlists for patients to be seen by some nephrologists in the Edmonton area.	Within some of our clinics we have in house nephrologists that we have referred to who have been able to have patients be assessed in am ore timely fashion.
	When to refer	More education
	lack of knowledge	become more educated
	REFERRALS- WAIT TIMES	CALL MANY PLACES

Supplemental File 5. Workshop Evaluation Results (n=48)

	The content was relevant to family medicine		**The content enhanced my knowledge**		**The content met my expectations**		**The content was well organized**		**Potential conflicts of interest were clearly communicated**		**Faculty members were effective in delivering and facilitating the program**		**There were adequate opportunities to interact with program faculty**		**I will use the information I learned in my practice**	
	n	**%**	n	**%**	n	**%**	n	**%**	n	**%**	n	**%**	n	**%**	n	**%**
Strongly Agree	31	**64.6**	28	**58.3**	22	**45.8**	26	**54.2**	25	**52.1**	26	**54.2**	22	**45.8**	27	**56.3**
Agree	15	**31.3**	16	**33.3**	20	**41.7**	16	**33.3**	18	**37.5**	17	**35.4**	18	**37.5**	16	**33.3**
Neutral	0	**0.0**	1	**2.1**	2	**4.2**	0	**0.0**	1	**2.1**	1	**2.1**	3	**6.3**	0	**0.0**
Disagree	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**
Strongly Disagree	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**	0	**0.0**
did not answer	2	**4.2**	3	**6.3**	4	**8.3**	6	**12.5**	4	**8.3**	4	**8.3**	5	**10.4**	5	**10.4**
Total	48	100.0	48	100.0	48	100.0	48	100.0	48	100.0	48	100.0	48	100.0	48	100.0