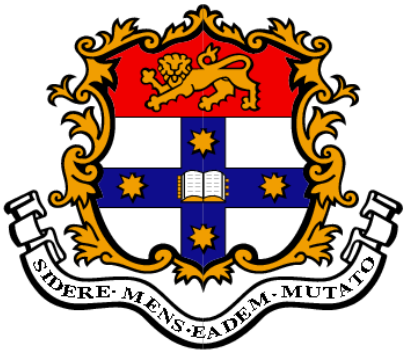
THE UNIVERSITY OF
SYDNEY

Improving outcomes for people with chronic kidney disease through education

Pamela Lopez-Vargas

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy



School of Public Health
Faculty of Medicine
University of Sydney

March 2016

Declaration

This thesis is submitted to the University of Sydney in fulfilment of the requirement is for the Doctor of Philosophy. The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

Signature: ..... Date: .....

Author's Contribution

The work presented in this thesis has been carried out by the author under the supervision of Professor Jonathan Craig, School of Public Health, and Associate Professor Allison Tong, School of Public Health, University of Sydney.

The author planned the research, designed the studies, obtained ethics approval, collected, managed and analysed the data, interpreted results, drafted and revised the manuscripts for submission to peer-reviewed journals, and wrote and compiled this thesis.

Ethical Clearance

The studies presented in Chapters 4 and 5 were approved by the Westmead Hospital Ethics Committee, the Royal Prince Alfred Hospital Ethics Committee, the Royal North Shore Ethics Committee and the Human Research Ethics Committee at the University of Sydney.

All study participants gave written informed consent for participation in the study.

Abstract

Background

Chronic kidney disease (CKD) continues to increase worldwide. Professional organisations have committed themselves to developing clinical practice guidelines to manage and prevent disease progression. People with diabetes and hypertension are at greater risk of developing CKD, but other risk factors include smoking, obesity, family history of CKD and being Aboriginal/ Torres Strait Islander or other ethnic minority. In order to prevent disease progression and other complications such as heart attack or stroke, people with early stage CKD must adhere to treatment regimes and make lifestyle modifications. Patients need to be active participants in their own care however their involvement may be limited by lack of awareness and understanding of CKD. Educational interventions may facilitate learning and provide patients with the knowledge and skills to better manage their condition.

Aims

The overarching aim of this thesis was to explore guideline recommendations about the management of patients with early stage CKD, identify ways in which patients could improve their knowledge and participation in self-care and discover strategies to educate them. The recommendations provided in clinical practice guidelines are crucial to patient care, therefore we sought to assess and compare guideline quality, scope, content and consistency. This was followed by identifying patients' level of awareness about CKD, their information needs, perspectives and beliefs about managing and living with the disease and its associated complications. Finally we assessed the effectiveness and quality of educational interventions for primary and secondary prevention of CKD.

Methods and Results

In Chapter 3 the Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument and textual synthesis was used to appraise and compare the recommendations. Fifteen guidelines and one consensus statement were identified and included. The methodological rigour across guidelines was variable and there were some evident inconsistencies across the recommendations. Some inconsistencies included variation in the definition thresholds for protein and albumin creatinine ratios and proteinuria, protein intake recommendations, blood pressure targets and the use of anti-hypertensives as either combined or monotherapy. Salt intake was recommended by most, but psychosocial and education recommendations were recommended by few.

In Chapter 4 participants with CKD Stages 1-5 were purposively sampled to participate in a mixed methods study. There were nine focus groups and participants had the opportunity to complete a survey on CKD risk factors. Thirty eight participants completed the survey, where 70 – 90% of participants recognised hypertension, diabetes, family history and obesity as risk factors for CKD. Heart attack, stroke and premature mortality were considered 20 – 40% lower risk in people with CKD than those with pre-existing cardiovascular disease (CVD) or diabetes. Five themes were identified which reflected reasons for patients choices: invisibility (asymptomatic disease), invincibility (refused to believe they were sick), lacking awareness, cumulative comorbidities (risks of associated diseases) and inevitability of death (CKD has no cure).

Focus group discussions were also used in Chapter 5. Transcripts were transcribed verbatim and thematically analysed. A total of 38 participants were included. Six major themes were identified: medical attentiveness (shared decision making, rapport, indifference and insensitivity); learning self-management (diet and nutrition, barriers to physical activity, medication safety); contextualizing comorbidities (prominence of chronic kidney disease, contradictory treatment); prognostic uncertainty (hopelessness, fear of disease progression, disbelief regarding diagnosis);

motivation and coping mechanisms (engage in research, pro-active management, optimism, feeling normal); and knowledge gaps (practical advice, access to information, comprehension of pathology results and CKD diagnosis, education for general practitioners).

In Chapter 6 we systematically searched the literature for educational interventions in people with Stages 1-5 CKD in the community and hospital setting. Study quality was assessed using the Cochrane Collaboration risk of bias tool. Twenty-five studies, 12 trials and 13 observational studies, involving 5,345 participants were included. Risk of bias was high in most studies. Interventions were multifaceted, including face-to-face teaching (25 studies), written information (19 studies) and telephone follow-up (13 studies). Nineteen studies involved one-on-one patient/educator interaction and 13 incorporated group sessions. Nine studies showed improved outcomes for quality of life, knowledge and self-management; eight had improved clinical endpoints; and two studies showed improvements in both patient reported and clinical outcomes. Characteristics of effective interventions included teaching sessions that were interactive - workshops/practical skills (12/14 studies); integrated negotiated goal setting (9/12 studies); involved groups of patients (11/13 studies), their families (4/4 studies) and a multidisciplinary team (6/6 studies); and had frequent [weekly (4/5 studies) or monthly (7/7 studies)] participant/educator encounters.

Conclusions

CKD guidelines were consistent in scope but were variable with respect to their recommendations, coverage and methodological quality. Participants were found to have limited understanding of the risk factors and comorbidities associated with CKD and therefore perceived CKD to be less of a threat to life compared with CVD and diabetes. Patients' ability to delay the progression of CKD may be affected by their lack of knowledge about the disease, its comorbidities, psychosocial influences and their ability to communicate effectively with their health care provider. Interactive,

frequent, and multifaceted educational interventions that include both individual and group participation appear to improve knowledge, self-management and patient outcomes.

To promote effective primary and secondary prevention of CKD, regularly updated guidelines that are based on the best available evidence and augmented with healthcare context-specific strategies for implementation are warranted. Implementation strategies would include patient education interventions which address CKD risk factors, comorbidities and outcomes, and may also increase awareness and foster better self-management for people with CKD. Support from a multidisciplinary care team, combined with provision of comprehensive, accessible and practical educational resources may enhance patients' ability and motivation to access and adhere to therapeutic and lifestyle interventions to retard progression of CKD.

Acknowledgements

I would like to thank Associate Professor Allison Tong and Professor Jonathan Craig for giving me the opportunity to be part of this incredible journey. Allison Tong ignited the idea for this project. She provided constant guidance, support, valuable feedback and introduced me to the wonderful world of qualitative research. Jonathan Craig inspired and challenged my ideas, provided clinical expertise and brilliant leadership. I am truly grateful for their commitment to kidney research and hope to one day follow in their footsteps.

I wish to thank my colleagues at the Centre for Kidney Research for their camaraderie, kindness, laughs, feedback and unfailing support. This journey would have been tougher without their presence. Thanks Denise for your wit and lunchtime chats, and Pathma for sharing the evening shift with me and your words of wisdom. Sandra and Tamara I am grateful for your mentoring and sound advice. Nicki, Martin and Rachael thank you for your friendship, support and help in running the focus groups.

I would also like to thank all the co-authors for their contribution, constructive feedback and support. A special thank you to all the participants who willingly provided their time and contribution, that are the focus of this thesis. I sincerely hope we will make a difference.

I am grateful to the National Health and Medical Research Council and the University of Sydney Postgraduate Award for their financial support. Kidney Health Australia and The Centre for Kidney Research at the Children's Hospital at Westmead also provided funding for this research.

I am indebted to my family who has been there for me at every turn, success and hurdle. This thesis is dedicated to them. To my parents Omar and Juany, I love you and thank you for your never

ending love, support, care and encouragement. My beautiful sisters Monica and Maria-Jose for lending an ear, a helping hand when I needed it most, encouraging me to get to the finish line, and sharing our 'sister' moments, I love you.

Thank you to Simona and Lucas for their love and hurrying me along, Lola for your unfailing company and Paulo for your generosity, companionship and quirky humour; you are all so dear to my heart. Finally, to my dear friends who have given me encouragement, smiles and remembering to call me, I thank you. We can go out and party now!

Thank you God for your blessings, teaching me patience and perseverance, and helping me finish what I started.

"Educating the mind without educating the heart is no education at all."
— Aristotle
"Education is the most powerful weapon which you can use to change the world."
— Nelson Mandela

Table of Contents

List of Tables

List of Figures

Appendices

Publications Arising from this Thesis

This thesis is presented for examination as a thesis containing published work. Two of the chapters presented in this thesis have been published in peer-reviewed journals, one is currently being considered for publication in a peer reviewed medical journal and two are to be submitted. The candidate is the principal author of each of these papers.

Chapter 2 **Lopez-Vargas PA,** Tong A and Craig JC. Self-management of chronic kidney disease through effective educational strategies. (Under peer review)

Chapter 3 **Lopez-Vargas PA**, Tong A, Sureshkumar P, Johnson DW and Craig JC. Prevention, detection and management of early chronic kidney disease: A systematic review of clinical practice guidelines. *Nephrology* 2013; 18: 592-604.

Chapter 4 **Lopez-Vargas PA**, Tong A, Howell M, Phoon RKS, Chadban SJ, Shen Y and Craig JC. Patient awareness and beliefs about the risk factors and comorbidities associated with chronic kidney disease – a mixed-methods study. (Under peer review – *Nephrology*)

Chapter 5 **Lopez-Vargas PA**, Tong A, Phoon RKS, Chadban SJ, Shen Y and Craig JC. Knowledge deficit of patients with stage 1-4 CKD: A focus group study. *Nephrology* 2014; 19: 234-243.

Chapter 6 **Lopez-Vargas PA**, Tong A, Howell M and Craig JC. Educational interventions for patients with early stage chronic kidney disease: A systematic review. *American*

Journal of Kidney Diseases (Accepted for publication: http://dx.doi.org/10.1053/j.ajkd.2016/01.022)

Published Abstracts and Conference Presentations

1. **Lopez-Vargas PA**, Tong A, Howell M and Craig JC. Educational interventions for patients with early stage chronic kidney disease. Presented at the Nephrology Educators Network Symposium, Sydney Feb 2015.

2. **Lopez-Vargas P,** Tong A, Phoon RKS, Chadban SJ, Shen Y, Craig J, editors. "I don't like what I read about chronic kidney disease, I might as well just go get a gun and shoot myself": focus group study of patients with early stage chronic kidney disease. 49th Annual Scientific Meeting of the Australian and New Zealand Society of Nephrology, Brisbane, Australia. Nephrology, 2013: 18(Supp. 1): 15-77.

3. **Lopez-Vargas PA,** Tong A, Sureshkumar P, Johnson DW, Craig JC, editors. Prevention, detection and management of early chronic kidney disease: a systematic review of clinical practice guidelines. American Society of Nephrology - Kidney Week, San Diego, California. JASN, 2012; Abstract Supplement: page 413A.

4. **Lopez-Vargas P,** Tong A, Sureshkumar P, Johnson D, Craig J, editors. Prevention, detection and management of early chronic kidney disease: a systematic review of clinical practice guidelines. 48th Annual Scientific Meeting of the Australian and New Zealand Society of Nephrology, Auckland, New Zealand. Nephrology, 2012: 17(Supp. s2): 1-27.

Chapter 1 Introduction

1.1 Background

On a global scale, chronic kidney disease (CKD) is affecting an ever increasing number of people [1, 2]. CKD increases the risk of end-stage kidney disease (ESKD) as well as cardiovascular disease (CVD) and other complications such as premature death [3-5]. Evidence suggests that early detection and treatment of CKD, that is guided by trustworthy guidelines [6, 7], can slow the progression of disease [2, 8, 9]. To be effective for use in clinical practice, guidelines should be rigorously developed, be consistent with the available scientific evidence, accessible, transparent, unbiased and acceptable to clinicians [6, 10]. If these factors are not met, the recommendations may be ineffective and potentially dangerous to clinical care [6].

The increased rates of diabetes, hypertension, and an ageing population are the main contributors to the rising prevalence of CKD and the increase in cardiovascular death [4, 11-13]. This increased risk is well known to healthcare providers but may not be so well known amongst patients. Lack of awareness about CKD has been found to persist in patients throughout the disease continuum [14]. This may limit their abilities and willingness to actively participate in self-management to prevent disease progression and treat their comorbidities. Some studies have assessed patients' awareness about the risk factors and comorbidities for CKD. While one identified that 92% of participants believed hypertension and diabetes (86%) were risk factors for CKD [15], others demonstrated that up to 36% of patients believed excessive alcohol intake was a major cause of CKD [16, 17] and 25% thought it was inadequate diet [17] and 40% were unsure [16]. However the reasons for patients' perception on risk factors and comorbidities are unknown.

The asymptomatic nature of early stage CKD and lack of public awareness about the disease [17, 18], also mean that patients may be reluctant to accept the diagnosis, lack insight into factors that

may drive progression and be at risk of non-adherence to recommended therapies. Therefore they need to be informed about the benefits of maintaining a healthy lifestyle and adhering to medication to reduce proteinuria, hypertension and diabetes [19]. Studies show that patients have very limited knowledge about CKD and the prevention of ESKD [14], they also experience depression and anxiety, and have limited participation in treatment planning, and poor quality of life [20, 21]. Effective education interventions can improve symptoms, survival, quality of life and reduce hospitalization rates and progression to ESKD [20, 22-24].

An essential element for the care of people with CKD is to educate them about the risk factors and their management, to ensure effective primary and secondary prevention [25-29]. Systematic reviews, focused on diet and fluid management, have shown that educational interventions may be effective in pre-dialysis and dialysis patients [30] and self-management programs in stages 1-4 CKD have shown some improvement in knowledge and quality of life [31]. However, previous systematic reviews were primarily focused on dialysis patients, or were limited to self-management interventions, rather than educational interventions more broadly.

Effective strategies to prevent CKD progression requires understanding the views, concerns, and needs of patients, so that educational interventions address their information needs and promotes their capacity to make lifestyle changes.

1.2 Aims

The primary aims of the research described in this thesis are:

1. To identify current clinical management for people with CKD, provide evidence of the need for increased education and health promotion, outline educational and preventive strategies for patients and include suggestions future strategies.

2. To compare the quality, scope, and consistency of clinical practice guidelines on the prevention, detection and management of stage 1-3 CKD. The published guidelines were also assessed for their methodological consistency and comprehensiveness.
3. To assess and describe patients' awareness and perceptions of the risk factors and comorbidities related to CKD.
4. To describe the experiences and perspectives of patients with early stage CKD, with a specific focus on their information needs in managing and living with CKD and its related complications.
5. To evaluate the effectiveness of education interventions for primary and secondary prevention of CKD, and to identify the individual characteristics of the more effective educational interventions.

1.3 Thesis overview

The overall objective of this thesis was to expand on the current evidence for the management of patients with early stage CKD by identifying patients' perceptions and beliefs about their disease, and their thoughts regarding the risk factors and associated comorbidities. To inform the development and implementation of educational interventions for the primary and secondary prevention of progression of CKD, and also to inform treatment that is based on good quality and evidence based guidelines.

Chapter 2 is a narrative review of the evidence covering current clinical management of people with CKD as recommended by clinical practice guidelines. The review also includes the a summary of the literature regarding patient awareness of CKD, their information and education needs and suggestions for education strategies used to promote awareness and patient knowledge about management and prevention of progression.

Chapter 3 is a systematic review of clinical practice guidelines that are used worldwide for the management, detection and prevention of CKD. The guidelines were assessed for quality, comprehensiveness and scope. The methodological quality of the guidelines was conducted using the Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument [32]. This instrument has been internationally validated and consists of six domains which include, scope and purpose, stakeholder involvement, rigour of development, clarity and presentation, applicability and editorial independence.

Chapters 4 and 5 were based on the study I conducted to identify patients' educational needs and awareness about CKD. This was a qualitative study which involved the recruitment of patients from three major hospitals in NSW to take part in focus group discussions. Focus group discussions facilitate group interaction and allow participants to explore and clarify their individual and shared experiences [33]. Chapter 4 was a mixed-methods study where knowledge and awareness of the risk factors and comorbidities associated with CKD was assessed using a self-administered survey that was given to all participants during the focus group discussions. The qualitative component provided the evidence to support their choices in the survey. Chapter 5 was solely a qualitative study, involving the identification of themes related to education and information needs.

Chapter 6 was a systematic review of educational interventions for patients with early stage CKD. The interventions were assessed for risk of bias using the Cochrane tool for randomised studies [34] and the Effective Practice and Organisation of Care (EPOC) Review Group Criteria for controlled before and after studies [35]. A detailed analysis of the intervention characteristics was done using a taxonomy framework for educational interventions. This framework assesses the setting (one-on-one, group), delivery style (face-to-face, telecommunication, written), teaching method (didactic, goal setting, situational), intensity (frequency, number of episodes, duration), content and personnel [36]. This framework has been previously used in diabetes education interventions.

Chapter 7 provides an overall discussion of this work, encompassing main findings, strengths and limitations, comparisons with other studies, implications for clinical practice and research, and conclusions.

1.4 References

1. El Nahas AM, Bello AK. Chronic kidney disease: the global challenge. *Lancet*. 2005;365(9456):331-40.
2. Levey A, Atkins R, Coresh J, Cohen E, Collins A, Eckardt K, et al. Chronic kidney disease as a global public health problem: approaches and initiatives–a position statement from Kidney Disease Improving Global Outcomes. *Kidney Int*. 2007;72(3):247-59.
3. Coresh J, Selvin E, Stevens LA, Manzi J, Kusek JW, Eggers P, et al. Prevalence of Chronic Kidney Disease in the United States. *JAMA*. 2007;298(17):2038-47.
4. Mathew T, Corso O. Review article: Early detection of chronic kidney disease in Australia: Which way to go? *Nephrology*. 2009;14(4):367-73.
5. Keith DS, Nichols GA, Gullion CM, Brown JB, Smith DH. Longitudinal follow-up and outcomes among a population with chronic kidney disease in a large managed care organization. *Arch Intern Med*. 2004;164(6):659-63.
6. Grimshaw J, Russell I. Achieving health gain through clinical guidelines. I: Developing scientifically valid guidelines. *Qual Health Care*. 1993;2(4):243-8.
7. Woolf SH, Grol R, Hutchinson A, Eccles M, Grimshaw J. Clinical guidelines. Potential benefits, limitations and harms of clinical guidelines. *BMJ*. 1999;318:527-30.
8. Eknoyan G, Lameire N, Barsoum R, Eckardt KU, Levin A, Levin N, et al. The burden of kidney disease: improving global outcomes. *Kidney Int*. 2004;66(4):1310-4.
9. Hallan SI, Coresh J, Astor BC, Åsberg A, Powe NR, Romundstad S, et al. International comparison of the relationship of chronic kidney disease prevalence and ESRD risk. *J Am Soc Nephrol*. 2006;17(8):2275.
10. Burls A. AGREE II—improving the quality of clinical care. *Lancet*. 2010;376(9747):1128-9.

11. Adler AI, Stevens RJ, Manley SE, Bilous RW, Cull CA, Holman RR. Development and progression of nephropathy in type 2 diabetes: the United Kingdom Prospective Diabetes Study (UKPDS 64). *Kidney Int*. 2003;63(1):225-32.

12. Fox CS, Matsushita K, Woodward M, Bilo HJG, Chalmers J, Heerspink HJL, et al. Associations of kidney disease measures with mortality and end-stage renal disease in individuals with and without diabetes: a meta-analysis. *Lancet*. 2012;380(9854):1662-73.

13. Shlipak MG, Fried LF, Cushman M, Manolio TA, Peterson D, Stehman-Breen C, et al. Cardiovascular mortality risk in chronic kidney disease: comparison of traditional and novel risk factors. *JAMA*. 2005;293(14):1737-45.

14. Finkelstein FO, Story K, Firanek C, Barre P, Takano T, Soroka S, et al. Perceived knowledge among patients cared for by nephrologists about chronic kidney disease and end-stage renal disease therapies. *Kidney Int*. 2008;74:1178-84.

15. Tan AU, Hoffman B, Rosas SE. Patient perception of risk factors associated with chronic kidney disease morbidity and mortality. *Ethn Dis*. 2010;20(2):106-10.

16. Burke M, Kapojos J, Sammartino C, Gray N. Kidney disease health literacy among new patients referred to a nephrology outpatient clinic. *Intern Med J*. 2014;44(11):1080-6.

17. White SL, Polkinghorne KR, Cass A, Shaw J, Atkins RC, Chadban SJ. Limited knowledge of kidney disease in a survey of AusDiab study participants. *Med J Aust*. 2008;188(4):204.

18. Chadban SJ, Briganti EM, Kerr PG, Dunstan DW, Welborn TA, Zimmet PZ, et al. Prevalence of kidney damage in Australian adults: The AusDiab kidney study. *J Am Soc Nephrol*. 2003;14(suppl 2):S131-S8.

19. Johnson DW, Atai E, Chan M, Phoon RKS, Scott C, Toussaint ND, et al. KHA-CARI Guideline: Early chronic kidney disease: Detection, prevention and management. *Nephrology*. 2013;18(5):340-50.

20. Devins GM, Mendelssohn DC, Barré PE, Binik YM. Predialysis psychoeducational intervention and coping styles influence time to dialysis in chronic kidney disease. *Am J Kidney Dis*. 2003;42(4):693-703.

21. Tong A, Sainsbury P, Chadban S, Walker R, Harris D, Carter S, et al. Patients' experiences and perspectives of living with CKD. *Am J Kidney Dis*. 2009;53:689 - 700.

22. Chen SH, Tsai YF, Sun CY, Wu IW, Lee CC, Wu MS. The impact of self-management support on the progression of chronic kidney disease - A prospective randomized controlled trial. *Nephrol Dial Transplant*. 2011;26(11):3560-6.

23. Devins GM, Mendelssohn DC, Barré PE, Taub K, Binik YM. Predialysis psychoeducational intervention extends survival in CKD: a 20-year follow-up. *Am J Kidney Dis*. 2005;46(6):1088-98.

24. Fisher EB, Thorpe CT, DeVellis BM, DeVellis RF. Healthy Coping, Negative Emotions, and Diabetes Management: A Systematic Review and Appraisal. *Diabetes Educ*. 2007;33(6):1080-103.

25. Costantini L, Beanlands H, McCay E, Cattran D, Hladunewich M, Francis D. The self-management experience of people with mild to moderate chronic kidney disease. *Nephrol Nurs J*. 2008;35(2):147.

26. Levey AS, Schoolwerth AC, Burrows NR, Williams DE, Stith KR, McClellan W. Comprehensive Public Health Strategies for Preventing the Development, Progression, and Complications of CKD: Report of an Expert Panel Convened by the Centers for Disease Control and Prevention. *Am J Kidney Dis*. 2009;53(3):522-35.

27. Lindström J, Eriksson JG, Valle TT, Aunola S, Cepaitis Z, Hakumäki M, et al. Prevention of diabetes mellitus in subjects with impaired glucose tolerance in the Finnish Diabetes Prevention Study: results from a randomized clinical trial. *J Am Soc Nephrol*. 2003;14(suppl 2):S108-S13.

28. Molitch ME, Fujimoto W, Hamman RF, Knowler WC. The diabetes prevention program and its global implications. *J Am Soc Nephrol*. 2003;14(suppl 2):S103-S7.

29. Zhu LX, Ho SC, Wong TK. Effectiveness of health education programs on exercise behavior among patients with heart disease: a systematic review and meta-analysis. *Journal of Evidence-Based Medicine*. 2013;6(4):265-301.

30. Mason J, Khunti K, Stone M, Farooqi A, Carr S. Educational interventions in kidney disease care: a systematic review of randomized trials. *Am J Kidney Dis*. 2008;51(6):933-51.

31. Bonner A, Havas K, Douglas C, Thepha T, Bennett P, Clark R. Self-management programmes in stages 1-4 chronic kidney disease: a literature review. *J Ren Care*. 2014;40(3):194-204.

32. Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, et al. AGREE II: advancing guideline development, reporting and evaluation in health care. *Can Med Assoc J*. 2010;182(18):E839-42.

33. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349-57.

34. Higgins JPT, Green, S. (eds),. *Cochrane handbook for systematic reviews of interventions.* Chichester: John Wiley & Sons Ltd; 2008.

35. Effective Practice and Organisation of Care (EPOC). *Suggested risk of bias criteria for EPOC reviews. EPOC resources for review authors*. Oslo: Norwegian Knowledge Centre for the Health Services; 2014; [cited 2013 30 October]; Available from: http://epocoslo.cochrane.org/epoc-specific-resources-review-authors.

36. Elasy TA, Ellis SE, Brown A, Pichert JW. A taxonomy for diabetes educational interventions. *Patient Educ Couns*. 2001;43(2):121-7.

Chapter 2 Self-management of chronic kidney disease through effective educational strategies

2.1 Abstract

The incidence and prevalence of chronic kidney disease (CKD) continues to rise worldwide, leading to a substantial health and financial burden, on individual patients and societally more generally. This occurs because of the direct effect of CKD and its treatment, and indirectly, by leading to cardiovascular disease, cancer and other comorbidities. Given the chronic nature of the condition, self-management is increasingly recognised as critical to improving the outcomes of people with CKD, and effective educational strategies are required to ensure this happens. If substantial improvements in the outcomes for people are to occur, prevention of progression needs to be the focus, rather than simply improving the care of people who need renal replacement therapy. Patients with early-stage CKD are required to make lifestyle modifications and adhere to treatment regimens to prevent disease progression and complications. This can only occur if patients understand their disease and what they can do to prevent its progression and effective educational strategies are central to this framework. The aims of this narrative review are to identify current clinical management for people with CKD, provide evidence of the need for increased education and health promotion, outline educational and preventive strategies for patients and suggest future strategies.

2.2 Introduction

The burden of chronic kidney disease (CKD) patients is increasing worldwide [3]. Kidney disease is associated with other acute and chronic diseases including cardiovascular disease, diabetes, chronic pulmonary disease and cancer [4]. Complications from CKD include all-cause and cardiovascular

mortality, acute kidney injury, progression of kidney disease, anaemia, mineral bone disorders, fractures and cognitive decline [5]. Preventing CKD and delaying its progression to end-stage kidney disease (ESKD) will also impact upon complications and will decrease the disease burden overall, directly and indirectly.

Introducing and incorporating preventive strategies such as early detection, patient education and promoting awareness about CKD in the community are methods that may reduce this global epidemic. There is evidence indicating that the ESKD incidence has been reduced in communities where comprehensive management strategies have been implemented [5].

Problems affecting the management of early stage CKD include its asymptomatic nature. Individuals with the disease may not be aware they have it and therefore fail to recognise the importance of treatment [6]. Improved awareness of the associated risk factors of CKD such as diabetes, hypertension, obesity and family history, may assist early detection.

The aims of this narrative review are to identify the current management and prevention strategies for CKD; to investigate patients' current needs about CKD management and prevention; explore the level of patients' awareness of CKD risk factors and comorbidities and factors affecting patients' willingness to make changes. Current CKD management policies and suggestions for future patient education strategies will also be discussed.

2.3 What is chronic kidney disease?

Definition*, classification and epidemiology*

Chronic kidney disease is defined as having a glomerular filtration rate (GFR) of <60 ml/min/1.73m2 , or the presence of albuminuria for ≥ 3 months or more [7]. There are six

progression stages of CKD which can be seen in Figure 2.1. The combination of estimated glomerular filtration rate (eGFR) and albuminuria determines the stage and severity of the disease, and places the individual at an increased risk of CKD progression at all ages, compared with those with only low GFR, albuminuria or proteinuria [1].

Worldwide, the prevalence of CKD is estimated to be 8-16% [5]. In Australia, kidney disease currently affects an estimated 1.7 million people (10%) aged 18 years of age and older. Approximately 4% of all adults are in Stage 1, 2.5% are in Stage 2 and less than 1% are in Stages 4-5 [8]. This means that up to 92.5% of patients may potentially have Stage 3 CKD (eGFR 30-60) whereby the majority will be cared for by their general practitioner rather than by nephrologists. Which means that CKD management and patient education is not only of concern for nephrologists, but for primary care physicians as well. Prevalence of CKD increases with age as only 5.5% of people under the age of 55 years had indicators of CKD compared to 42.2% of people aged 75 years and over [8]. Similar prevalence rates are found worldwide. In the USA, data from the National Health and Nutrition Examination Survey indicates a prevalence rate of 15% for CKD stages 1-4 for the period 2007 – 2012 [9].

2.3.1 What causes CKD?

Risk factors, comorbidities and complications

Diabetes and hypertension are the main causes of CKD in developed and many developing countries. In developing countries, infectious diseases continue to contribute to the burden of CKD, whereas in developed countries the problem has shifted to lifestyle-related diseases which include hypertension and diabetes [5, 7]. Along with obesity and smoking, diabetes and hypertension are regarded as modifiable risk factors which, when addressed, may minimise the risk of CKD. The non-modifiable risk factors for CKD include increasing age, family history of CKD and ethnicity.

Ethnic minority groups include Indigenous Australians, Pacific and Torres Strait Islanders, Maori people, South American Aborigines, First Nation Canadians, black and Asian people in the United Kingdom, and black, Hispanic and Native Americans in the United States [1, 5, 7].

Hypertension and diabetes are not only risk factors for CKD but also regarded as comorbidities which increase the rate of progression of CKD, mortality and morbidity. The prevalence of hypertension in adults has been estimated to increase to 1.56 billion by 2025 [10]. The current rates for treatment and control of hypertension is low, with 29% and 10% respectively in men, and 41% and 17% respectively in women [11]. The global prevalence of diabetes is estimated to be 6.4%, affecting 285 million adults. This is projected to increase to 7.7%, affecting 439 million adults in 2030 [12]. Diabetes may be the leading cause of CKD and end-stage kidney disease (ESKD) in the US. Strategies that address the control of hypertension and diabetes are necessary to decrease the risk and rate of progression of CKD [2].

A series of health complications arise from having CKD. Some of these begin to develop during the earlier stages of the disease such as anaemia, while others appear later; calcium-phosphorus mineral and bone disorder, metabolic acidosis, hypoalbuminaemia, malnutrition, dyslipidaemia and the development of cardiovascular disease (CVD) [2]. Results from the Framingham cohort study showed that patients with mild CKD had almost double the prevalence of CVD compared to those with no CKD [2]. In 2010, more than 40% of deaths worldwide were due to CVD, CKD and diabetes where high blood pressure was the leading risk factor. High body mass index (BMI) and glucose were responsible for about 15% of deaths each, and high cholesterol for more than 10% [13].

2.3.2 Current clinical management of CKD

Current clinical practice for CKD management is guided by clinical practice guidelines (CPG) which provide guidance for the detection and management of CKD and prevention of progression [14]. While there have been 523 guidelines on kidney disease published to date [14], 15 of them address the detection, management and prevention of CKD [15]. Guidelines help clinicians and patients make informed choices about their care, ultimately leading to improved patient outcomes and quality of care [16] .

The current Australian and New Zealand guideline for the management of early CKD recommends lifestyle modification and nutrition interventions, along with medical therapies for blood pressure control, glucose control, lipid management, anti-platelet , uric acid and vitamin D [1]. Management of blood pressure mainly involves the use of angiotensin-converting enzyme inhibitors (ACEi) or angiotensin receptor blockers (ARB) as first line therapy. The blood pressure target is ≤140/90 or ≤130/80 for people with micro or macro albuminuria [1]. Both these medications have been shown to slow the progression of CKD [17].

The guideline also recommends dietary modification of protein, salt, phosphate and potassium, and other specific diets. Lifestyle changes include increasing physical activity, cessation of smoking and moderate consumption of alcohol, carbonated beverages and fluid intake [1]. Although early detection and management of CKD can prevent disease progression, studies have shown that current management is inadequate. This can be attributed to the asymptomatic nature of early CKD and lack of preventive care, such as monitoring modifiable risk factors in high-risk patients [18].

The guideline also recommends dietary modification of protein, salt, phosphate and potassium, and other specific diets. Lifestyle changes include increasing physical activity, cessation of smoking and moderate consumption of alcohol, carbonated beverages and fluid intake [1]. Although early detection and management of CKD can prevent disease progression, studies have shown that

current management is inadequate. This can be attributed to the asymptomatic nature of early CKD and lack of preventive care, such as monitoring modifiable risk factors in high-risk patients [18].

Recommendations for the early detection of CKD include screening people with risk factors such as diabetes, smoking, hypertension, obesity, established CVD, family history and Aboriginal or Torres Strait Islander origin, assessing kidney function (estimated glomerular filtration rate eGFR) and urine (albumin:creatinine ratio ACR). If the kidney function is <60ml/min/1.73m2, the test needs to be repeated within two weeks, and twice again within the next three months if the second test remains below <60ml/min/1.73m2. Likewise the urine test needs to be repeated if values exceed >2.5 and >3.5 mg/mmol for males and females respectively. If the renal function remains low, the individual needs to be referred to a nephrologist [1]. The presence of albuminuria is of prognostic importance as studies have shown that patients with eGFR >60 ml/min/1.73m2 and moderately elevated proteinuria (ACR of 30/300 mg/g) have significantly worse outcomes than those with an eGFR <60 ml/min/1.73m2 but no proteinuria. These adverse outcomes include increased risk of CVD, hospitalisation, infections and all-cause mortality [19]. Other guidelines have defined similar management regimes however there are some variations with respect to recommendations for albumin creatinine ratios and proteinuria definition thresholds [15].

2.4 Prevention of progression of CKD

Aside from screening and early management of CKD, preventive strategies include effective self-management through patient education and behaviour modification, and multidisciplinary care. Patient education should provide information about the management of risk factors and comorbidities for CKD, strategies to improve self-management for blood pressure and glucose control, medication adherence and lifestyle changes. These involve promoting active lifestyle, weight control, and smoking cessation. Educational programs should take into consideration the

patient's stage of CKD, individual health requirements and cultural and social backgrounds. The care provided should be multidisciplinary involving a doctor, nurse, dietician and social worker [1]. A clinical algorithm adapted from Johnson et al [1] (Figure 2.2) demonstrates the pathway for the screening and education of patients with CKD.

The implementation of prevention programs has shown some improvements in countries such as Cuba, Chile, Uruguay and Taiwan. These have included screening and management, continuing education for nephrologists, general practitioners and other health professionals, increased nephrology services and surveillance. Since their commencement the incidence and prevalence of end-stage renal disease have declined [5].

2.4.1 Early intervention programs

Community awareness programs

There are several programs which promote awareness and improve screening that are being implemented worldwide. The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) developed the National Kidney Disease Education Program (NDKEP), which aims to increase awareness of CKD amongst primary care providers and people at high risk. The program comprises three areas of care: laboratory screening for CKD and management of risk factors such as hypertension; public awareness particularly for African American individuals and program evaluation [17, 20]. The Kidney Early Evaluation Program (KEEP) initiated by the National Kidney Foundation, targets high risk individuals and their relatives with diabetes or hypertension and provides free health screening. This program offers blood and urine testing, on-site physician consultation, referrals to appropriate health care providers and follow-up for those with abnormal findings [17, 20]. The Kidney Check Australia Taskforce (KCAT) is responsible for Kidney Health Australia's health professionals' education program. KCAT produced a CKD Management in

General Practice booklet, which provides guidance and clinical information to help general practitioners identify and manage patients at high risk of CKD [21].

2.5 Patient awareness about CKD

Patient awareness involves having general knowledge about CKD, its risk factors, complications, and an understanding of their own CKD stage and associated risks. Awareness has been found to be consistently low [22, 23]. Up to a third of participants believed that alcohol was the main cause for CKD and 2.8% and 8.6% respectively identified hypertension and diabetes as risk factors. Additionally, participants being treated for hypertension were not more aware of the risk of CKD compared to patients who were normotensive (3.3% versus 2.7%), but those diagnosed as having diabetes did have greater awareness of the risks of CKD compared to those without diabetes (25.7% versus 4.2%) [23]. Tuot et al. have shown that up to 90% of individuals with two or three markers of CKD were unaware of their condition. These markers included hyperkalaemia, hyperphosphataemia, uraemia, nitrogen, acidosis, albuminuria, anaemia and hypertension. However, individuals with albuminuria had greater awareness of their disease compared to those without ($P<0.01$) [24].

Awareness of the relationship between CKD and other comorbidities such as CKD and diabetes is also limited. Individuals with coronary heart disease (CHD) have an increased prevalence of CKD and vice versa. The Reasons for Geographical and Racial Differences in Stroke (REGARDS) cohort study showed that among participants with both CHD and CKD, 5% were aware of their CKD compared to 2% in those without CHD. Among participants with a GFR <60ml/min/1.73m^2, 10% reported having been told by a physician that they had kidney disease [25]. Similarly patients with uncontrolled hypertension or diabetes were shown to have a poor perception of the likelihood of developing CKD [26].

In patients with CKD and hypertension, knowledge of the blood pressure target is independently associated with lower systolic blood pressure [27]. However, in a study of the treatment needs of primary care patients 41% of individuals were unaware of their CKD diagnosis and up to 33% required improved blood pressure control. Almost 10% of patients needed advice to investigate anaemia or to stop nephrotoxic drugs [28]. Thus is can be seen that patients have limited awareness about their CKD status and even in those who were aware, their blood pressure management remained inadequately controlled.

Patient awareness and treatment adherence

The association between patient awareness of CKD and adherence to therapy was examined in a study involving adults with CKD who participated in the National Health and Nutrition Examination Surveys 2003-2008. Results indicated that there was no difference in blood pressure control and ACEi/ARB use between individuals who were aware of their CKD and those that were not, adjusted odds ratio 0.91 (95%CI 0.52-1.58) and 0.75 (0.44-1.30) respectively. Also, glycaemic control was not associated with increased CKD awareness AOR 0.41 (0.14-1.18) [29]. Awareness of the condition alone does not promote behaviour change or ensure adequate management. Education interventions to improve patient knowledge may be the key to promoting increased awareness, management and participation in self-care.

2.5.1 Patient education needs

Knowledge of patient information needs is fundamental to the development of patient education programs and services. Patient information need is defined as the '*recognition that their knowledge is inadequate to satisfy a goal, within the context/situation that they find themselves at a specific point in the time'* [30, 31]. The terms information need and education need have been used

synonymously, however these should be differentiated. Both terms imply a knowledge deficit, however education need refers to a cognitive deficit that is objectively measured (by an external individual) and that is aimed at modifying health behaviour. Information need is a subjective/cognitive knowledge deficit recognized by the individual [31-33].

Providing information to patients gives them the opportunity to improve their understanding of CKD, self-management, decreases concerns and promotes the maintenance of a normal life [34]. In a systematic review about the education needs of patients with CKD, the topics of interest included: information – physiology, symptoms, disease progression, complications; CKD management – medical and renal replacement therapy; diagnostic tests; lifestyle and dietary management; family, social and psychosocial impact; patient experiences, support groups and service provision [34]. Ormandy et al. conducted semi-structured interviews of pre-dialysis and dialysis patients to identify their information needs. Of highest priority were information needs about how kidney disease may affect patients, how to recognise symptoms and what to expect. Patients in full or part-time employment were most concerned with how to manage their condition, complications, side effects and the impact it will have on their lifestyle. Most participants identified information about the causes of CKD, its progression and understanding what to expect in the future as necessary information for all new patients [35, 36].

In a focus group study on patients with CKD and hypertension, six themes about blood pressure control were identified: lack of basic knowledge about blood pressure (BP); conflicting advice given by doctors; delay in diagnosis due to lack of symptoms; changes in BP management; self-management – BP monitoring; and views on the patient-health professional relationship. Increasing patient knowledge and motivation helped to address the confusion experienced by the participants [37].

These studies have shown that patients desperately need more information and education about their disease, its management and prevention. Patients want to know what future outcomes they should expect and how this will affect them, their families and social sphere. Providing patients with the necessary information has been shown to assist in managing stress, improve well-being, compliance with treatments and self-care, and reduced dependency on health care services [31, 33, 38].

2.5.2 The process of patient education

The process of patient education involves five stages. These are: 1. Assess current knowledge, learning abilities, misconceptions, attitudes and motivation; 2. Identify their learning needs and barriers; 3. Plan the education intervention with patient input including their goals, frequency, type of education, who will provide the education and how; 4. Deliver the education intervention; 5. Evaluate the patient's needs and the effectiveness of the program [39]. In a study by Wright-Nunes, the association between knowledge and patient satisfaction with physician communication was assessed. Perceived knowledge was associated with higher odds (2.13) and objective knowledge was associated with lower odds (0.91) of patient satisfaction with physician communication [40]. We need to be aware of what patients believe they know and what they actually know in order to tailor education to their needs.

2.6 Education for chronic kidney disease

What is health education*?*

Health education is any combination of learning experiences designed to help individuals and communities improve their health, by increasing their knowledge or influencing their attitudes [41]. The main purpose of health education is to produce a positive change in patient behaviour which promotes health. However, to be effective, health education programs need to consider the target

audience, their social characteristics, beliefs, attitudes, skills and past behaviours [42]. Knowledge increases perceived control and improves the patient's ability to adapt to the chronic-illness role and self-care behaviour such as modification of diet and fluid intake, increased exercise and medication adherence and attending physician appointments [39].

2.6.1 Theoretical basis

Education theories and models of care

The use of theory in health education facilitates research and practice. It can be applied during the planning, implementation and evaluation stages of an intervention. Theories help explain behaviour and suggest ways to modify it [42]. Models on the contrary, draw from a number of theories to aid in understanding a specific problem in a particular context or setting [43]. The most commonly used theories and models in health education are the Social Cognitive Theory, the Theory of Reasoned Action, the Health Belief Model and the Trans-theoretical Model [42]. However the model that would most likely be used in a future CKD educational intervention would be the Trans-theoretical Model. This model has been applied to some of the more resistant behaviours to change such as smoking cessation, diet and weight control, addictive and life-threatening behaviours [44], all of which are factors associated with CKD.

Transtheoretical Model of Behaviour Change

Prochaska's model of behaviour change focuses on the transition points in the process and the underlying factors that facilitate movement between stages. It helps us to understand how an individual will progress through the stages of behaviour change until the behaviour becomes a habit [45]. The six stages of change are [42]: Pre-contemplation – the individual does not intend to take action in the next six months; Contemplation – the individual intends to change within the next six

months and are aware of the costs and benefits; Preparation – the individual intends to take action within the next month. They have a plan of action to make a change; Action – the individual has made obvious changes in the past six months; Maintenance – the individual strives to prevent relapse but does not apply change processes as often as people in the action stage; Termination – the individual is no longer tempted by old habits and has complete self-efficacy.

2.6.2 Barriers to patient education

Health-care provider barriers

Identifying the barriers and enablers to change is necessary for the implementation of education interventions. Interventions addressing the barriers may improve patient care and outcomes [46]. Consideration should be given to patient and physician characteristics as well as the social, economic, organizational and political circumstances [47]. Barriers preventing the dissemination of health promotion innovations and implementation include: access to information – sometimes physicians and health-care providers may not be aware of the available information; physician beliefs regarding the effectiveness of the intervention; organizational priorities; behavioural intervention skills – physicians may feel inadequately prepared to provide advice; inappropriate expectations in assuming a complex health problem could be controlled through health promotion alone; lack of sociocultural relevance – ethnic, minority and other subcultural groups need to be considered [48].

Patient barriers

Sometimes underlying issues may affect a patients' willingness to adhere to an education program. In a focus group study [49] involving 54 chronically ill people, the perceived barriers to active self-management included depression, weight problems, fatigue, difficulty exercising, poor physician

communication, low family support, pain and financial problems. Medication adherence has been found to depend on patients' beliefs about the necessity of taking their medication versus concerns about its side effects [50]. Similar results were identified in another study which assessed adherence to a low sodium diet. Adherence was associated with greater perceived benefits and fewer perceived barriers [51].

Lack of awareness about a disease can affect an individual's willingness to engage in education. In a study involving 2017 African Americans it was identified that only 24% had been screened for kidney disease and of the 44% who had a risk factor, only 2.8% reported that CKD was an important health concern. Participants who perceived themselves at increased risk, and had been screened for CKD, had diabetes, hypertension, a family history of kidney disease, a tertiary education and who had also spoken with a medical professional or their family [52].

Cultural barriers

People's abilities to modify their lifestyle can be impeded by their cultural and health beliefs. Such was the case amongst Bangladeshi people with CKD whose dietary customs and culturally-established taste for salt made it difficult for them to restrict their salt intake. Once these barriers were identified, appropriate interventions such as cooking with less salt were introduced to promote dietary changes [53].

2.6.3 Known strategies – education programs

Effective management and prevention of CKD requires multiple interventions. Education of health care personnel is essential to improve awareness of the disease. Educating patients and their families about preventive strategies, risk factors, diabetes, hypertension and obesity is necessary to

slow the progression [54]. Cueto-Manzano et al. [55] conducted an educational intervention involving a multidisciplinary health team aimed at improving the outcomes for patients with diabetes, hypertension and obesity. It involved patient education in health-related problems, nutritional advice from a dietician, counselling from a social worker and exercise guidance from a physical trainer. Participants significantly reduced their BMI, waist circumference, reduced glucose in diabetics and increased GFR. Hypertensive patients reduced their systolic blood pressure and also increased their GFR, though only slightly. In another study, a disease management programme involving patients with Stages 4-5 CKD, demonstrated significantly improved systolic and diastolic blood pressure, cholesterol levels and improved eGFR. The median decrease in eGFR prior to the programme was 3.69 ml/min/1.73m^2 compared to 0.32 ml/min/1.73m^2 in the 12 months after enrolment ($P<0.001$). The programme was delivered by a community based team of nurses, dietician and social worker and involved patient education, medicine management, dietetic advice and clinical management to achieve clinical targets [56].

2.7 Future implications

Education interventions

Education interventions for patients with CKD vary in terms of their methodology, intervention type and outcomes. Some studies have used education tools such as worksheets to teach patients about CKD. The one-page worksheet proved effective in that patients who took part in the study had an improved their knowledge about their diagnosis, their kidney function and eGFR compared to controls [57]. Another study involved a multidisciplinary team for the care of pre-dialysis patients. The program was beneficial but it required: early patient referral to the nephrology centre, adequate resources for staff and infrastructure, and available resources for patients with ESKD [58].

Patients and health-care providers continuously access health information online. Not all information is reliable therefore it is important that patients are directed to the right sources. These sources are generally associated with a Professional Nephrology association or consumer organisations that have links to professional organisations. Some of these include the National Kidney Disease Education Program (NKDEP), The National Kidney Foundation, Kidney Health Australia, National Kidney Federation, The Kidney Foundation of Canada and Pró Renal from Brasil. Their website addresses can be found in Table 2.1. These organisations provide evidence-based patient information and resources along with a platform for patients to communicate with others.

The future of education interventions will most likely involve face-to-face interaction between patient and health-care provider combined with information technology (IT) [59]. The current high internet and mobile phone use means that patients have the technology to access information, however the target patient population and the type of technology used should be considered. In the iNephro study it was identified that users of the 'Medication Plan' smart phone application were predominantly middle-aged, well-educated and relatively healthy males [59]. The target population for CKD is generally people over the age of 50 who may also have other comorbidities such as diabetes, hypertension or CVD. The application and health programs need to be user friendly and preferably interactive to enable patient feedback.

Other IT delivery methods include Telehealth interventions such as the delivery of telephone-based educational materials and prompts via landline and video-conferencing of clinical visits. Interactive voice response system (IVRS) applications are easy to use, can be accessed from any phone and may therefore appeal more to an older patient group. Personal health record (PHR) for use by patients to communicate with their health care provider are becoming more widely used, but the implications of these initiatives have yet to be determined [59]. A recent study on electronic

personal health records (ePHR) identified that patients with internet access and post-secondary education were more likely to indicate their intentions to use an ePHR. They indicated ePHR would facilitate greater involvement in their own care and improve access to lab results and health information. Privacy concerns were reported but they were not associated with intent to use an ePHR [60].

Educators

Teaching should take place in either a primary, secondary or combined health-care setting. This would allow key stakeholders to provide adequate patient care and education and a greater access to resources for patients. Educators should include primary care physicians, nephrologists, nurses and allied health care professionals including pharmacist, nutritionist, psychologist, social worker and physiotherapist. Education should begin once the patient has surpassed the initial diagnosis stage so they are more receptive to the information given. It should also be frequent as there is a vast amount of information to be acquired [39]. A study on patient priorities has shown that patients identified the hospital consultant as the most useful resource followed by the dietitian, renal community nurse and renal unit nurse. The General Practitioner, self-help groups / patient associations, pharmacists, family and friends were seldom used as sources of information. Participants valued face to face education interaction the most, on their own and with their family [35].

In order for education to be standardised and taught in a diverse setting, National Standards for CKD education will need to be developed. These standards could be based on the diabetes self-management education standards which focuses on: programme structure - key stakeholders, participants, providers, curriculum, resources; the process of education, assessment and the outcomes including quality improvement measures [61].

Patients and carers

It is apparent that patients are not satisfied with the amount of education being given as their information needs have not been met. Patients' awareness about CKD, its management, and knowledge about preventing its progression is also limited [62]. This issue has been ongoing for decades and is not isolated to the CKD community but within general patient education [63]. Possibly the main barriers to the implementation of patient education interventions is the lack of coordination of services, inadequate preparation of physicians, nurses and educators and lack of interest from administration [63].Coordinating education programs with other established institutions such as the Diabetes Association and the Heart Foundation may be an effective way of delivering information to CKD patients.

2.7.1 Other future strategies for CKD

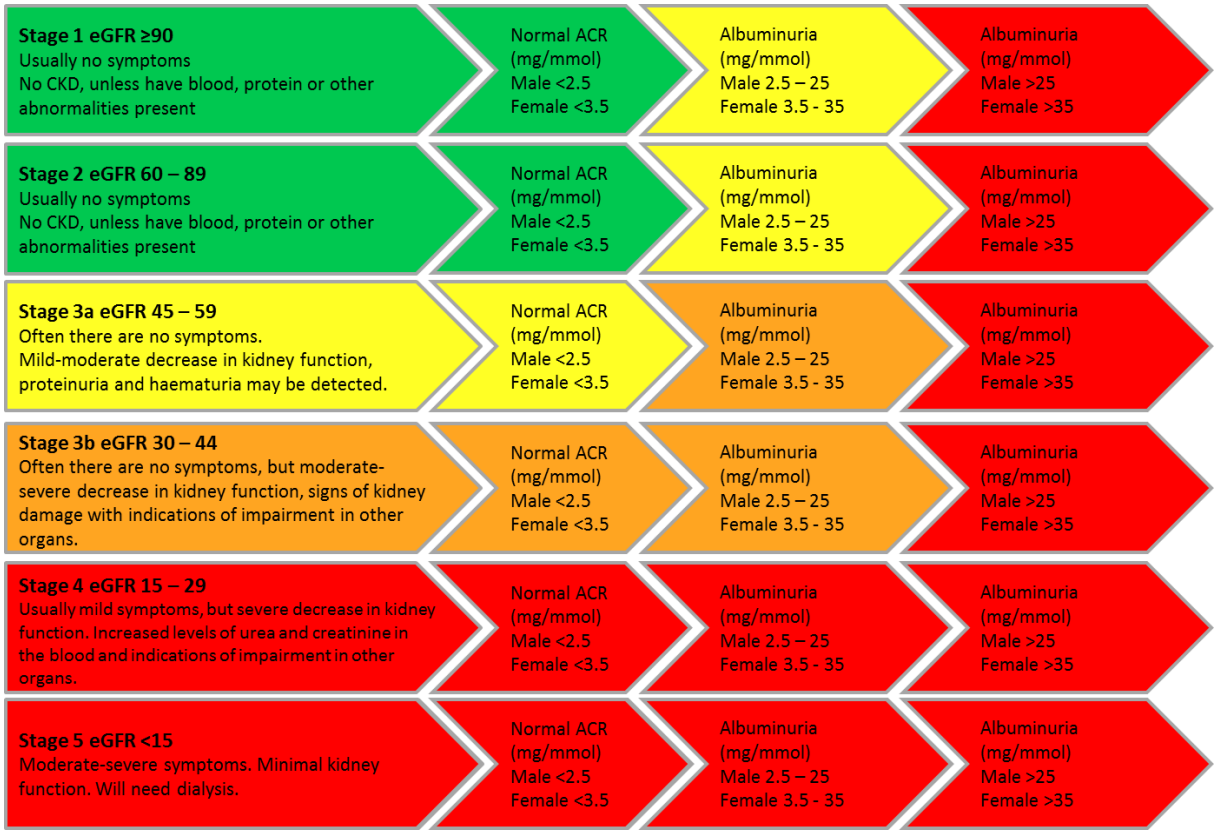
The World Health Organization (WHO) has developed a non-communicable diseases action plan to be implemented from 2013 to 2020. This focuses on reducing four modifiable risk factors, namely tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol. There are nine target areas to be addressed by 2025 which include: reducing premature death of CVD, cancer, diabetes or chronic respiratory diseases by 25% in those aged between 30 to 70; reduce harmful alcohol intake by 10%; reduce prevalence of physical inactivity by 10%, salt intake by 30%, tobacco use by 30%, the prevalence of high blood pressure by 25%, stop the rise in diabetes and obesity, increase availability of preventive therapy for heart attacks and strokes for 50% of people, and an 80% availability of affordable technology and medicine to treat non-communicable diseases. It is estimated that the cost of implementing the Global Action Plan will be $11 billion per year, while the estimated loss of productivity and health care cost without taking action will be $7 trillion over

the next 20 years. By taking action against the four risk factors, the resulting reduction in CVD, cancer, diabetes and chronic respiratory diseases [64] will directly affect the incidence of CKD.

CKD promotion needs to be escalated in the national agenda so that changes to the Australian health care system can be implemented. General practitioners will have a key role to play in the early detection of the disease and in coordinating continuity of care. Healthcare education needs to incorporate learning outcomes that include symptom control and quality of life matters [65]. Research that focuses on the prevention of CKD and the reduction of symptoms should be included in the research priority list [66].

2.8 Conclusion

This review has identified the relevant issues that are important for the effective care of patients with early stage CKD. Clinical care of these patients focuses on management of blood pressure, glucose control and minimisation of cardiovascular events and complications such as anaemia. Preventive management focuses on lifestyle modification such as smoking cessation, physical activity and weight management, salt reduction and glucose management for patients with diabetes. Strategies to improve the detection and awareness of CKD include screening patients at high risk; that is, those with diabetes, hypertension or a family history of CKD. Patient education strategies are also recommended to improve patient knowledge of the risk factors and comorbidities of CKD and awareness of the management and prevention of progression of the disease. Although there is consensus to promote and improve prevention, the amount of educational strategies conducted in this group of patients is limited. More research in this field is required to improve the current educational methods and interventions used.



Abbreviations: eGFR – estimated glomerular filtration rate; CKD – chronic kidney disease; ACR – albumin : creatinine ratio

Figure 2.1. Classification of chronic kidney disease.
Green is low risk of CKD, yellow is moderate, orange is high and red is very high risk.
Adapted from Johnson et al. 2013 [1] .

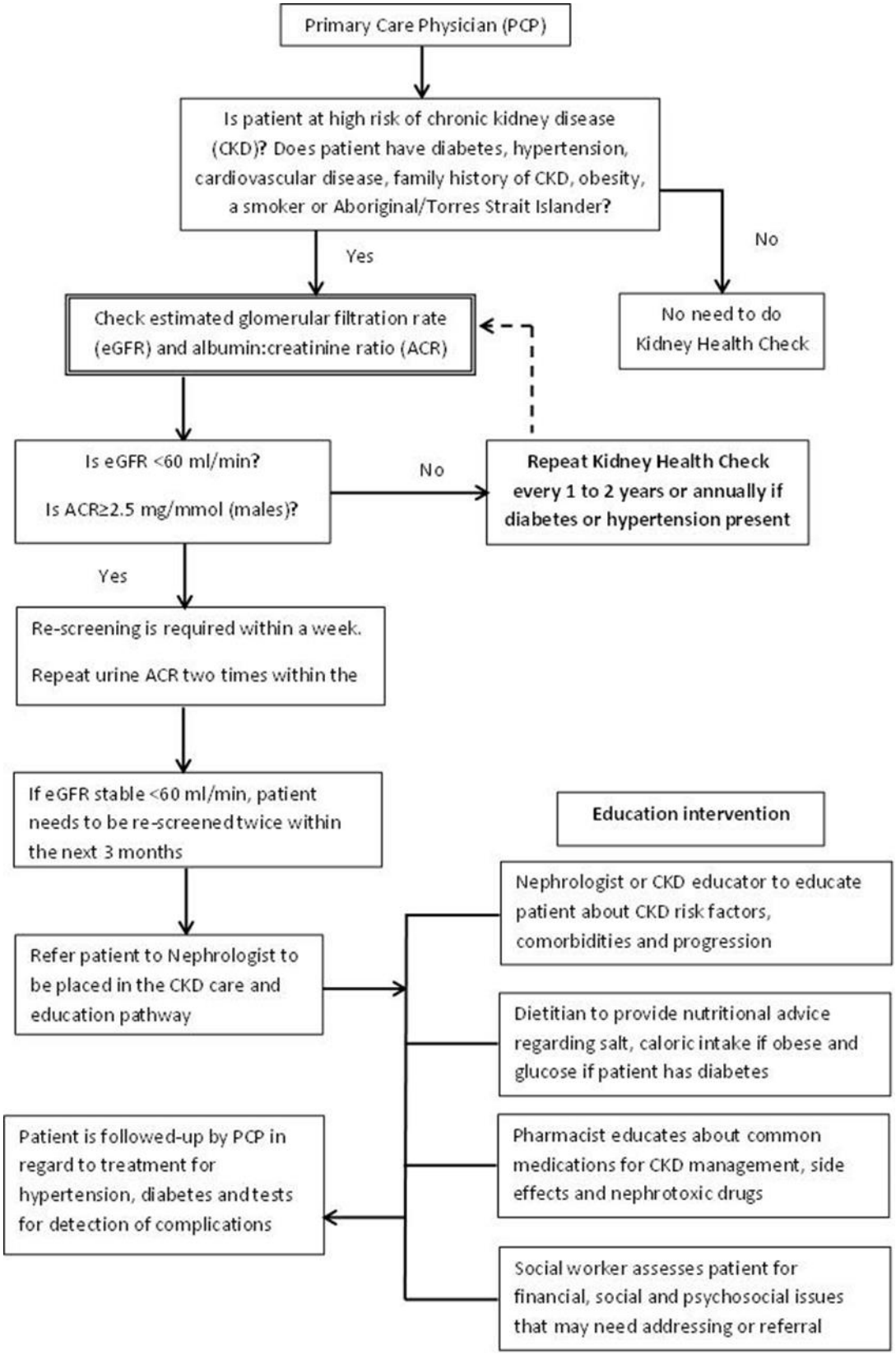


Figure 2.2. Chronic kidney disease patient management and education pathway.
Kidney Check component was adapted from Johnson et al [1] .
Ideas for the patient education component were obtained from St Peter et al.[2]

Table 2.1 Patient information websites

Country of Origin	Name of organization	Website address
United States of America	National Kidney Disease Education Program (NKDEP)	http://nkdep.nih.gov/
United States of America	National Kidney Foundation	https://www.kidney.org/
Australia	Kidney Health Australia (KHA)	http://www.kidney.org.au/ForPatients/Recommendedweblinks/tabid/619/Default.aspx
United Kingdom	British Kidney Patient Association	http://www.britishkidney-pa.co.uk/patient-info
United Kingdom	National Health Services (NHS)	http://www.nhs.uk/Livewell/Kidneyhealth/Pages/Advicefornewpatients.aspx
United Kingdom	National Kidney Federation	http://www.kidney.org.uk/help-and-information/
United Kingdom	Renal Medicine	http://www.renalmed.co.uk/patient-information
Canada	The Kidney Foundation of Canada	http://www.kidney.ca/detection-and-prevention
Brazil	Pró Renal	http://pro-renal.org.br/educacao.php

2.9 References

1. Johnson DW, Atai E, Chan M, Phoon RK, Scott C, Toussaint ND, et al. KHA-CARI Guideline: Early chronic kidney disease: detection, prevention and management. *Nephrology*. 2013;18(5):340-50.
2. St Peter WL, Schoolwerth AC, McGowan T, McClellan WM. Chronic kidney disease: issues and establishing programs and clinics for improved patient outcomes. *Am J Kidney Dis*. 2003;41(5):903-24.
3. El Nahas AM, Bello AK. Chronic kidney disease: the global challenge. *Lancet*. 2005;365(9456):331-40.
4. Eckardt K-U, Coresh J, Devuyst O, Johnson RJ, Köttgen A, Levey AS, et al. Evolving importance of kidney disease: from subspecialty to global health burden. *Lancet*. 2013;382(9887):158-69.
5. Jha V, Garcia-Garcia G, Iseki K, Li Z, Naicker S, Plattner B, et al. Chronic kidney disease: global dimension and perspectives. *Lancet*. 2013;382(9888):260-72.
6. Plantinga LC, Boulware LE, Coresh J, Stevens LA, Miller ER, Saran R, et al. Patient awareness of chronic kidney disease: trends and predictors. *Arch Intern Med*. 2008;168(20):2268-75.
7. Levey AS, Eckardt K-U, Tsukamoto Y, Levin A, Coresh J, Rossert J, et al. Definition and classification of chronic kidney disease: a position statement from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney Int*. 2005;67(6):2089-398.
8. Australian Bureau of Statistics. *Australian Health Survey: Biomedical Results for Chronic Diseases, 2011-12*. In: Statistics ABo, editor. Australia: Commonwealth of Australia; 2013.
9. Centers for Disease Control and Prevention. *Chronic Kidney Disease Surveillance System*. United States2015; Available from: http://www.cdc.gov/ckd.

10. Ibrahim MM, Damasceno A. Hypertension in developing countries. *Lancet*. 2012;380(9841):611-9.

11. Pereira M, Lunet N, Azevedo A, Barros H. Differences in prevalence, awareness, treatment and control of hypertension between developing and developed countries. *J Hypertens*. 2009;27(5):963-75.

12. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract*. 2010;87(1):4-14.

13. Danaei G, Lu Y, Singh GM, Carnahan E, Stevens GA, Cowan MJ, et al. Cardiovascular disease, chronic kidney disease, and diabetes mortality burden of cardiometabolic risk factors from 1980 to 2010: a comparative risk assessment. *LANCET DIABETES & ENDOCRINOLOGY*. 2014;2(8):634-47.

14. Stevens PE, Lamb EJ, Levin A. Integrating Guidelines, CKD, Multimorbidity, and Older Adults. *Am J Kidney Dis*. 2014.

15. Lopez-Vargas PA, Tong A, Sureshkumar P, Johnson DW, Craig JC. Prevention, detection and management of early chronic kidney disease: a systematic review of clinical practice guidelines. *Nephrology*. 2013;18(9):592-604.

16. Graham R, Mancher M, Wolman D. *Clinical Practice Guidelines We Can Trust. Institute of Medicine, Committee on Standards for Developing Trustworthy Clinical Practice Guidelines*: Washington, DC: National Academies Press; 2011.

17. Hostetter TH, Lising M. National kidney disease education program. *J Am Soc Nephrol*. 2003;14(7 Suppl 2):S114-6.

18. Pereira B. Overcoming barriers to the early detection and treatment of chronic kidney disease and improving outcomes for end-stage renal disease. *Am J Manag Care*. 2002;8(4 Suppl):S122-35; quiz S36-9.

19. Levin A, Stevens PE. Early detection of CKD: the benefits, limitations and effects on prognosis. *Nat Rev Nephrol*. 2011;7(8):446-57.

20. Levey AS, Schoolwerth AC, Burrows NR, Williams DE, Stith KR, McClellan W. Comprehensive public health strategies for preventing the development, progression, and complications of CKD: report of an expert panel convened by the Centers for Disease Control and Prevention. *Am J Kidney Dis*. 2009;53(3):522-35.

21. Kidney Health Australia (KHA) and Kidney Check Australia Taskforce (KCAT). *Chronic Kidney Disease (CKD) Management in General Practice*. 3rd ed. Melbourne: Kidney Health Australia; 2015.

22. Burke M, Kapojos J, Sammartino C, Gray N. Kidney disease health literacy among new patients referred to a nephrology outpatient clinic. *Intern Med J*. 2014;44(11):1080-6.

23. White SL, Polkinghorne KR, Cass A, Shaw J, Atkins RC, Chadban SJ. Limited knowledge of kidney disease in a survey of AusDiab study participants. *Med J Aust*. 2008;188(4):204-8.

24. Tuot DS, Plantinga LC, Hsu C-Y, Jordan R, Burrows NR, Hedgeman E, et al. Chronic kidney disease awareness among individuals with clinical markers of kidney dysfunction. *Clin J Am Soc Nephrol*. 2011;6(8):1838-44.

25. McClellan WM, Newsome BB, McClure LA, Cushman M, Howard G, Audhya P, et al. Chronic kidney disease is often unrecognized among patients with coronary heart disease: The REGARDS Cohort Study. *Am J Nephrol*. 2009;29(1):10-7.

26. Boulware LE, Carson KA, Troll MU, Powe NR, Cooper LA. Perceived susceptibility to chronic kidney disease among high-risk patients seen in primary care practices. *J Gen Intern Med*. 2009;24(10):1123-9.

27. Wright-Nunes JA, Luther JM, Ikizler TA, Cavanaugh KL. Patient knowledge of blood pressure target is associated with improved blood pressure control in chronic kidney disease. *Patient Educ Couns*. 2012;88(2):184-8.

28. McIntyre NJ, Fluck R, McIntyre C, Taal M. Treatment needs and diagnosis awareness in primary care patients with chronic kidney disease. *Br J Gen Pract*. 2012;62(597):e227-32.

29. Tuot DS, Plantinga LC, Hsu C-y, Powe NR. Is awareness of chronic kidney disease associated with evidence-based guideline-concordant outcomes? *Am J Nephrol*. 2012;35(2):191-7.

30. Case DO. *Looking for information: A survey of research on information seeking, needs and behavior*. San Diego, CA: Academic Press / Elsevier Science; 2002.

31. Ormandy P. Defining information need in health–assimilating complex theories derived from information science. *Health Expect*. 2010;14(1):92-104.

32. Garlick W. Patient information. What's the prognosis. *London: Consumers' Association*. 2003.

33. Timmins F. Exploring the concept of 'information need'. *Int J Nurs Pract*. 2006;12(6):375-81.

34. Ormandy P. Information topics important to chronic kidney disease patients: a systematic review. *J Ren Care*. 2008;34(1):19-27.

35. Ormandy P, Hulme C, Caress A, Macdonald J, O'Donoghue D, Crane D. *Identifying Chronic Kidney Disease Patients' Priorities and Preferences for Information Topics*: University of Salford, Institute for Health and Social Care Research; 2007.

36. Barnieh L, King-Shier K, Hemmelgarn B, Laupacis A, Manns L, Manns B. Views of Canadian patients on or nearing dialysis and their caregivers: a thematic analysis. *Canadian Journal of Kidney Health and Disease*. 2014;1:4.

37. Mason J, Stone M, Khunti K, Farooqi A, Carr S. Educational needs for blood pressure control in chronic kidney disease. *J Ren Care*. 2007;33(3):134-8.

38. Lambert SD, Loiselle CG. Health information—seeking behavior. *Qual Health Res*. 2007;17(8):1006-19.

39. Strömberg A. The crucial role of patient education in heart failure. *Eur J Heart Fail*. 2005;7(3):363-9.

40. Wright Nunes JA, Wallston KA, Eden SK, Shintani AK, Ikizler TA, Cavanaugh KL. Associations among perceived and objective disease knowledge and satisfaction with physician communication in patients with chronic kidney disease. *Kidney Int*. 2011;80(12):1344-51.

41. World Health Organization (WHO). *Health Education*. 2015 [June 2015]; Available from: http://www.who.int/topics/health_education/en/.

42. Glanz K, Rimer BK, Lewis FM, Editors. *Health behavior and health education: theory, research, and practice*. 3rd ed. San Francisco, CA: John Wiley & Sons; 2002.

43. Earp JA, Ennett ST. Conceptual models for health education research and practice. *Health Educ Res*. 1991;6(2):163-71.

44. Rankin SH, Stallings KD, London F. *Patient education in health and illness*: Lippincott Williams & Wilkins; 2005.

45. Lorig K, Associates. *Patient education: a practical approach*. Thousand Oaks, California: Sage; 2001.

46. Shaw B, Cheater F, Baker R, Gillies C, Hearnshaw H, Flottorp S, et al. Tailored interventions to overcome identified barriers to change: effects on professional practice and health care outcomes. *Cochrane Database Syst Rev*. 2005(3.):Art.No:CD005470. DOI: 10.1002/14651858.CD005470.

47. Grol R, Wensing M. What drives change? Barriers to and incentives for achieving evidence-based practice. *Med J Aust*. 2004;180(6 Suppl):S57-60.

48. Orlandi MA. Promoting health and preventing disease in health care settings: An analysis of barriers. *Prev Med*. 1987;16(1):119-30.

49. Jerant AF, von Friederichs-Fitzwater MM, Moore M. Patients' perceived barriers to active self-management of chronic conditions. *Patient Educ Couns*. 2005;57(3):300-7.

50. Horne R, Weinman J. Patients' beliefs about prescribed medicines and their role in adherence to treatment in chronic physical illness. *J Psychosom Res*. 1999;47(6):555-67.

51. Walsh E, Lehane E. An exploration of the relationship between adherence with dietary sodium restrictions and health beliefs regarding these restrictions in Irish patients receiving haemodialysis for end-stage renal disease. *J Clin Nurs*. 2011;20(3-4):331-40.

52. Waterman AD, Browne T, Waterman BM, Gladstone EH, Hostetter T. Attitudes and behaviors of African Americans regarding early detection of kidney disease. *Am J Kidney Dis*. 2008;51(4):554-62.

53. de Brito-Ashurst I, Perry L, Sanders TAB, Thomas JE, Yaqoob MM, Dobbie H. Barriers and facilitators of dietary sodium restriction amongst Bangladeshi chronic kidney disease patients. *J Hum Nutr Diet*. 2011;24(1):86-95.

54. Assadi F. Strategies to reduce the incidence of chronic kidney disease in children: time for action. *J Nephrol*. 2013;26(1):41-7.

55. Cueto-Manzano AM, Martinez-Ramirez HR, Cortes-Sanabria L. Management of chronic kidney disease: primary health-care setting, self-care and multidisciplinary approach. *Clin Nephrol*. 2010;74 Suppl 1:S99-104.

56. Richards N, Harris K, Whitfield M, O'Donoghue D, Lewis R, Mansell M, et al. Primary care-based disease management of chronic kidney disease (CKD), based on estimated glomerular filtration rate (eGFR) reporting, improves patient outcomes. *Nephrol Dial Transplant*. 2008;23(2):549-55.

57. Wright Nunes J, Greene JH, Wallston K, Eden S, Shintani A, Elasy T, et al. Pilot study of a physician-delivered education tool to increase patient knowledge about CKD. *Am J Kidney Dis*. 2013;62(1):23-32.

58. Levin A, Lewis M, Mortiboy P, Faber S, Hare I, Porter EC, et al. Multidisciplinary predialysis programs: quantification and limitations of their impact on patient outcomes in two Canadian settings. *Am J Kidney Dis*. 1997;29(4):533-40.

59. Diamantidis CJ, Becker S. Health information technology (IT) to improve the care of patients with chronic kidney disease (CKD). *BMC Nephrol*. 2014;15:7.

60. Harrison TG, Wick J, Ahmed SB, Jun M, Manns BJ, Quinn RR, et al. Patients with chronic kidney disease and their intent to use electronic personal health records. *Canadian Journal of Kidney Health and Disease*. 2015;2(1):23.

61. Mensing C, Boucher J, Cypress M, Weinger K, Mulcahy K, Barta P, et al. National standards for diabetes self-management education. *Diabetes Care*. 2007;30(suppl 1):S96-S103.

62. Lopez-Vargas PA, Tong A, Phoon RKS, Chadban SJ, Shen Y, Craig JC. Knowledge deficit of patients with stage 1-4 CKD: a focus group study. *Nephrology*. 2014;19(4):234-43.

63. Webber GC. Patient education: a review of the issues. *Med Care*. 1990:1089-103.

64. World Health Organization (WHO). *Global status report on noncommunicable diseases*. Switzerland: WHO;,2014.

65. Dowrick C. The chronic disease strategy for Australia. *Med J Aust*. 2006;185(2):61.

66. Tong A, Sainsbury P, Carter SM, Hall B, Harris DC, Walker RG, et al. Patients' priorities for health research: focus group study of patients with chronic kidney disease. *Nephrol Dial Transplant*. 2008;23(10):3206-14.

Chapter 3. Prevention, detection and management of early chronic kidney disease: a systematic review of clinical practice guidelines

3.1 Abstract

Aim: In response to the increase in Chronic Kidney Disease (CKD) worldwide, several professional organisations have developed clinical practice guidelines to manage and prevent its progression. This study aims to compare the scope, content and consistency of published guidelines on CKD Stages I-III.

Methods: Electronic databases of the medical literature, guideline organisations, and the websites of nephrology societies were searched to November 2011. The Appraisal of Guidelines for Research and Evaluation (AGREE) II instrument and textual synthesis was used to appraise and compare recommendations.

Results: One consensus statement and 15 guidelines were identified and included. Methodological rigour across guidelines was variable, with average domain scores ranging from 24% to 95%. For detection of CKD, all guidelines recommended estimated glomerular filtration rate measurement, some also recommended serum creatinine and dipstick urinalysis. The recommended protein and albumin creatinine ratios and proteinuria definition thresholds varied (>150-300mg/day to >500mg/day). Blood pressure targets ranged (<125/75 to <140/90mmHg). Angiotensin converting enzyme inhibitor and angiotensin receptor blockers were recommended for hypertension, as combined or as monotherapy. Protein intake recommendations varied (no restriction or 0.75g/kg/day–1.0g/kg/day). Salt intake of 6g/day was recommended by most. Psychosocial support and education were recommended by few but specific strategies were absent.

Conclusions: CKD guidelines were consistent in scope but were variable with respect to their recommendations, coverage and methodological quality. To promote effective primary and secondary prevention of CKD, regularly updated guidelines that are based on the best available evidence and augmented with healthcare context-specific strategies for implementation are warranted.

3.2 Introduction

Chronic kidney disease (CKD) is a rapidly increasing public health problem worldwide [1]. CKD predisposes to end-stage kidney disease (ESKD) and is a risk factor for cardiovascular disease, the leading cause of premature death in the CKD population. The rising prevalence of CKD is largely attributable to increased rates of diabetes and hypertension, as well as the ageing population [2].

Despite evidence demonstrating that early detection and treatment of CKD can slow the progression of disease and other adverse outcomes [1, 3, 4], there is still a steady increase in the number of incident patients with ESKD requiring dialysis or kidney transplantation [5, 6]. Of greater concern is the continued rise in the number of patients with earlier stages of CKD [3]. In 1999-2000, 9.7% of Australian adults in the general population were identified as having renal impairment [6]. This proportion increased at a rate of 1% per annum in five years [7].

Prevention of progression can be achieved through early detection [8] and appropriate patient management that is guided by trustworthy clinical practice guidelines [9, 10]. To be effective for use in clinical practice, guidelines should be rigorously developed and be consistent with the available scientific evidence [11]. They should also be unbiased, transparent, accessible and acceptable to clinicians [12]. If guideline developers fail to consider these factors, the recommendations may be ineffective and potentially dangerous to clinical care [11].

This study aims to compare the quality, scope, and consistency of clinical practice guidelines on the prevention, detection and management of early stage I - III CKD. The published guidelines were also assessed for their methodological consistency and comprehensiveness.

3.3 Methods

Selection criteria

Guidelines defined as "*systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances*" [13] and consensus statements that primarily focussed on the prevention, detection, and management of early chronic kidney disease (stages 1-3; defined as >30 mL/min per 1.73m^2) were included. Non-English publications were included if resources for translation were available. Guidelines relevant to late stage 4 - 5 CKD such as, bone mineral disease, anaemia or renal replacement therapy, draft unpublished guidelines, previous guideline versions, clinical protocols and research articles were excluded.

Search for guidelines and consensus statements

Medical terms and Subject Heading (MeSH) terms and text words for chronic kidney disease were combined with MeSH terms and text words relating to clinical practice guidelines and consensus statements. The searches were conducted in Medline (1948 to November Week 3 2011) and Embase (1980 to week 50 2011). Guideline organisations, including the Guidelines International Network and the National Guideline Clearinghouse, Intercollegiate Guidelines Network (SIGN); National Collaborating Centre for Chronic Conditions (NICE) and professional nephrology society websites were also searched (Supplementary material). PLV screened the titles and abstracts and

discarded those that were ineligible. Full texts of potentially relevant articles were obtained and examined for eligibility.

Appraisal of guidelines and consensus statement

The Appraisal of Guidelines for Research and Evaluation (AGREE) II Instrument [14] was used to assess the methodological quality of the guidelines. The 23-item instrument has been internationally validated and consists of six domains: scope and purpose, stakeholder involvement, rigour of development, clarity and presentation, applicability and editorial independence. A definition of these domains can be found in Appendic A - Table A3. Each guideline was independently appraised by PLV and AT. Each item within the six domains was rated by allocating a value from 1 to 7 (1 = 'Strongly Disagree'; 7 = 'Strongly Agree') based on the specific assessment criteria provided. Major discrepancies in the scores were discussed and independently reassessed. Domain scores were calculated as per the AGREE II user's manual, whereby a total quality score was obtained for each domain by summing up the scores of each item [14]. A maximum possible score for each domain was calculated by multiplying the number of appraisers by the number of items for that domain and multiplying by seven (value for 'strongly agree'). A minimum possible score for each domain was calculated by multiplying the number of appraisers by the number of items for that domain and multiplying by one (value for 'strongly disagree'). The domain score was then standardised as a percentage using the following formula:

$$\textit{Standardized domain score (\%)} = \frac{\textit{(total quality score – minimum possible score) x 100}}{\textit{(maximum possible score – minimum possible score)}}$$

To measure inter-observer agreement across the ordinal categories for each guideline and consensus statement, a weighted kappa (κ_w) was calculated using SAS version 9.2 software. This takes into account the degree of disagreement between the observers by assigning less weight to agreement, as categories are further apart [15, 16]. An overall κ_w was also calculated across all guidelines and

consensus statement. A kappa value of <0.2 indicates poor agreement; 0.21- 0.4 fair; 0.41- 0.6 moderate;.61 - 0.8 good and 0.81-1.0 very good agreement [17]. Due to resource limitations, only guidelines published or translated in English were appraised.

Synthesis of guideline recommendations

We conducted a textual descriptive synthesis to analyse the scope, content and consistency of the recommendations. Initially, the guidelines were read by PLV to gain an overall knowledge of guideline content. PLV inductively coded the text manually to identify domains covered by the guidelines. The inclusion of specific themes and domains were discussed with the team. These were cross-tabulated with the guidelines and recommendations were inserted into the corresponding cell. For each domain, we compared guideline recommendations to identify similarities and discrepancies.

3.4 Results

Search and guideline characteristics

The search yielded 1266 citations of which 1218 were excluded because they did not fulfil the eligibility criteria, leaving 48 articles requiring full text analysis. Thirty two were excluded because they were guidelines replaced by an updated version, were guideline summaries, did not include recommendations for early stage CKD or were a duplicate. This left 15 clinical practice guidelines from Australasia [18, 19], Japan [20], France [21, 22], Netherlands [23], Italy [24, 25], United Kingdom[26-28] , Canada [29], U.S.A. [30], Chile [31] and Argentina [32], and one consensus statement from Spain [33] able to be included. (Fig A1. Appendix A) A total of 93 nephrology societies were identified in the web search (Table A2), but only seven societies had published guidelines available [20, 21, 24, 25, 28, 31-33].

The characteristics and guideline development processes are provided in Table 3.1. The guidelines were published between 2002 and 2011. Seven (44%) guidelines [18, 19, 21, 22, 24, 25, 30] were published more than three years ago. All were peer reviewed and almost half included public consultation [18, 19, 21, 22, 26-30]. All guideline groups conducted a systematic literature search, however the methods used to extract the data and synthesise the evidence varied. Some guidelines graded the evidence [18, 19, 24-26], graded the strength of the recommendations [23, 29, 30], or both [20-22, 27, 28, 31-33]. The target users, as specified by guideline developers, included primary health care providers (general practitioners) and nephrologists.

Methodological quality

As part of the guideline appraisal, weighted kappa scores (κ_w) were calculated to determine the strength of agreement between the two assessors (AT and PLV). These values ranged from moderate $\kappa_{w=}$0.49, (95%CI: 0.17 to 0.82) to very good 0.85 (95%CI: 0.76 to 0.93). The overall inter-rater agreement was κ_w= 0.82 (95%CI: 0.78 to 0.85) indicating very good strength of agreement [15, 16].

Of the 16 guidelines, 11 (69%) were appraised [18-22, 26-30, 33] as they were written in English, the common language for both assessors. The domain scores for each guideline are shown in Table 3.2. The average scores (and range) for the domains were: scope and purpose 75% (25% - 100%); stakeholder involvement 63% (14% - 97%); rigour of development 67% (20% - 96%); clarity of presentation 81% (64% - 94%); applicability 46% (10% - 90%) and editorial independence 67% (0% - 100%). Seven (64%) guidelines were independently assessed as ’recommended‘ for use [18, 19, 26-30], their quality scores ranged between 5 and 7, representing good to high quality guidelines. The other four (36%) guidelines were ‘recommended for use after modification’, they were given quality scores of 3 and 4 [20-22, 33].

Synthesis of recommendations

We identified three major domains addressed by the guidelines including: early detection of CKD (identification of risk factors, diagnostic tests, proteinuria, albuminuria, haematuria, dyslipidaemia); medical management of early CKD (hypertension, proteinuria, glucose control, dyslipidaemia, antiplatelet therapy); and lifestyle modification and education (smoking cessation, weight management, exercise, protein restriction, salt restriction, psychosocial support and education).

Early detection of CKD

The recommendations for early detection of CKD are provided in Table 3.3. The key areas addressed included: who to test; details of diagnostic tests; proteinuria and albuminuria thresholds for renal dysfunction; tests for haematuria; and detection of dyslipidaemia. Almost all guidelines identified high blood pressure, diabetes, family history and cardiovascular disease as the main risk factors to be considered, with five (31%) guidelines also considering 'chronic use of nephrotoxic drugs' [21, 26, 30-32] and 'prostatic syndrome/urological disease' [19, 21, 23, 28, 32] as risk factors for CKD.

Most guidelines recommended the referral of patients with more advanced disease and uncontrolled blood pressure. Seven (44%) guidelines [19, 23, 26, 28-30, 33] recommended that patients should be referred to a nephrologist if they had an estimated glomerular filtration rate (eGFR) of < 30 ml/min/1.73m^2; or uncontrolled hypertension [19, 22, 26, 28, 30, 31, 33]; persistent proteinuria [19, 26-31] or unexplained anaemia [19, 28, 33]. Some guidelines stated that the patient's age [23, 30, 33] and presence of unexplained haematuria [26-28, 33] should be considered as indicators for referral to a nephrologist. Two (13%) guidelines also recommended that patients with acute renal

failure [28, 29] should be referred as well as patients with other suspected genetic or rare cause of renal disease [26].

Estimated glomerular filtration rate was the main diagnostic test recommended by all guidelines, while some also recommended serum creatinine and/or dipstick urinalysis as adjunct tests. Six (38%) guidelines [18, 20, 23, 28, 30, 33] specified morning urine as the preferred method of urine collection, while two (13%) guidelines also suggested 24hr urine collection [20, 21]. Most guidelines gave recommendations for proteinuria, albuminuria, protein creatinine ratio (PCR) and albumin creatinine ratio (ACR) marker levels of renal dysfunction. Eight (50%) guidelines recommended proteinuria values which consisted of: >150-300 mg/day [19], >300mg/day [21, 33] or >500 mg/day [20, 26-29] and four (25%) recommended an albuminuria value of >300 mg/day [19, 23, 27, 31].. Three (19%) guidelines recommended a PCR value of >23 mg/mmol [21, 30, 31] and two (13%) recommended a level ≥34 mg/mmol [32, 33]. ACR levels for diabetes were recommended by seven (44%) guidelines, these were >2 mg/mmol [21, 29] or >3.4 mg/mmol [26, 30-33] and two (13%) guidelines also specified an ACR value of >30 mg/mmol [26, 27] for non-diabetes.

The use of dipstick urinalysis was recommended by nine (56%) guidelines [20, 21, 23, 26-28, 30-32] for the detection of haematuria, three (19%) also recommended microscopy [20, 21, 31] and four (25%) also recommended sediment analysis [23, 30-32]. The detection of dyslipidaemia was recommended by only four (25%) guidelines [25, 28, 29, 33].

Medical management of early CKD

Recommendations for the medical management of early CKD are provided in Table 3.4. All the guidelines provided recommendations for medical management of hypertension and proteinuria.

Angiotensin converting enzyme inhibitor (ACEi) and angiotensin receptor blockers (ARB) were recommended by most guidelines as first line of therapy, singly or in combination, for the management of hypertension. However one (6%) guideline [31], recommended lifestyle changes as the first line of therapy followed by medication (thiazide diuretics, beta-blockers, calcium channel blockers [CCBs], ACEi and ARBs). Only two (13%) guidelines [23, 26] specified ACEi as first line and ARBs as second line therapy. Diuretics followed by CCBs and beta-blockers, either alone or in combination, were the preferred choice for second line therapy by most guidelines. Non-dihydropyridine CCBs, CCBs and beta-blockers were recommended as third line therapy by five (31%) guidelines [19, 22, 24, 30, 33].

Recommendations for blood pressure control targets were included in all guidelines however the targets varied depending on diabetic status and/or presence of proteinuria. The majority of the guidelines indicated a target value of <130/80 mmHg for non-diabetics [20, 22-24, 29, 30, 33], but four (25%) guidelines [26, 28, 31, 32] recommended a higher target of <140/90mmHg. Three (19%) guidelines recommended a target of <125/75 mmHg if proteinuria >1 g/day [19, 20, 32], one (6%) guideline recommended <125/75 if proteinuria >500 mg/g [33] and another guideline recommended a systolic blood pressure of ≤130 mmHg if proteinuria >1 g/day [27]. A value of ≤130/80mmHg was recommended for diabetes [20, 26, 28, 31, 32].

For the management of proteinuria in non-diabetes, ACEi alone or in combination with ARBs was recommended by 12 (75%) guidelines [19, 22-24, 26-33]. However, four (25%) stated this was conditional and depended on the level of proteinuria detected [23, 26, 28, 30]. For diabetes, two (13%) guidelines recommended ACEi alone [19, 24] and five (31%) guidelines recommended either ACEi or ARBs or in combination [26-29, 32]. Combination therapy (ACEi and/or ARBs) was recommended for non-diabetes by all guidelines except for one [20]. Eight (50%) guidelines recommended an HbA1c target ranging from <6.5 % to <7.5 % [19, 20, 28-33], but most

recommended a target of <7 %. Three (19%) also recommended a target fasting blood glucose level between 4.4 to 6.7 mmol/L [19, 29, 30]. Avoidance of oral hypoglycaemics (metformin in particular) was recommended by three (19%) guidelines [29, 31, 33]. Statins were recommended by most guidelines for all patients with dyslipidaemia with or without diabetes, for the prevention of a cardiovascular event, whilst five (31%) guidelines [20, 25, 31-33] also provided a threshold level for low density lipoprotein (LDL), which varied across guidelines from <100 mg/dl to ≤120 mg/dl. Aspirin was recommended as antiplatelet therapy for patients with diabetic nephropathy [20] and to prevent cardiovascular complications [23, 26, 27, 31, 33].

Lifestyle modification and education

For the recommendations on lifestyle modification and education (Table 3.5), all guidelines except for two [24, 25] recommended smoking cessation, while 10 (63%) guidelines recommended weight management to prevent CKD progression [19, 23, 25-29, 31-33] and exercise to prevent cardiovascular disease [19, 20, 25-29, 31-33]. Other recommended lifestyle modifications included: reduction in alcohol intake [20, 29, 31], restriction of fluid and energy intake [22], carbohydrate-restricted diet for diabetic nephropathy [19], reduction in saturated fat and cholesterol intake [25, 31], increase fruit and vegetables in the diet [31] and avoidance of non-steroidal anti-inflammatory drugs (NSAIDs) [33]. Four (25%) guidelines stated that restricting protein from the diet was not recommended or that it should be considered for later stages of CKD [20, 27, 32, 33]. In contrast, five (31%) guidelines recommended protein restriction ranging between 0.75 and 1.0 g/kg/day [19, 22, 23, 29, 30] and one (6%) guideline also recommended 0.75g/kg/day for diabetic nephropathy [19]. Three (19%) guidelines [20, 22, 28] mentioned referral to a dietitian for advice regarding protein intake. Eight (50%) guidelines recommended salt restriction to reduce the risk of cardiovascular events [20, 22, 27-31, 33] although the recommended amount of salt intake was the same, it was expressed in different terms (sodium: 2.4g/day; salt: 6g/day and <100mmol/day).

Three (19%) guidelines recommended psychosocial support and education [19, 26, 27]. However, specific strategies or tools for implementing health promotion and education recommendations were not provided in any of the guidelines.

3.5 Discussion

Overall, guidelines on early CKD are comprehensive and consistent in scope covering early detection of CKD, medical management, and lifestyle modification and education. However the extent of coverage varied due to implicit and explicit discrepancies in recommendations, particularly for diagnostic testing of eGFR, protein and albumin excretion, blood pressure targets, treatment of hypertension and proteinuria, glucose control targets, and dietary protein intake. The importance of health promotion and education was highlighted, but to a lesser extent, and was not supported with tools or specific strategies for implementation. Most guidelines appeared to be methodologically robust, but not all guidelines were consistent in the way they were developed, also almost half were out of date. All guidelines conducted a systematic review of the literature to search for evidence but there were clear differences in the way the literature was synthesized and graded. Thus the discrepancies between guideline recommendations can be attributed, at least in part, to the methodology employed by the guideline groups and to the evidence available at the time of guideline development.

There was general consensus on the recommendations for detection of early CKD in terms of the risk factors, which may be reflective of current epidemiological data supporting the association between obesity, hypertension, cardiovascular disease, and chronic kidney disease [34, 35]. There were implicit inconsistencies across guideline recommendations for PCR, ACR, proteinuria and albuminuria. SI units of measurement used varied between the guidelines and this was most likely attributed to the different laboratories used. A recent study has found no consensus on the

diagnostic cut-off levels, sampling procedures and on the units used in laboratory reports when reporting on proteinuria [36].

The recommendations for the treatment of hypertension and proteinuria were consistent in that they recommended ACEi or ARBs as first line therapy. However there were explicit inconsistencies in the regimens recommended. Some guidelines recommended ACEi or ARBs as monotherapy but other guidelines recommended that they be used in combination. Combination therapy is no longer recommended as recent studies have shown that patients on combined ACEi and ARBs therapy were at increased risk of cardiovascular death, increased risk of hypotension, syncope, renal dysfunction and hyperkalaemia [37, 38]. This evidence however was not available at the time of guideline development for most of the guidelines. There were also inconsistencies in the agents recommended for use as second and third line therapy which may be explained by the limited evidence on the efficacy of combined treatment with other agents including non-dihydropyridine CCBs and thiazide diuretics. Blood pressure targets varied depending on the presence of other risk factors, such as: diabetes; over 50 or under 50 years of age; proteinuria ≥1g/day; or ACR >500mg/g. Current evidence suggests that a blood pressure target below 125/75 to 130/80mmHg provides no extra benefit than a target of <140/90 for patients with CKD [39]. However, a lower blood pressure may be of benefit for patients with diabetes mellitus or impaired glucose tolerance [40]. While the majority of the guidelines recommended a blood pressure target of <130/80 mmHg for non-diabetes, there were a few that were consistent with the more recent recommendation of <140/90 mmHg.

More than half of the guidelines explicitly recommended glucose control although the HbA1c target varied from 6.5 to 7.5%. With the exception of one guideline, recommendations for HbA1c below 7% were inconsistent with the current evidence. Glycaemic control has been shown to slow the progression of CKD in the diabetic population, however there is concern about the potential

complications associated with intensive glucose lowering including hypoglycaemia [41, 42]. Almost all guidelines recommended statin therapy to reduce cardiovascular risk. Evidence suggests that while statin therapy may reduce mortality and cardiovascular events in the early CKD setting, the effect on CKD progression is still uncertain [43, 44]. Similarly, there is some weak evidence suggesting that the benefits of antiplatelet therapy such as reduced myocardial infarction and mortality may be outweighed by the potential risks of major and minor bleeding in patients with CKD [45].

All guidelines provided recommendations for lifestyle modification. Inconsistencies were evident with regard to protein intake where the recommendations ranged from, no restriction to up to 1.0g/kg/day. There is no conclusive evidence to demonstrate that long-term protein reduction delays CKD progression, therefore specific dietary protein restriction cannot be recommended [46, 47]. Recommendations for salt restriction ranged from no recommendation to < 6 g/day to reduce cardiovascular risk in the Stage 1-4 CKD population. Although there is no clinical evidence that salt reduction slows the progression of CKD, there is some evidence that a low-sodium diet reduces blood pressure and proteinuria [48-50]. Psychosocial support and education were recommended by three guidelines but specific tools or strategies were not included or referenced, therefore limiting the applicability of the recommendations.

Our study is the first to systematically review clinical practice guidelines for CKD. We used the AGREE II instrument, a validated and reliable instrument, to appraise the guidelines and consensus statements and achieved good agreement between reviewers. Non-English guidelines (published in Italian, Dutch and Spanish) were included in the review, but their methodological rigour was not assessed with the AGREE II instrument due to resource limitations. The guidelines were assessed by two reviewers who were affiliated with the KHA-CARI guideline group. This may be seen as a

potential geographical bias however, the AGREE II instrument is solely focussed on the guideline development and reporting methodology, making geographical bias unlikely.

Based on our assessment, we identified that guidelines scored consistently low in the applicability domain. This domain covers four questions which refer to: the barriers and facilitators to implementation; provision of advice or tools to implement the recommendations; consideration of potential resource implications; and the provision of auditing and/or monitoring criteria [14]. To improve guideline uptake and implementation, we recommend that guidelines include facilitators and barriers to consider additional resources with specific plans or strategies for guideline implementation (e.g. quality indicators, algorithms, links to manuals), economic evaluations and cost analysis. Also, some guidelines scored particularly low for specific domains such as editorial independence and stakeholder involvement because they did not address or define these domains. Editorial independence covers two aspects referring to: the views of the funding body; and competing interests of the guideline development group members. Stakeholder involvement addresses the individual members of the guideline development group; the views and preferences of the target population; and the target users [14]. These aspects should be made explicit in the guideline document.

Consumer involvement in guidelines has been widely advocated to ensure that guidelines are relevant to consumers. This can promote guideline uptake and implementation, and lead to improved patient outcomes. In a study by Tong et al [51] patients and carers identified seven main topics that they considered important to be included in guidelines for early stage CKD. These topics included: patient education, nutrition and exercise, CKD monitoring, managing fatigue, medication interactions and side effects, financial and emotional support for patients and carers, and health-care services. We suggest that guideline developers facilitate active consumer involvement in guideline development, and incorporate topics and outcomes that patients believe are important.

Chronic kidney disease is a global health problem and the development of methodologically robust guidelines that are applicable in the community and clinical setting is warranted. Current guidelines addressing early stage chronic kidney disease cover early detection, medical management and lifestyle modification and education. While comprehensive, there are implicit and explicit discrepancies across guidelines in regards to detection of CKD, targets for management of risk factors, dietary intake of protein and inconsistencies in the SI units used. Combination therapy (ACEi and ARB) for blood pressure and proteinuria management and recommendations for antiplatelet therapy are also inconsistent with current evidence. These recommendations are potentially harmful to patient care and should be revised. Specific tools or strategies to implement guideline recommendations were mostly absent, limiting guideline applicability. We acknowledge that implementation strategies and action plans would need to be context-specific given the variation of resources, disease prevalence, and health care structures across geographical areas.

Guideline developers must ensure, where possible, that recommendations are graded and underpinned by the best available evidence. We suggest using the GRADE system (Grading of Recommendations Assessment, Development and Evaluation) which promotes evaluation of the quality of the evidence and judgement about the strength of the recommendation, leading to a more structured and transparent approach to decision making [52]. Application of the eight Standards for developing trustworthy clinical practice guidelines as set out by the Institute of Medicine [53] should also be considered. This in turn, may lead to more effective primary and secondary prevention of CKD.

Acknowledgements

I would like to thank Anouk Bakens and Maria Cristina Vecchio for translating the Dutch and Italian guidelines, respectively.

Table 3.1 Characteristics of the included guidelines

Guideline Organisation /Society	Guideline Name/s	Year/s of publication	Target Users	Guideline Writers	Guideline Review	Methods Support	Evidence Base	Level of Evidence†	Grade of recommendation ‡
Asia Pacific									
KHA-CARI [18, 19]	Prevention of progression of kidney disease; Urine protein as diagnostic test	2004, 2006, 2007	Clinicians, Healthcare professionals	Multidisciplinary	Expert review, public consultation	Editorial team	Systematic literature review	I to IV	NS
JSN [20]	Evidence-based Practice Guideline for the Treatment of CKD	2009	General physicians	Nephrologists	Peer review	NS	Systematic literature review	1 to 4	A to C
Europe									
ANAES/ HAS [21, 22]	Diagnosis of chronic renal failure in adults; Treatment strategies to slow the progression of chronic renal failure in adults	2002; 2004	Nephrologists, primary health care providers, service providers	Multidisciplinary	Public, stakeholder consultation, peer review	NS	Systematic reviews and narrative synthesis of the literature	1 to 4	A to C
NfN [23]	Guideline for the treatment of patients with chronic kidney disease	2009	Professionals involved in primary and secondary care of patients with chronic kidney disease	Multidisciplinary	Dutch association for general practitioners (NHG), Dutch association for internists (NIV)	Dutch federation for Nephrology	Systematic literature review	A to C	NS
SIN [24, 25]	Use of statins for preventing cardiovascular and renal outcomes in patients with chronic kidney disease excluding dialysis); Antihypertensive agents for the prevention of chronic kidney disease progression	2006	Nephrologists, primary health care providers, service providers	Nephrologists	Peer review	NS	Systematic literature review	1 to 4	NS
NICE[26]	Chronic kidney disease: national clinical guideline for early identification and management in adults in primary and secondary care	2008	Healthcare professionals in primary and secondary care, patients and carers, commissioning organisations, service providers	Multidisciplinary	Public, stakeholder consultation	Technical team (Chair, clinical advisor, information scientist, research fellow, health economist, project manager)	Systematic literature review	1++ to 4	NS
SIGN [27]	Diagnosis & management of chronic kidney disease	2008	Healthcare professionals in primary and secondary care, patients and carers	Multidisciplinary	Public, independent experts, SIGN editorial group	SIGN information officer	Systematic literature review	1++ to 4	A to D
SEN [33]	SEN-sem FYC consensus document on chronic	2008	Primary and secondary care	Nephrologists	Peer review	NS	Literature review	High, moderate,	A to C

Guideline Organisation /Society	Guideline Name/s	Year/s of publication	Target Users	Guideline Writers	Guideline Review	Methods Support	Evidence Base	Level of Evidence†	Grade of recommendation ‡
	kidney disease		health care practitioners					low level evidence	
UK RA[28]	Renal association clinical practice guideline on detection, monitoring and management of patients with CKD	2011	Renal medical, nursing and technical staff, other health professionals caring for patients with renal disease	Nephrologists	Expert review, public, stakeholder consultation	NHS Centre for Reviews and Dissemination	Systematic literature review	A to D	GRADE (1 or 2)
North America									
CSN [29]	Guidelines for the management of chronic kidney disease	2008	Nephrologists, primary caregivers (GPs), endocrinologists, cardiologists,	Multidisciplinary	Expert review, CSN members and stakeholders (other guideline groups)	Canadian Society of Nephrology Implementation Committee	Systematic literature review	NS	A to D, opinion
KDOQI [30]	Clinical practice guidelines for chronic kidney disease: evaluation, classification and stratification	2002	Health care providers, patients and carers, service providers (manufacturers, laboratories)	Multidisciplinary	Internal and external review (advisory board, experts, NKF board members)	Independent evidence review team (nephrologists and methodologists)	Systematic literature review and Work group consensus	NS	S, C, R, O
South America									
SCN [31]	Clinical guidelines on identification, management and complications of chronic kidney disease (Supplement)	2009	Primary health care providers (medical community)	Nephrologists	Expert review	Guideline writers working group	Systematic literature review	1 to 4	A, B, C, I
SAN [32]	Clinical practice guideline on the early prevention and detection of chronic kidney disease in adults at the primary health care level	2010	Primary health care practitioners and other health care professionals	Multidisciplinary	Expert review	NS	Systematic literature review	1++ to 4	A – D, I, BP

KHA-CARI - Kidney Health Australia – Caring for Australasians with Renal Impairment; **JSN** - Japanese Society of Nephrology; **ANAES/HAS -** Agence Nationale d'Accreditation et d'Evaluation en Sante/ L'Haute Autorite de Santé: (France); **NfN –** The Netherlands Federation of Nephrology; **SIN -** Societa Italiana di Nefrologia (Italian); **NICE -** National Institute for Health and Clinical Excellence & National Collaborating Centre for Chronic Conditions; **SIGN -** Scottish Intercollegiate Guidelines Network; **SEN** – Sociedad Española de Nefrologia (Spain); **UK RA** – UK Renal Association; **CSN -** Canadian Society of Nephrology; **KDOQI -** Kidney Disease Outcomes Quality Initiative; **SCN -** Sociedad Chilena de Nefrologia (Chilean society of Nephrology); **SAN –** Sociedad Argentina de Nefrologis (Argentinian Society of Nephrology)

†**Level of evidence**
Level 1++: High quality meta-analysis, systematic reviews of randomised controlled trials (RCTs), or RCTs with a very low risk of bias
Level 1+: Well conducted meta-analysis, systematic reviews of RCTs, or RCTs with a low risk of bias
Level 1 or Level A: RCTs of high power; meta-analyses of RCTs; systematic reviews; well executed study with very strong effects or well performed RCT; high quality evidence
Level 2++: High quality systematic reviews of case-control or cohort studies. High quality case-control or cohort studies with a very low risk of confounding bias and a high probability that the relationship is causal
Level 2+: Well-conducted case-control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal
Level 2 or Level B: RCTs of low power; at least one properly designed RCT; properly conducted non-RCTs; cohort studies; RCTs with serious flaws; moderate quality evidence; significant risk that the relationship is not causal
Level 3 or Level C: Case-control studies; descriptive and cohort studies; controlled trials with serious limitations; low quality evidence; non-analytic studies

Level 4 or Level D: Comparative studies with major bias; retrospective; case studies; expert opinion; very low quality evidence
High evidence: Subsequent research is unlikely to change confidence in effect estimation
Moderate evidence: Subsequent research may have an impact on effect estimation and this estimation may change
Low or very low evidence: Subsequent research is likely to have a significant impact on effect estimation

‡**Grade of the recommendation**
Grade A: Based on scientific evidence established by trials of high level evidence, RCTs of high power and free of major bias, and/or meta-analyses of RCTs or decision analyses based on properly conducted studies
Grade B: Based on scientific evidence from studies of intermediate level evidence, RCTs of low power, well-conducted non-RCTs or cohort studies
Grade C: Based on studies of lower level evidence, such as case-control studies or case series; expert opinion; composition of original articles
Grade D: Based on evidence level 3 or 4; or extrapolated evidence from well-conducted case-control or cohort studies with a low risk of confounding
Grade I: Insufficient information to formulate a recommendation
Grade S: Analysis of individual patient data from a single large, generalizable study of high methodological quality
Grade R: Review of reviews and selected original articles
Grade O: Opinion
Grade BP: Group consensus
Grade 1: Strong recommendation (benefits outweigh the risks)
Grade 2: Weak recommendation (benefits and risks are more uncertain)

Table 3.2 Guideline assessment according to the Appraisal of Guidelines for Research and Evaluation (AGREE II) instrument

Guideline Organisation/Society	Domain Scores (%)						Agreement between appraisers	Mean domain scores (%)
	Scope and Purpose	Stakeholder Involvement	Rigour of Development	Clarity and Presentation	Applicability	Editorial Independence	Weighted kappa coefficient (k, 95% CI)	
Asia Pacific								
KHA-CARI [18, 19]	81	69	83	86	29	96	0.78 (0.63 – 0.92)	74
JSN [20]	25	14	20	64	10	8	0.77 (0.63 – 0.91)	24
Europe								
ANAES/HAS [21, 22]	81	53	59	78	23	0	0.80 (0.71 – 0.90)	49
NICE [26]	100	97	96	94	81	100	0.74 (0.45 – 1.00)	95
SIGN [27]	100	94	90	81	90	96	0.49 (0.17 – 0.82)	92
SEN [33]	44	47	42	86	25	17	0.81 (0.70 – 0.91)	44
UK Renal Association [28]	75	56	69	81	58	100	0.69 (0.54 – 0.84)	73
North America								
CSN [29]	92	61	60	86	23	92	0.85 (0.76 – 0.93)	69
KDOQI [30]	81	75	80	72	79	96	0.69 (0.51 – 0.87)	81

KHA-CARI - Kidney Health Australia – Caring for Australasians with Renal Impairment; **JSN** - Japanese Society of Nephrology; **ANAES/HAS -** Agence Nationale d'Accreditation et d'Evaluation en Sante/ L'Haute Autorite de Santé: (France); **NICE -** National Institute for Health and Clinical Excellence & National Collaborating Centre for Chronic Conditions; **SIGN -** Scottish Intercollegiate Guidelines Network; **SEN** – Sociedad Española de Nefrologia (Spain); **UK RA** – UK Renal Association; **CSN -** Canadian Society of Nephrology; **KDOQI -** Kidney Disease Outcomes Quality Initiative;

Table 3.3 Guideline recommendations for detection of early stage chronic kidney disease

Criteria	Guideline Recommendations	CARI [18, 19]	JSN [20]	ANAES [21, 22]	NfN [23]	SIN [24, 25]	NICE [26]	SIGN [27]	SEN [33]	UK Renal [28]	CSN [29]	KDOQI [30]	SCN [31]	SAN [32]
Who to test for chronic kidney disease														
	High blood pressure	•		•	•	•	•	•	•	•	•	•	•	•
	Diabetes	•	•	•	•		•	•	•	•	•	•	•	•
	Family history	•		•	•		•		•	•	•	•	•	•
	Cardiovascular disease	•			•		•	•	•	•	•			•
	Prostatic syndrome/ Urologic disease	•		•	•					•				•
	Use of nephrotoxic drugs			•			•			•		•	•	•
Tests used to diagnose chronic kidney disease														
	eGFR	•	•	•	•		•	•	•	•	•	•	•	•
	Serum creatinine			•	•		•	•	•	•	•			•
	Dipstick urinalysis		•	•						•		•	•	•
	Morning urine†	•	•		•				•	•		•		
	24hour urine*		•	•										
Protein and albumin thresholds for renal dysfunction														
Proteinuria														
	>150 - 300 mg/day	•												
	>300 mg/day			•					•					
	>0.5 g/day (50 mg/mmol)		•				•	•		•	•			
Protein creatinine ratio														
	>23 mg/mmol (>200 mg/g)			•								•	•	
	≥34 mg/mmol (>300 mg/g)								•					•
Albuminuria														
	>300 mg/day	•			•			•					•	
Albumin creatinine ratio (diabetes)														
	>2 mg/mmol (>20 mg/g)			•							•			
	>3.4 mg/mmol (>30 mg/g)						•		•			•	•	•
Albumin creatinine ratio (non-diabetes)														
	>30 mg/mmol						•	•						
Detection of haematuria														
	Dipstick urinalysis		•	•	•		•	•		•		•	•	•
	Microscopy		•	•									•	
	Sediment analysis				•							•	•	•
Detection of dyslipidaemia														
	LDL					•			•					
	HDL								•	•				
	Total cholesterol					•				•				
	Fasting lipid profile										•			

KHA-CARI - Kidney Health Australia – Caring for Australasians with Renal Impairment; **JSN** - Japanese Society of Nephrology; **ANAES/HAS -** Agence Nationale d'Accreditation et d'Evaluation en Sante/ L'Haute Autorite de Santé: (France); **NfN –** The Netherlands Federation of Nephrology; **SIN -** Societa Italiana di Nefrologia (Italian); **NICE -** National Institute for Health and Clinical Excellence & National Collaborating Centre for Chronic Conditions; **SIGN -** Scottish Intercollegiate Guidelines Network; **SEN** – Sociedad Española de Nefrologia (Spain); **UK RA** – UK Renal Association; **CSN -** Canadian Society of Nephrology; **KDOQI -** Kidney Disease Outcomes Quality Initiative; **SCN -** Sociedad Chilena de Nefrologia (Chilean society of Nephrology); **SAN –** Sociedad Argentina de Nefrologis (Argentinian Society of Nephrology)
eGFR – estimated glomerular filtration rate; **LDL** – low-density lipoprotein; **HDL** – high-density lipoprotein
Note: urinary protein/albumin to creatinine (mg/g) was converted to (mg/mmol) by multiplying by 0.113; blank cells indicate no recommendations were available

† Methods of urine collection

Table 3.4 Guideline recommendations for medical management of early stage chronic kidney disease

Criteria	Guideline Recommendations	CARI [18, 19]	JSN [20]	ANAES [21, 22]	NfN [23]	SIN [24, 25]	NICE [26]	SIGN [27]	SEN [33]	UK Renal [28]	CSN [29]	KDOQI [30]	SCN [31]	SAN [32]
Hypertension treatment														
First line therapy	ACEi &/or ARBs	•	•			•		•	•					•
	ACEi or ARBs									•	•	•		
	ACEi			•	•		•							
	ARBs (type II diabetics)			•										
	Lifestyle changes												•	
Second line therapy	Beta-blockers	•									•		•	
	Diuretics		•									•		
	Thiazide diuretic			•					•		•		•	
	Loop diuretic			•										
	CCB		•										•	
	DHP- CCB					•								
	Non-DHP CCB							•						
	Long-acting CCB										•			
	ARBs				•		•						•	
	ACEi												•	
Third line therapy	Non-DHP CCB	•				•								
	Beta -blockers			•					•			•		
	CCB	•		•		•			•			•		
Blood pressure targets														
Diabetes	≤130/80mmHg		•				•			•			•	•
Non-diabetes	<130/80mmHg		•	•	•	•			•		•	•		
	<140/90mmHg						•			•			•	•
	<125/75 If proteinuria >1g/day	•	•											•
Proteinuria treatment														
Diabetes	ACEi	•				•								
	ACEi & ARBs						•	•			•			•
	ACEi or ARBs									•				•
Non-diabetes	ACEi &/or ARBs	•		•	•	•	•	•	•	•	•	•	•	•
Glucose control														
HbA1c target	<6.5%		•											
	<7.0%	•							•		•	•	•	•
	<7.5%									•				
Other	FBG 4.4-6.7 mmol/L	•									•	•		
Dyslipidaemia treatment and targets														
Treatment	Statins	•	•		•	•	•	•	•	•	•		•	•
LDL-cholesterol	<100 mg/dL					•			•				•	•
	≤120 mg/dL		•											
Antiplatelet treatment														
Treatment	Aspirin		•		•		•	•	•				•	

KHA-CARI - Kidney Health Australia – Caring for Australasians with Renal Impairment; **JSN** - Japanese Society of Nephrology; **ANAES/HAS -** Agence Nationale d'Accreditation et d'Evaluation en Sante/ L'Haute Autorite de Santé: (France); **NfN –** The Netherlands Federation of Nephrology; **SIN -** Societa Italiana di Nefrologia (Italian); **NICE -** National Institute for Health and Clinical Excellence & National Collaborating Centre for Chronic Conditions; **SIGN -** Scottish Intercollegiate Guidelines Network; **SEN** – Sociedad Española de Nefrologia (Spain); **UK RA** – UK Renal Association; **CSN -** Canadian Society of Nephrology; **KDOQI -** Kidney Disease Outcomes Quality Initiative; **SCN -** Sociedad Chilena de Nefrologia (Chilean society of Nephrology); **SAN –** Sociedad Argentina de Nefrologis (Argentinian Society of Nephrology)
ACEi and ARBs: Angiotensin Converting Enzyme inhibitors & Angiotensin Receptor Blockers; **CCB**- Calcium Channel Blockers; **DHP**- Dihydropyridine; **Non-DHP** – Non-dihydropyridine; **FBG**: Fasting Blood Glucose; **CKD**: Chronic Kidney Disease; **LDL:** Low Density Lipoprotein Cholesterol. **Note**: fasting blood glucose (mg/dL) was converted to (mmol/L) by dividing by 18; blank cells indicate no recommendations available

Table 3.5 Guideline recommendations on lifestyle modification and education

Criteria	Guideline Recommendations	CARI [18, 19]	JSN [20]	ANAES [21, 22]	NfN [23]	SIN [24, 25]	NICE [26]	SIGN [27]	SEN [33]	UK Renal [28]	CSN [29]	KDOQI [30]	SCN [31]	SAN [32]
Lifestyle changes														
	Smoking cessation	●	●	●	●		●	●	●	●	●	●	●	●
	Weight management	●			●	●	●	●	●	●	●		●	●
	Exercise	●	●			●	●	●	●	●	●		●	●
Other lifestyle and dietary changes														
	Reduce alcohol intake		●								●		●	
	Fluid intake approx. (1.5L/day)			●										
	Energy intake 30-35 kcal/kg/day			●										
	CR-LIPE diet for diabetic nephropathy	●												
	Reduce saturated fat and cholesterol					●							●	
	Increase fruit and vegetables in diet												●	
	Avoid use of NSAIDs								●					
Protein restriction														
	Diabetic nephropathy: 0.75 g/kg/day	●												
	0.75 – 1.0 g/kg/day	●		●	●						●	●		
	Dietician advice		●	●						●				
	Not recommended for Stage 1-3 CKD		●					●	●					●
Salt restriction														
	<6 g/day [<100 mmol/day; <2.4g/day (sodium)]		●	●				●	●	●	●	●	●	
Psychosocial Support /Education														
	Pre end-stage-kidney-disease program	●												
	Information, education, lifestyle advice						●							
	Pre-dialysis psycho-education							●						

KHA-CARI - Kidney Health Australia – Caring for Australasians with Renal Impairment; **JSN** - Japanese Society of Nephrology; **ANAES/HAS -** Agence Nationale d'Accreditation et d'Evaluation en Sante/ L'Haute Autorite de Santé: (France); **NfN –** The Netherlands Federation of Nephrology; **SIN -** Societa Italiana di Nefrologia (Italian); **NICE -** National Institute for Health and Clinical Excellence & National Collaborating Centre for Chronic Conditions; **SIGN -** Scottish Intercollegiate Guidelines Network; **SEN** – Sociedad Española de Nefrologia (Spain); **UK RA** – UK Renal Association; **CSN -** Canadian Society of Nephrology; **KDOQI -** Kidney Disease Outcomes Quality Initiative; **SCN -** Sociedad Chilena de Nefrologia (Chilean society of Nephrology); **SAN –** Sociedad Argentina de Nefrologis (Argentinian Society of Nephrology)
CR-LIPE- carbohydrate restricted low-iron available polyphenol-enriched diet; **DN** – diabetic nephropathy; **NSAIDs** – non-steroidal anti-inflammatory drugs
Note: blank cells indicate no recommendations were available

3.6 References

1. Levey A, Atkins R, Coresh J, Cohen E, Collins A, Eckardt K, et al. Chronic kidney disease as a global public health problem: approaches and initiatives–a position statement from Kidney Disease Improving Global Outcomes. *Kidney Int*. 2007;72(3):247-59.
2. Mathew T, Corso O. Review article: Early detection of chronic kidney disease in Australia: Which way to go? *Nephrology*. 2009;14(4):367-73.
3. Eknoyan G, Lameire N, Barsoum R, Eckardt KU, Levin A, Levin N, et al. The burden of kidney disease: improving global outcomes. *Kidney Int*. 2004;66(4):1310-4.
4. Hallan SI, Coresh J, Astor BC, Åsberg A, Powe NR, Romundstad S, et al. International comparison of the relationship of chronic kidney disease prevalence and ESRD risk. *J Am Soc Nephrol*. 2006;17(8):2275.
5. Grace B, Hurst K, McDonald S. *ANZDATA Registry Annual Report: Stock and Flow*. Adelaide, South Australia: Australia and New Zealand Dialysis and Transplant Registry,2011.
6. Chadban SJ, Briganti EM, Kerr PG, Dunstan DW, Welborn TA, Zimmet PZ, et al. Prevalence of Kidney Damage in Australian Adults: The AusDiab Kidney Study. *J Am Soc Nephrol*. 2003;14:S131-S8.
7. Barr E, Magliano D, Zimmet P, Polkinghorne K, Atkins R, Dunstan D, et al. *AusDiab 2005.The Australian Diabetes,Obesity and Lifestyle Study. Tracking the Accelerating Epidemic:Its Causes and Outcomes*. Melbourne, Australia: International Diabetes Institute,2006.
8. Wilson JMG, Jungner G. *Public health papers No. 34 - Principles and practice of screening for disease*. Geneva: World Health Organisation,1968.
9. Grimshaw JM, Russell IT. Effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations. *Lancet*. 1993;342(8883):1317-22.

10. Woolf SH, Grol R, Hutchinson A, Eccles M, Grimshaw J. Clinical guidelines. Potential benefits, limitations and harms of clinical guidelines. *BMJ*. 1999;318:527-30.

11. Grimshaw J, Russell I. Achieving health gain through clinical guidelines. I: Developing scientifically valid guidelines. *Qual Health Care*. 1993;2(4):243-8.

12. Burls A. AGREE II—improving the quality of clinical care. *Lancet*. 2010;376(9747):1128-9.

13. Field MJ, Lohr KN. *Clinical practice guidelines: direction of a new program*. Washington DC: National Academy Press; 1990.

14. Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, et al. AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ*. 2010;182(18):E839-42.

15. Cohen J. Weighted kappa: Nominal scale agreement provision for scaled disagreement or partial credit. *Psychol Bull*. 1968;70(4):213.

16. Viera AJ, Garrett JM. Understanding interobserver agreement: the kappa statistic. *Fam Med*. 2005;37(5):360-3.

17. Altman DG. *Practical statistics for medical research*. Boca Raton: Chapman & Hall/CRC; 1991.

18. Caring for Australasians with Renal Impairment. The CARI guidelines. Urine protein as diagnostic test: testing for proteinuria. *Nephrology*. 2004;9 (Suppl 3):S3-7.

19. Harris D, Thomas M, Johnson D, Nicholls K, Gillin A. The CARI guidelines. Prevention of progression of kidney disease. *Nephrology*. 2006;11 (Suppl 1):S2-197.

20. Japanese Society of Nephrology. Evidence-based practice guideline for the treatment of CKD. *Clin Exp Nephrol*. 2009;13(6):537-66.

21. Agence Nationale d'Accréditation et d'Évaluation en Santé (ANAES). *Diagnosis of chronic renal failure in adults*. France: ANAES,2002.

22. Agence Nationale d'Accréditation et d'Évaluation en Santé (ANAES). *Treatment strategies to slow the progression of chronic renal failure in adults*. France ANAES,2004.

23. Rensma PL, Hagen EC, van Bommel EFH, Wetzels JFM, Kaasjager HAH, ter Wee (voorzitter) PM, et al. *Richtlijn voor de behandeling van patiënten met Chronische Nierschade (CNS)*. Geneeskunde: Nederlandse federatie voor Nefrologie; 2009.

24. Del Vecchio L, Manno C, Ravani P, De Nicola L, Cianciaruso B. Farmaci antiipertensivi per la prevenzione della progressione delle nefropatie croniche. *G Ital Nefrol*. 2006;23(S37):S64-S82.

25. De Nicola L, Strippoli GFM, Ravani P, Del Vecchio L, Cianciaruso B. Statine per la prevenzione della progressione del danno renale. *G Ital Nefrol*. 2006;23(S37):S83-S90.

26. National Collaborating Centre for Chronic Conditions. *Chronic kidney disease: National clinical guideline for early identification and management in adults in primary and secondary care.* London: Royal College of Physicians,2008.

27. SIGN. *Diagnosis and management of chronic kidney disease: A national clinical guideline*: Scottish Intercollegiate Guidelines Network,2008.

28. MacGregor MS, Taal MW. Renal Association Clinical Practice Guideline on Detection, Monitoring and Management of Patients with CKD. *Nephron Clin Pract*. 2011;118(S1):c71-c100.

29. Levin A, Hemmelgarn B, Culleton B, Tobe S, McFarlane P, Ruzicka M, et al. *Canadian Society of Nephrology: Guidelines for the Management of Chronic Kidney Disease*: Canadian Society of Nephrology,2008.

30. National Kidney Foundation. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. *Am J Kidney Dis*. 2002;39:S1-266.

31. Flores JC, Alvo M, Borja H, Morales J, Vega J, Zuniga C, et al. [Clinical guidelines on identification, management and complications of chronic kidney disease]. *Rev Méd Chile*. 2009;137(1):137-77.

32. Alemano G, Celia E, Cusumano AM, Depine S, Greloni G, Inserra F, et al. *Guía de práctica clínica sobre prevención y detección precoz de la enfermedad renal crónica en adultos en el*

primer nivel de atención. Programa nacional de garantía de calidad de la atención médica. Buenos Aires, Argentina: Ministerio de la Salud de la Nación; 2010.

33. Alcázar R, Egocheaga Mª I, Orte L, Lobos J Mª, González Parra E, Álvarez Guisasola F, et al. SEN-semFYC Consensus Document on chronic kidney disease. *Nefrología* 2008;28(3):273-82.

34. Brosius FC, 3rd, Hostetter TH, Kelepouris E, Mitsnefes MM, Moe SM, Moore MA, et al. Detection of chronic kidney disease in patients with or at increased risk of cardiovascular disease: a science advisory from the American Heart Association Kidney and Cardiovascular Disease Council; the Councils on High Blood Pressure Research, Cardiovascular Disease in the Young, and Epidemiology and Prevention; and the Quality of Care and Outcomes Research Interdisciplinary Working Group: developed in collaboration with the National Kidney Foundation. *Circulation*. 2006;114(10):1083-7.

35. Haroun MK, Jaar BG, Hoffman SC, Comstock GW, Klag MJ, Coresh J. Risk factors for chronic kidney disease: a prospective study of 23,534 men and women in Washington County, Maryland. *J Am Soc Nephrol*. 2003;14(11):2934-41.

36. Montanes Bermudez R, Gracia Garcia S, Perez Surribas D, Martinez Castelao A, Bover Sanjuan J. Consensus Document. Recommendations on assessing proteinuria during the diagnosis and follow-up of chronic kidney disease. *Nefrologia* 2011;31(3):331-45.

37. Chan K, Ikizler T, Gamboa J, Yu C, Hakim R, Brown N. Combined angiotensin-converting enzyme inhibition and receptor blockade associate with increased risk of cardiovascular death in hemodialysis patients. *Kidney Int*. 2011;80:978-85.

38. Yusuf S, Teo KK, Pogue J, Dyal L, Copland I, Schumacher H, et al. Telmisartan, Ramipril, or Both in Patients at High Risk for Vascular Events. *N Engl J Med*. 2008;358(15):1547-59.

39. Upadhyay A, Earley A, Haynes SM, Uhlig K. Systematic Review: Blood Pressure Target in Chronic Kidney Disease and Proteinuria as an Effect Modifier. *Ann Intern Med*. 2011:E-335.

40. Bangalore S, Kumar S, Lobach I, Messerli F. Blood Pressure Targets in Subjects With Type 2 Diabetes Mellitus/Impaired Fasting Glucose: Observations From Traditional and Bayesian Random-Effects Meta-Analyses of Randomized Trials. *Circulation*. 2011;123(24):2799-810.

41. Action to Control Cardiovascular Risk in Diabetes Study Group, Gerstein HC, Miller ME, Byington RP, Goff DC, Jr., Bigger JT, et al. Effects of intensive glucose lowering in type 2 diabetes. *N Engl J Med*. 2008;358(24):2545-59.

42. Advance Collaborative Group, Patel A, MacMahon S, Chalmers J, Neal B, Billot L, et al. Intensive blood glucose control and vascular outcomes in patients with type 2 diabetes. *N Engl J Med*. 2008;358(24):2560-72.

43. Navaneethan SD, Pansini F, Perkovic V, Manno C, Pellegrini F, Johnson DW, et al. HMG CoA reductase inhibitors (statins) for people with chronic kidney disease not requiring dialysis. *Cochrane Database Syst Rev*. 2009(2):CD007784.

44. Strippoli GFM, Navaneethan SD, Johnson DW, Perkovic V, Pellegrini F, Nicolucci A, et al. Effects of statins in patients with chronic kidney disease: meta-analysis and meta-regression of randomised controlled trials. *BMJ*. 2008;336(7645):645-51.

45. Palmer SC, Di Micco L, Razavian M, Craig JC, Perkovic V, Pellegrini F, et al. Effects of antiplatelet therapy on mortality and cardiovascular and bleeding outcomes in persons with chronic kidney disease: a systematic review and meta-analysis. *Ann Intern Med*. 2012;156(6):445-59.

46. Klahr S, Levey AS, Beck GJ, Caggiula AW, Hunsicker L, Kusek JW, et al. The effects of dietary protein restriction and blood-pressure control on the progression of chronic renal disease. Modification of Diet in Renal Disease Study Group. *N Engl J Med*. 1994;330(13):877-84.

47. Robertson L, Waugh N, Robertson A. Protein restriction for diabetic renal disease. *Cochrane Database Syst Rev*. 2007(4):CD002181.

48. Jones-Burton C, Mishra SI, Fink JC, Brown J, Gossa W, Bakris GL, et al. An in-depth review of the evidence linking dietary salt intake and progression of chronic kidney disease. *Am J Nephrol*. 2006;26(3):268-75.

49. Pimenta E, Gaddam KK, Oparil S, Aban I, Husain S, Dell'Italia LJ, et al. Effects of dietary sodium reduction on blood pressure in subjects with resistant hypertension. *Hypertension*. 2009;54(3):475-81.

50. Suckling RJ, He FJ, MacGregor GA. Altered dietary salt intake for preventing and treating diabetic kidney disease. *Cochrane Database Syst Rev*. 2010;12.

51. Tong A, Lopez-Vargas P, Howell M, Phoon R, Johnson D, Campbell D, et al. Consumer involvement in topic and outcome selection in the development of clinical practice guidelines. *Health Expect*. 2011;15:410 - 23.

52. Thornton J, Alderson P, Tan T, Turner C, Latchem S, Shaw E, et al. Introducing GRADE across the NICE clinical guideline program. *J Clin Epidemiol*. 2013;66(2):124-31.

53. Graham R, Mancher M, Wolman D. *Clinical Practice Guidelines We Can Trust. Institute of Medicine, Committee on Standards for Developing Trustworthy Clinical Practice Guidelines*: Washington, DC: National Academies Press; 2011.

Chapter 4. Patient awareness and beliefs about the risk factors and comorbidities associated with chronic kidney disease – a mixed-methods study.

4.1 Abstract

Background: Diabetes, hypertension and smoking may contribute to the development and progression of chronic kidney disease (CKD) and its complications. The aim of this study was to assess patients' awareness and beliefs about risk factors associated with CKD.

Methods: Participants with CKD Stages 1-5 were purposively sampled to participate in a mixed methods study. This involved nine focus groups who completed a survey on CKD risk factors and discussed the reasons for their choices. Thematic analysis was used to analyse the qualitative data.

Results: Of the 38 participants, the proportion who identified hypertension, family history, diabetes and obesity as risk factors for CKD were 89%, 87%, 87% and 70% respectively. Only 54% and 38% recognised that smoking and Aboriginal or Torres Strait Islander status were also risk factors. Participants considered the risks of heart attack, stroke and premature mortality to be 20 to 40% lower in people with CKD than those with diabetes or pre-existing CVD. Five themes reflecting reasons for their choices were identified: invisibility (lack of signs and symptoms of CKD), invincibility (participants did not feel they were at risk), lacking awareness (identified not knowing much about their disease), cumulative comorbidities (concerned about the increased risks of associated diseases) and inevitability of death (there is no cure for CKD).

Conclusion: Participants had limited understanding of the risk factors and comorbidities associated with CKD. Compared to diabetes and CVD, CKD was perceived to pose less of a threat to life. Patient

education that addresses CKD risk factors, comorbidities and outcomes may increase awareness and foster better self-management for people with CKD.

4.2 Introduction

It is well established that people with chronic kidney disease (CKD) have three times the risk of major cardiovascular events compared to people without CKD [1]. Those with stages 2 and 3 CKD are also 20-times more likely to die than to progress to end-stage kidney disease (ESKD) [2]. CKD also causes cognitive decline, poor quality of life, and directly and indirectly leads to inpatient care [3-10]. Risk factors such as diabetes, systolic hypertension and smoking in people with CKD have been shown to independently increase cardiovascular death [11-13].

This excess risk is well known to healthcare providers but may not be so well known amongst patients. Lack of awareness about CKD has been found to persist in patients throughout the disease continuum, who have shown to have limited knowledge about their condition and about renal replacement therapy [14]. Poor knowledge about CKD may limit patients' motivation and willingness to participate actively and effectively in self-management to prevent disease progression and treat their comorbidities. Patients' awareness about the risk factors and comorbidities for CKD has been assessed using self-administered questionnaires [15-17]. One study found that 92% of participants believed that hypertension and diabetes (86%) were risk factors for CKD and that CKD increased the risk of dying (90%) and having a heart attack (89%) [15]. While others have shown that approximately one-third of patients believed that excessive alcohol intake was a major cause of CKD [16, 17], a quarter thought that it was inadequate diet [17] and close to half were unsure [16]. However the reasons for their perception on risk factors and comorbidities are unknown.

The aim of this study was to assess and describe patients' awareness and perceptions of the risk factors and comorbidities related to CKD, to inform the development and implementation of education interventions for patients with early stage CKD.

4.3 Methods

This was a mixed-methods study which included a survey and focus groups.

Participant selection

Patients with Stages 1-5 CKD, who were 18 years of age or older, English-speaking and able to give informed consent were eligible to participate. Participants were recruited from three hospitals in New South Wales, Australia. Purposive sampling was done to include patients with a variety of demographic and clinical characteristics (gender, age, time since diagnosis, cultural background and education). Participants not able to speak or read English, or not able to provide informed consent were excluded. We aimed to recruit six to eight participants per focus group as recommended [18]. A list of eligible patients was provided by a nephrologist at each unit. The primary investigator (PLV) then contacted patients and posted written information to those interested in being involved. A reimbursement of AUD$30 was offered to participants to cover travel and parking expenses. Ethical clearance was obtained from all participating institutions.

Data collection

Participant knowledge and awareness of the risk factors for and comorbidities of CKD was assessed using a self-administered survey which was given to all participants during the focus group session. The development of the survey was based on a literature review of the risk factors for CKD and its related comorbidities [2, 3, 19] as well as with discussion among the research team. It consisted of four

sections: one on risk factors for CKD, and three sections on comorbidities which included hypothetical scenarios based on three medical conditions, diabetes, CKD and cardiovascular disease (CVD). Each scenario presented a set of related comorbidities namely heart attack, stroke, kidney disease, cancer and death. In the section on risk factors, participants were asked to indicate the factors that they thought would increase their chances of developing CKD. Participants were also asked to indicate the proportion of people they believed would develop a heart attack, stroke, kidney disease and cancer in their lifetime, as well as the excess risk of death due to each condition (Appendix B1).

Nine focus group discussions were conducted in March/April 2011, in which participants discussed the reasons for their choices and what they knew about the risk factors for CKD, complications of the disease, diagnosis, prevention and management. Each two-hour focus group was facilitated by the primary investigator (PLV). An observer (RK, NV, AT or MH) was also present during each session to record field notes on participant interactions, characteristics and group dynamics. Discussions were recorded with a digital voice recorder and transcribed verbatim.

Analysis

Survey results were recorded and then analysed using SPSS Version 21. Median and inter-quartile ranges were calculated for continuous variables and proportions were represented in box plots. The Kruskal-Wallis test for independent samples was used to calculate the statistical significance of the differences in the reported event rates for stroke, heart attack, cancer and death across the three scenarios.

All transcripts were downloaded into HyperRESEARCH (Version 3.0.3. Research Ware Inc. Randolph, MA, USA) for coding and analysis. Using the consolidated criteria for reporting focus groups [20] and the principles of grounded theory [21] PLV coded and grouped similar concepts and developed preliminary themes that captured patients' beliefs and awareness of the comorbidities and

risk factors for CKD. After discussion with AT, the themes were discussed among the research team and refined.

4.4 Results

Participant demographics

Of the 97 participants eligible to attend, 38 (39%) participated in the study. Reasons for non-participation included disinterest / unaware of being diagnosed with CKD (19%), non-attendance (13%), work and family commitments (10%), poor health (10%) and transport difficulties (8%), The participant characteristics are provided in Table 4.1. The mean age was 54 years (range 20 to 79 years), 23 (60.5%) were male, and 25 (66%) were diagnosed with CKD for more than 1 year. Causes of CKD included inherited 6 (16%), diabetes 5 (13%), autoimmune disease 4 (11%), hypertension 4(11%), other causes 5 (13%), and 11 (29%) participants did not know the cause of their disease. Twenty (53%) patients reported that they had received information about CKD prior to the study commencement.

Survey responses

Risk factors (Figure 4.1): The proportion who indicated that hypertension, diabetes and obesity were modifiable risk factors for CKD were 89%, 87%, and 70% respectively. Only 54% of participants identified smoking as a risk factor. For the non-modifiable risk factors however, 87% of participants identified family history whilst 41% and 38%, respectively, regarded age and being of Aboriginal or Torres Strait Islander descent as risk factors. Up to 70% and almost 50% respectively considered inadequate fluid intake and alcohol as risk factors for CKD.

Comorbidities (Figure 4.2): The box plots showed consistently narrow inter-quartile ranges and the results for most outcomes appeared to be of normal distribution except for death and stroke which tended to be either positively or negatively skewed. In scenario A, participants indicated that 50% (IQR: 40 – 70%) of people with Type 2 diabetes would develop kidney disease, 50% (30 - 67.5%) experience a heart attack, and 40% (23 - 60%) have a stroke. The excess risk of death was considered to be 30% as was the risk of developing cancer. Participants perceived that having chronic kidney disease (scenario B) would increase the chances of having a heart attack by 30% (20 - 40%), while having a stroke and cancer would increase by 20%. The excess risk of dying was also 20%. Having cardiovascular disease (scenario C) was evidently considered to have the worst outcomes. Participants believed that 70% (60 - 80%) of people with CVD would have a heart attack in their lifetime, 60% (48 - 80%) a stroke and 55% (30 - 73%) would have an excess risk of dying. The increased likelihood of developing kidney disease was 45% (30 - 60%) and having a cancer 25% (13 - 38%). The condition which participants reported as having the highest risk was heart attack. Cancer was consistently rated low, while excess death rates were variable. Overall there were significant differences identified for stroke $P < 0.001$, heart attack $P < 0.001$ and death $P < 0.001$ across the three scenarios. The median reported risks for stroke, heart attack, cancer and excess death were rated consistently lower for CKD compared to CVD and diabetes.

Thematic analysis

We identified five themes: invisibility, invincibility, cumulative comorbidities, lacking awareness and inevitability of death; these are described in the following section. Selected illustrative quotations for each theme are provided in Table 4.2.

Invisibility: Participants described kidney disease as invisible as many had not experienced any signs or symptoms and had not felt sick – *'They just told me that I had kidney disease. I was sort of surprised but I didn't feel any different, I still don't.'* Some participants also stated that because the

disease was not physically noticeable, it went unnoticed by their family and friends. This was especially true for those whose lifestyle was unaffected by their disease – '*People are more concerned of the ones [diseases] that have more physical effect where they can see it happening to you. With kidney disease, they don't see anything.'* Due to its nature, participants felt their disease was not well understood and for some, the opportunity to learn more about it occurred mainly when they became unwell – '*It was only until he started running into a problem that we started to realise what it was all about. Even now we're still learning about what his problem is'.*

Invincibility: Some male participants felt invincible and fearless. They preferred to ignore the risk factors regardless of the potential consequences. One participant had a family history of cardiovascular disease and hypertension, yet he had refused to monitor his blood pressure, until the day he ended up in hospital – '*… I felt like I was going to die, my heart was racing, my blood pressure was really high… I thought I was invincible'.* Another participant with diabetes was aware of the risk of developing kidney disease - *'...an inevitable result, but like all brave males'* preferred not to *'worry about it'* as there was nothing he could do to prevent it.

Lacking awareness: Even though there were participants with CKD for several years, they rarely thought about their disease and potential consequences because they felt well. They only realised the gravity of their condition when they experienced a critical event and needed specialist care – *'...I absolutely thought nothing of the kidneys because I felt nothing… then I turned 18, the doctor visits were every four months or so ... I slurred off and ended up in hospital… I didn't think it was serious until then.'* Some participants regretted not being more pro-active about their medical treatment particularly during the early stages. They felt they could have prevented disease progression if they had asked for a more thorough explanation of their condition as they were not aware of the related comorbidities, risk factors and complications of kidney disease – *'I don't think the relationship between high blood pressure and kidney disease is known at all. So consequently, I didn't take that*

seriously enough, which I regret…' While participants responded to the survey they discussed the risk factors and comorbidities for CKD.

> *'Just because you've got kidney disease, it doesn't mean you're going to have a heart attack, stroke or die.' (Female, 56 years, Stage 3)*

> *'What's type one diabetes? I don't really understand. How are you at risk if you're Aboriginal or Torres Strait Islander? How does that increase your risk?' (Female, 39 years, Stage 3)*

Cumulative comorbidities: Participants with multiple comorbidities including diabetes, hypertension and now kidney disease were concerned about their prognosis and about what other risk factors they may have – *'...I'm seeing a cardiologist now as well, my heart lining is getting thicker. So now I'm going, the kidney, the heart, what else is going to go wrong? They [doctors] said, you're a diabetic and all these things will happen.'*

Others were also concerned and wondered that if they had kidney disease, it was possible they could have another condition which they were not aware of – *'...If this is going wrong, what else is going wrong? Am I more prone to heart disease? Am I more prone to whatever? It does worry you quite a lot.'*

Inevitability of death: Older participants accepted that they may be at a higher risk of early death compared to those without kidney disease. They believed that nothing could be done to increase their survival time – *'that's the trouble with it [CKD], there's nothing people can do. My first reaction [when diagnosed] was I'm not going to live very long'.* Others did not think kidney disease would increase their risk of dying. One participant, after having had a heart attack, coronary artery bypass surgery, an aortic abdominal aneurysm repaired and a defibrillator implanted, concluded that some comorbidities were less serious than others and did not warrant immediate action. Thus, kidney disease

would not put him at greater risk of dying compared to having a heart attack or a ruptured aorta – *'... it's just another problem. I can't do anything very much about it. It hasn't affected me too much really.'*

4.5 Discussion

Our study has shown that participants were aware that hypertension, diabetes, family history and obesity were risk factors for CKD, but were unsure about how smoking, Aboriginal / Torres Strait Islander descent, age, alcohol and fluid intake could affect them. Participants also believed that that the outcomes for people with diabetes and cardiovascular disease were poorer than those with kidney disease. These findings are in part explained by participants' perceptions about CKD, as 'invisible', with many demonstrating limited understanding of the risk factors and comorbidities associated with CKD. Participants were not generally aware of the consequences of CKD progression, and its multiple comorbidities, and were therefore anxious about the future. Some participants were more accepting of death as they believed nothing could be done to better manage their condition and prevent its progression.

Although about half the participants had received information about CKD, the majority still had limited knowledge about the disease and its related risk factors and comorbidities. Almost half thought alcohol was a risk factor and about three quarters also believed that inadequate fluid intake was a risk factor. Previous studies have also reported participants' belief that alcohol misuse caused kidney disease [16, 17]. Although alcohol intake is not a risk factor, some studies have demonstrated that more than two drinks per day was associated with CKD and ESRD [22, 23]. Likewise, inadequate fluid intake is not a risk factor for CKD, but a recent study found that participants with adequate fluid intake had a significantly lower risk of having the disease [24].

Patients appear to regard diabetes and CVD as more serious conditions than having CKD. They consistently indicated higher event rates for stroke, heart attack and death when associated with diabetes and CVD. According to the American Heart Association 2014 Report, individuals with earlier stages of CKD are at significantly increased risk of CVD, independent of other CVD risk factors [25]. It has been demonstrated that the predicted lifetime risk for cardiovascular disease is considerably increased in the presence of two or more major risk factors 68.9% compared with no risk factors 5.2% for men, and 50.2% versus 8.2% for women [26]. These risk factors included diabetes, smoking, obesity and hypertension, all of which are associated with CKD. In a study by Tan et al [15] participants identified diabetes and hypertension as the main risk factors for CKD. Their perceptions about CKD-related complications were assessed, but their beliefs with regard to diabetes and CVD associated complications were not evaluated.

For most participants, the process of learning about their condition commenced too late. They felt they could have prevented CKD if they had been more aware of the effects of having diabetes and hypertension and wished they had managed them better. Previous studies have shown that patients with earlier stages of CKD or with fewer symptoms, perceived their disease to be less threatening compared to those with advanced disease, and that patients' perceived knowledge improved with disease progression [14, 27]. These studies have identified patients' knowledge gap about CKD however, patients' perceptions about CKD-related co-morbidities were not assessed.

In this study, we have shown how patients' perceive the risks and comorbidities associated with CKD compared with diabetes and cardiovascular disease. Patients' attitudes and beliefs about the risk factors of CKD and comorbidities, and thoughts about their future health were also described. Our study had some limitations. The survey was not pilot tested and the sample size was small, however this can be attributed to the difficulty in recruiting patients with early stage CKD. Patients did not consider they were at risk nor believed they had kidney disease. Although the study was cross-sectional and only

English speaking participants were included, participants from different ethnic populations were included.

To slow CKD progression, it may be necessary for patients to be better educated during the early stages of the disease. In our study, it was evident that participants had limited awareness about risk factors and comorbidities, even though 40% of them had been diagnosed for more than five years. An education program needs to be implemented where patients' needs are met and where patient barriers to learning are identified and addressed. Educational interventions that are based on a health care model or theory may facilitate the learning process. One such model is the Health Belief Model which is based on the premise that a person will take action in response to a health concern if they believe they are susceptible, they understand the severity of the disease, they understand the benefits and barriers of taking action, are able to identify when to take action and show self-efficacy [28, 29].

There is also a need to improve awareness of the risk factors and comorbidities associated with CKD, especially for people at high risk. One such national public awareness program is the Kidney Early Evaluation Program (KEEP) developed by the National Kidney Foundation [30] which aims to screen and educate patients with high blood pressure, diabetes or a family history of kidney failure. Consumer / professional organisations such as Kidney Health Australia (KHA) [31], the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) [32], The Renal Association in the UK [33] and The Kidney Foundation of Canada [34] provide evidence based information for patients and health care providers and this should be more vastly promoted.

It has been previously demonstrated that patients with diabetes have a greater awareness of the risk of developing CKD compared to those without diabetes (25.9% versus 7.3% respectively, $P<0.001$). This was not the case however for patients being treated for hypertension, as only 3.3% knew that this was a risk factor for CKD compared to 2.7% of participants with normal blood pressure (P= not significant) [17]. Therefore, research should aim to facilitate patient learning by identifying their learning needs

and capabilities followed by educational interventions that are suited to their needs. Strategies that are important to early stage CKD patients such as self-management interventions including dietary modification, medication adherence, weight management, blood pressure monitoring, smoking cessation and patient education about CKD, its risk factors and comorbidities should be considered.

In conclusion, participants perceived diabetes and CVD as more serious conditions compared to CKD. Most participants were not aware of the interaction between having kidney disease and developing a heart attack or stroke. This was partly due to the nature of the disease, participants' lack of awareness and their attitude about accepting that they have a disease. Implementation of education interventions during the earlier stages of CKD, that address patients' beliefs about health and illness as well as education about risk factors and CKD-related comorbidities is needed.

Acknowledgements

We thank all the participants who took part in the study. We thank Martin Howell, Rachael Kearns and Nicola Vakusin for assisting with running the focus group sessions by taking field notes and Elizabeth Barnes for assisting with the statistical analysis.

Table 4.1 **Participant characteristics (n = 38)**

Characteristics	Number (%)
Gender	
Males	23 (60.5)
Females	15 (39.5)
Age (years)	
20-29	5 (13)
30-39	5 (13)
40-49	4 (10.5)
50-59	6 (15.8)
60-69	9 (23.7)
70-79	9 (23.7)
Time diagnosed with CKD (years)	
≤ 1	5 (13)
> 1 ≤ 5	10 (26)
>5	15 (39.5)
Uncertain	8 (21)
Cause of CKD	
Diabetes	5 (13)
Hypertension	4 (10.5)
Cancer / Radiotherapy	3 (7.9)
Hereditary	6 (15.8)
Autoimmune	4 (10.5)
Other	5 (13)
Uncertain	11 (29)
Stage of CKD	
I	1 (2.6)
II	6 (15.8)
III	21(55)
IV	9 (23.7)
V[†]	1 (2.6)
Level of education	
Primary	4 (10.5)
Secondary	15 (39.5)
Tertiary	19 (50)
English as first language	
Yes	31 (81.5)
No	7 (18.4)
Country of birth	
Oceania (Australia / New Zealand)	25 (65.8)
Europe (Austria, Italy, Portugal, United Kingdom)	5 (13.2)
Asia (India, Iraq, Philippines)	4 (10.5)
Africa (Mauritius, South Africa)	3 (7.9)
South America	1 (2.6)
Level of employment	
Full-time	8 (21)
Part-time	5 (13)
Other (home duties, unemployed, student, retired)	25 (66)
Received CKD information	
Yes	20 (53)
No	18 (47)
Source of information	
Specialist	14 (36.8)
General Practitioner	9 (23.7)
Nurse	7 18.4)
Self	5 (13.2)
Other (family)	3 (7.9)

Abbreviations: CKD – chronic kidney disease

[†]At the time of the focus groups, one participant had progressed to CKD Stage 5

Table 4.2 Illustrative quotations

Theme	Quotes
Invisibility	'I didn't feel any different. They just told me that I had kidney disease. I was sort of surprised but I didn't feel any different, I still don't. Every time I go there [see *nephrologist*] - your kidneys - they haven't got any better but they haven't got any worse' **(Male, 68 years, Stage 4)**
	'I wouldn't say I was concerned when it hasn't really impacted the family, I don't think so. I mean, when I have a blood test I always get a copy of it and it would be two pages of tests and the only thing not in the normal is my creatinine, everything else is in the normal range. So, I don't think it impacts it at the moment because I feel fine and I play tennis, and I walk and I do things so I don't really feel I'm sick' **(Female, 60 years, Stage 3)**
	'People are more concerned of the ones that have more physical effect where they can see it happening to you. With kidney disease, they don't see anything. You can tell them about it, they won't remember it unless something really bad happens' **(Female, 22 years, Stage 3)**
	'Well back when it started, you didn't really get much of any information whatsoever. It was only until he started running into a problem that we started to realise what it was all about. Even now we're still learning about what his problem is' **(Female – carer)**
Invincibility	**'**I felt like I was going to die, it felt like my heart was racing… So i called my father and my father and mother suffer from high blood pressure… *[patient's father]* took my blood pressure and it was really pretty high…went to the G.P. he took my blood pressure and they immediately told my father – 'take him to the hospital now'… they *[medical team]* found out what I have today, IgA nephropathy' **(Male, 33 years, Stage 3)**
	'[participant was asked if concerned about hypertension since he has a family history] Yes, but I thought I was invincible' **(Male, 33 years, Stage 3)**
	'*[participant questioned if kidney disease was ever mentioned since has diabetes]* Well it was mentioned as an inevitable result, but like all brave males, thought I'd put that at the back of the line, can't do anything about it so I won't worry about it' **(Male, 72 years, Stage 4)**
Lacking awareness	'For the five years or six years I absolutely thought nothing of the kidneys; because I felt nothing. Maybe because I was seeing a child paediatric nephrologist, I saw her often and didn't get sick for very long. Then when I turned 18, the doctor visits were every four months or so... That's when I slurred off and I realised how sick I could get. I ended up in hospital for a week. I didn't think it [*kidney disease*] was serious until then' **(Female, 22 years, Stage 3)**
	'I don't think the relationship between high blood pressure and kidney disease is known at all. So consequently, I didn't take that seriously enough, which I regret. But I have to say also, I'm someone who doesn't like to take medicines anyway and so I was somewhat resistant to it. But I didn't ask the fundamental question which was, what's the consequences of not *[taking medication]'* **(Female, 76 years, Stage 4)**
	'Well the thing is, maybe we should have been better educated - and we're not blaming it on any of the doctors, it's just that we didn't look for more information. When he became a diabetic, we never thought ahead that it would lead to the insulin stage and when it got to the insulin stage, we never thought it would end up with the problem of the kidneys. So in other words, right at the beginning, instead of learning as you go - in other words, really we didn't know the consequences of what can happen at the end' **(Female – carer)**
	' Just because you've got kidney disease, it doesn't mean you're going to have a heart attack, stroke or die *[participant answering survey]'* **(Female, 56 years, Stage 3)**
	'Smoking doesn't give you kidney disease does it? *[participant answering survey]'* **(Female, 67 years, Stage 4)**

Theme	Quotes
	‘What’s type one diabetes? I don’t really understand. How are you at risk if you’re, Aboriginal or Torres Strait Islander descent? How does that increase your risk? *[participant answering survey]’* **(Female, 39 years, Stage 3)**
	‘It’s a bit of guesswork this, isn’t it?’ **(Male, 74 years, Stage 3)**
	‘It just goes to show how ill-informed we are. It’s like a needle in the haystack’ **(Female, 58 years, Stage 4).**
	‘Type two diabetes is the obesity related?’ **(Male,39 years, Stage 3)**
	‘Ah, the risk factors, and what are the risk factors?’ **(Male, 51 years, Stage 4)**
Cumulative comorbidities	**‘**At the moment, because my blood pressure is always really high up to 200/120. I’m seeing a cardiologist now as well... and they found that my heart lining is getting thicker as well. So, now I’m going, the kidney, the heart, what else is going to go wrong? Because they [*doctors*] said, you’re diabetic and all these things will happen... and I go, mm yeah ok’ **(Male, 38 years, Stage 2)**
	‘Also the impact of this on other aspects of one's health is really a concern. If this is going wrong, what else is going wrong? Am I more prone to heart disease? Am I more prone to whatever? It does worry you quite a lot. You don't understand the links 100 per cent. It is concerning’ **(Male, 69 years, Stage 3)**
Inevitability of death	**‘**That’s the trouble with it, there’s nothing people can do.... I think my really first reaction was I’m not going to live very long... no, I don’t want to die, I’m not saying that. But I just had that you know, that was just my first reaction’ **(Female, 56 years, Stage 3)**
	‘I had a coronary in 1986; In 2002 I had the abdominal aortic aneurism repaired, lucky that they found that. In 2003 I had open heart surgery and (five) bypasses. At the end of 2003, I had a defibrillator inserted and when I was told that I had a kidney disease, I just sort of thought oh well, it's just another problem. I just accepted the fact that I can't do anything very much about it. It hasn't affected me too much really’ **(Male, 70 years, Stage 3)**

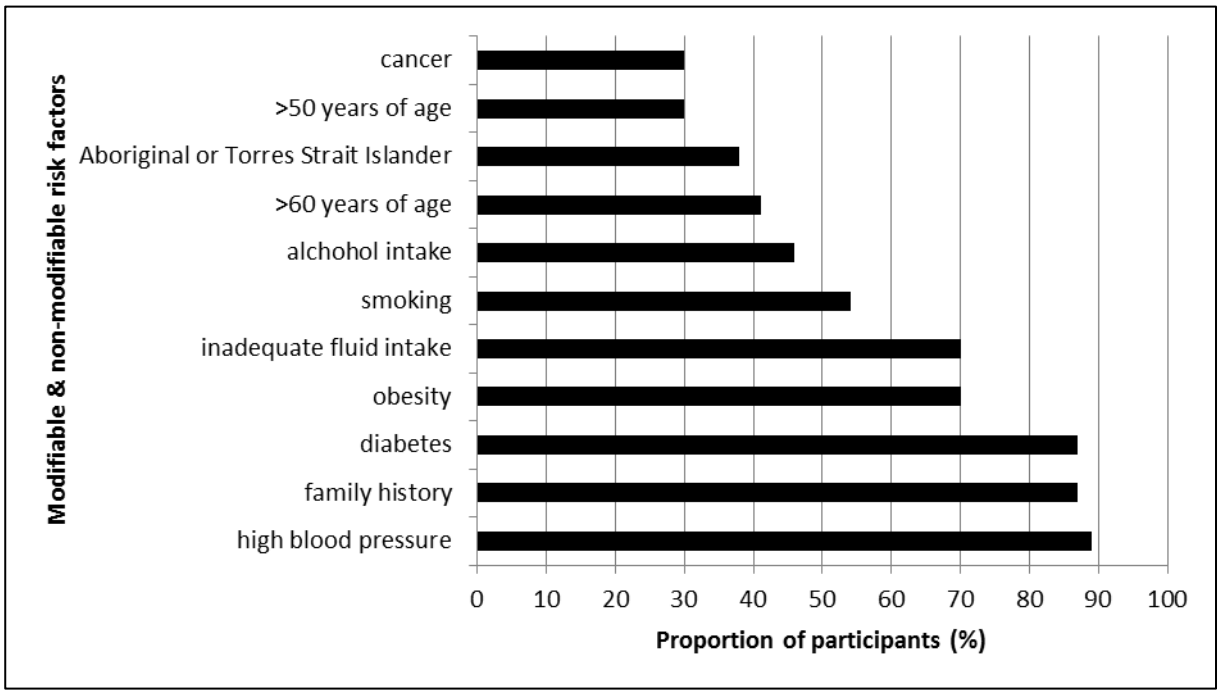


Figure 4.1 Proportion of participants who identified risk factors for chronic kidney disease

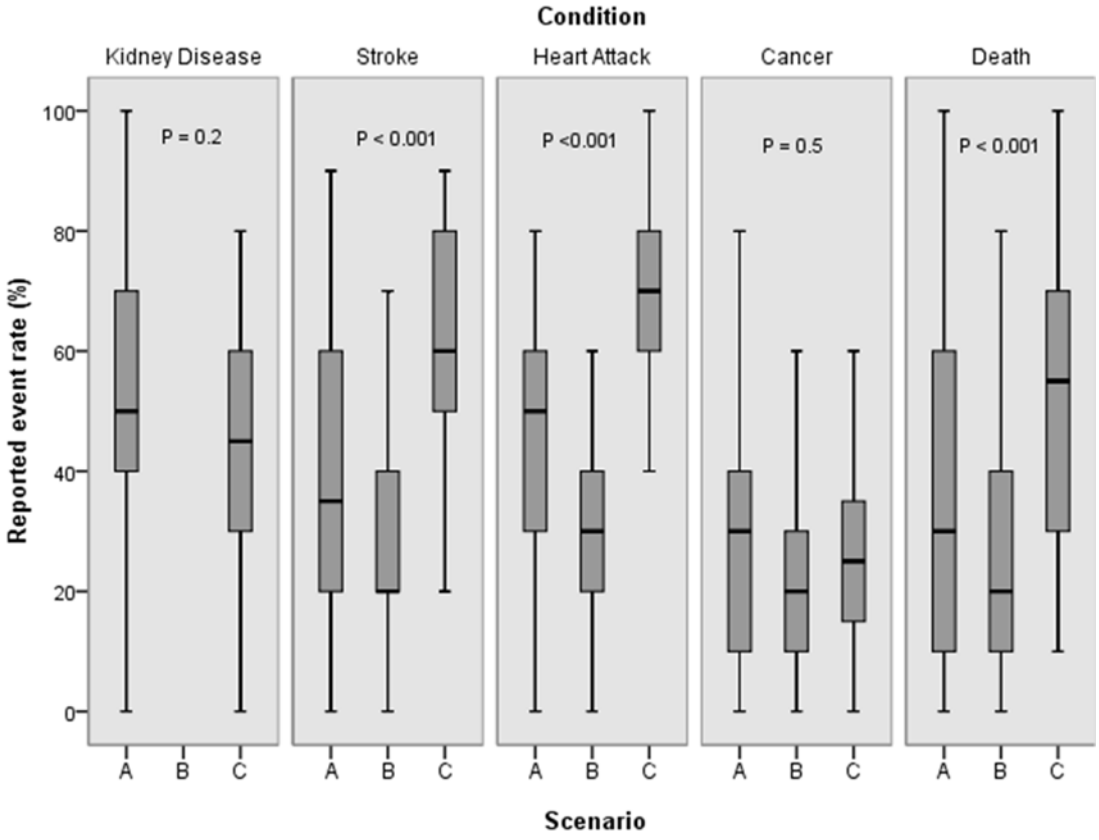


Figure 4.2 Patient reported event rates for the three hypothetical scenarios: A. Type 2 diabetes; B. chronic kidney disease; C. cardiovascular disease

4.6 References

1. Brantsma AH, Bakker SJ, Hillege HL, de Zeeuw D, de Jong PE, Gansevoort RT. Cardiovascular and renal outcome in subjects with K/DOQI stage 1–3 chronic kidney disease: the importance of urinary albumin excretion. *Nephrol Dial Transplant*. 2008;23(12):3851-8.
2. Keith DS, Nichols GA, Gullion CM, Brown JB, Smith DH. Longitudinal follow-up and outcomes among a population with chronic kidney disease in a large managed care organization. *Arch Intern Med*. 2004;164(6):659-63.
3. Foley RN, Murray AM, Li S, Herzog CA, McBean AM, Eggers PW, et al. Chronic kidney disease and the risk for cardiovascular disease, renal replacement, and death in the United States Medicare population, 1998 to 1999. *J Am Soc Nephrol*. 2005;16(2):489-95.
4. Gansevoort RT, Correa-Rotter R, Hemmelgarn BR, Jafar TH, Heerspink HJL, Mann JF, et al. Chronic kidney disease and cardiovascular risk: epidemiology, mechanisms, and prevention. *Lancet*. 2013;382(9889):339-52.
5. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu C-y. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. *N Engl J Med*. 2004;351(13):1296-305.
6. Herzog CA, Asinger RW, Berger AK, Charytan DM, Díez J, Hart RG, et al. Cardiovascular disease in chronic kidney disease. A clinical update from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney Int*. 2011;80(6):572-86.
7. James MT, Hemmelgarn BR, Tonelli M. Early recognition and prevention of chronic kidney disease. *Lancet*. 2010;375(9722):1296-309.
8. Jha V, Garcia-Garcia G, Iseki K, Li Z, Naicker S, Plattner B, et al. Chronic kidney disease: global dimension and perspectives. *Lancet*. 2013;382(9888):260-72.
9. Mujais SK, Story K, Brouillette J, Takano T, Soroka S, Franek C, et al. Health-related Quality of Life in CKD Patients: Correlates and Evolution over Time. *Clin J Am Soc Nephrol*. 2009;4(8):1293-301.

10. Tonelli M, Muntner P, Lloyd A, Manns BJ, Klarenbach S, Pannu N, et al. Risk of coronary events in people with chronic kidney disease compared with those with diabetes: a population-level cohort study. *Lancet*. 2012;380(9844):807-14.

11. Adler AI, Stevens RJ, Manley SE, Bilous RW, Cull CA, Holman RR. Development and progression of nephropathy in type 2 diabetes: the United Kingdom Prospective Diabetes Study (UKPDS 64). *Kidney Int*. 2003;63(1):225-32.

12. Fox CS, Matsushita K, Woodward M, Bilo HJG, Chalmers J, Heerspink HJL, et al. Associations of kidney disease measures with mortality and end-stage renal disease in individuals with and without diabetes: a meta-analysis. *Lancet*. 2012;380(9854):1662-73.

13. Shlipak MG, Fried LF, Cushman M, Manolio TA, Peterson D, Stehman-Breen C, et al. Cardiovascular mortality risk in chronic kidney disease: comparison of traditional and novel risk factors. *JAMA*. 2005;293(14):1737-45.

14. Finkelstein FO, Story K, Firanek C, Barre P, Takano T, Soroka S, et al. Perceived knowledge among patients cared for by nephrologists about chronic kidney disease and end-stage renal disease therapies. *Kidney Int*. 2008;74(9):1178-84.

15. Tan AU, Hoffman B, Rosas SE. Patient perception of risk factors associated with chronic kidney disease morbidity and mortality. *Ethn Dis*. 2010;20(2):106-10.

16. Burke M, Kapojos J, Sammartino C, Gray N. Kidney disease health literacy among new patients referred to a nephrology outpatient clinic. *Intern Med J*. 2014;44(11):1080-6.

17. White SL, Polkinghorne KR, Cass A, Shaw J, Atkins RC, Chadban SJ. Limited knowledge of kidney disease in a survey of AusDiab study participants. *Med J Aust*. 2008;188(4):204.

18. Krueger RA, Casey MA. *Focus groups: A practical guide for applied research*: Sage Publications, Inc.; 2000.

19. Tong B, Stevenson C. *Comorbidity of cardiovascular disease, diabetes and chronic kidney disease in Australia*: Australian Institute of Health and Welfare; 2007.

20. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349-57.

21. Strauss A, Corbin J. *Basics of Qualitative Research*. 2nd ed. Thousand Oaks, California: Sage Publications; 1998.

22. Perneger TV, Whelton PK, Puddey IB, Klag MJ. Risk of end-stage renal disease associated with alcohol consumption. *Am J Epidemiol*. 1999;150(12):1275-81.

23. Shankar A, Klein R, Klein BE. The association among smoking, heavy drinking, and chronic kidney disease. *Am J Epidemiol*. 2006;164(3):263-71.

24. Strippoli GF, Craig JC, Rochtchina E, Flood VM, Wang JJ, Mitchell P. Fluid and nutrient intake and risk of chronic kidney disease. *Nephrology*. 2011;16(3):326-34.

25. Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, Blaha MJ, et al. Heart disease and stroke statistics--2014 update: a report from the American Heart Association. *Circulation*. 2014;129(3):e28.

26. Lloyd-Jones DM, Leip EP, Larson MG, d'Agostino RB, Beiser A, Wilson PW, et al. Prediction of lifetime risk for cardiovascular disease by risk factor burden at 50 years of age. *Circulation*. 2006;113(6):791-8.

27. Pagels AA, Klang B, Susanne Heiwe S. Differences in illness representations in patients with chronic kidney disease. *J Ren Care*. 2015:1-10.

28. Glanz K, Rimer BK, Lewis FM, Editors. *Health behavior and health education: theory, research, and practice*. 3rd ed. San Francisco, CA: John Wiley & Sons; 2002.

29. Lorig K, Associates. *Patient education: a practical approach*. Thousand Oaks, California: Sage; 2001.

30. National Kidney Foundation. *Kidney Early Evaluation Program (KEEP)* 2015 [cited 2015 22 May]; Available from: https://www.kidney.org/news/keep.

31. Kidney Health Australia (KHA). *Support*. [cited 2015 22 May]; Available from: http://www.kidney.org.au/ForPatients/tabid/581/Default.aspx.

32. National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). *Health Information*. 2015 [cited 2015 22 May]; Available from: http://www.niddk.nih.gov/health-information/healthcare-professionals/Pages/default.aspx.

33. The Renal Association. *Information for Patients*. 2015 [cited 2015 22 May]; Available from:http://www.renal.org/information-resources/information-for-patients#sthash.QR2EhCY4.dpbs.

34. The Kidney Foundation of Canada. *Your Kidneys*. 2015 [cited 2015 22 May]; Available from: http://www.kidney.ca/your-kidneys.

Chapter 5. Knowledge deficit of patients with stage 1-4 CKD - a focus group study.

5.1 Abstract

Background: Patients with early-stage chronic kidney disease (CKD) must make lifestyle modifications and adhere to treatment regimens to prevent their progression to end-stage kidney disease. The aim of this study was to elicit the perspectives of patients with stage 1-4 CKD about their disease, with a specific focus on their information needs in managing and living with CKD and its sequelae.

Methods: Patients with CKD stages 1-4 were purposively sampled from three major hospitals in Sydney, Australia to participate in focus groups. Transcripts were thematically analysed.

Results: From nine focus groups including 38 participants, six major themes were identified: medical attentiveness (shared decision making, rapport, indifference and insensitivity); learning self-management (diet and nutrition, barriers to physical activity, medication safety); contextualizing comorbidities (prominence of chronic kidney disease, contradictory treatment); prognostic uncertainty (hopelessness, fear of disease progression, disbelief regarding diagnosis); motivation and coping mechanisms (engage in research, pro-active management, optimism, feeling normal); and knowledge gaps (practical advice, access to information, comprehension of pathology results and CKD diagnosis, education for general practitioners).

Conclusion: Patients capacity to slow the progression of CKD may be limited by their lack of knowledge about the disease, its comorbidities, psychosocial influences and their ability to interact and communicate effectively with their health care provider. Support from a multidisciplinary care team, combined with provision of comprehensive, accessible and practical educational resources may

enhance patients' ability and motivation to access and adhere to therapeutic and lifestyle interventions to retard progression of CKD.

5.2 Introduction

Prevention of chronic kidney disease (CKD) and its progression to end-stage kidney disease (ESKD) requires complex care, because it involves both specific CKD management and the management of comorbidities such as hypertension and diabetes. The asymptomatic nature of early stage CKD and lack of public awareness about the disease [1, 2], also mean that patients may be reluctant to accept the diagnosis, lack insight into factors that may drive progression and be at risk of non-adherence to recommended therapies. An effective patient and provider partnership is important to optimize patient care [3] in preventing disease progression [3, 4].

To delay ESKD and its complications including cardiovascular disease, cancer, increased hospitalization, and premature death [5-8], patients must make lifestyle modifications and adhere to treatment regimens. Patients with CKD need to be informed about the benefits of maintaining a healthy lifestyle and adhering to medication to reduce proteinuria, hypertension and diabetes, all of which are risk factors for CKD [9, 10]. However, a recent study found that 35% of patients stated they had very limited or no knowledge at all about CKD and the prevention of ESKD [11]. Patients diagnosed with early CKD have also reported poor coping skills, depression and anxiety, limited participation in treatment planning, and poor quality of life [12, 13]. Effective patient education can improve symptoms, quality of life, coping mechanisms [12, 14], patient survival, and reduce rates of hospitalizations and progression to ESKD [15, 16].

Effective strategies to prevent CKD progression requires understanding the views, concerns, and needs of patients, so that educational interventions address their information needs and promotes their capacity to make lifestyle changes. This study aims to describe the experiences and perspectives of

patients with early CKD to inform treatment and education strategies for primary and secondary prevention of progression of CKD.

5.3 Methods

We conducted nine focus groups from March to April 2011. Focus groups capitalize on group interaction which allows participants to explore and clarify their individual and shared perspectives [17]. Each focus group lasted two hours and was facilitated by the primary investigator (PLV).
A field observer (RK, NV, AT or MH) was also present during each session. No researcher had prior contact with, or knowledge of, the participants. Three focus groups were conducted for each of the three participating institutions (Westmead Hospital, Royal Prince Alfred Hospital and Royal North Shore Hospital). Ethics approval was obtained from all sites.

Participant selection

Participants were eligible to participate if they were diagnosed with CKD (Stages 1-4), aged 18 years or older, English-speaking, and able to give informed consent. Patients were purposively sampled to include a range of demographic and clinical characteristics including age, sex, cultural backgrounds, time since diagnosis and education. A nephrologist or a CKD coordinator from each institution identified eligible patients. PLV invited patients to participate by telephone, written information about the study including consent form was sent to those who were interested in taking part. Participants were offered AUD$30 reimbursement to cover travel and parking expenses.

Data collection

The primary investigator developed a question guide based on a literature review [18] current guidelines [19, 20] and discussion among the research team. Topics included experiences of being

diagnosed with CKD, concerns about CKD, knowledge about CKD diagnosis and management, and specific information needs (Table C1). During the focus group, participants were shown a range of information pamphlets and booklets about CKD which have been developed by various organizations (Table C2). The participants were asked to comment on the content (for example, type and amount of information), and format (layout, readability and appeal). Using a standardised template, an observer recorded field notes on participant interactions and characteristics, body language and group dynamics. To facilitate open discussion between the participants, the focus groups were conducted in a hotel meeting room. The focus group sessions were recorded with a digital voice recorder and transcribed verbatim. Data collection ceased when theoretical saturation was reached, that is, when little or no new concepts were raised by the participants.

Analysis

All transcripts were downloaded into HyperRESEARCH (Version 3.0.3. Research Ware Inc. Randolph, MA, USA) a software package used to facilitate coding and analysis of qualitative data. Using the principles of grounded theory [21] PLV coded and recorded concepts inductively, grouped similar concepts, and developed preliminary themes. After discussion with AT, the themes were refined until all relevant concepts relating to patient perspectives and experiences of early CKD were captured. The FreeMind software 0.9.0 Beta 14 (Source Forge, Mountain View, California, USA) was used to map the interrelationships between themes and to develop analytical themes. The preliminary findings and themes were discussed among the research team, and then incorporated into subsequent revisions of the analytical thematic schema.

5.4 Results

Participant demographics

Of the 99 patients contacted, 38 (38%) participated in the study. Reasons for non-participation included family and work commitments, transport difficulties, poor health, disinterest, unaware of being diagnosed with CKD, and limited English. The participant characteristics are provided in Table 5.1. The mean age of participants was 54 years (range 20 to 79 years), 23 (60.5%) were male, and 25 (66%) were diagnosed with CKD for more than 1 year. Causes of CKD included inherited 6 (16%), diabetes 5 (13%), autoimmune disease 4 (11%), hypertension 4(11%), and other causes 5 (13%), with 11 (29%) participants not knowing the cause of their disease. There were 28 (73.6%) stage 1-3 CKD patients. Twenty (53%) patients reported that they had received information about CKD prior to the study commencement.

Thematic analysis

We identified six themes: medical attentiveness (shared decision making, indifference and insensitivity, rapport); learning self-management (diet and nutrition, barriers to physical activity, medication safety); contextualizing comorbidities (prominence of chronic kidney disease, contradictory treatment); prognostic uncertainty (defeat and hopelessness, disease progression, disbelief regarding diagnosis); motivation and coping mechanisms (engage in research, pro-active management, optimism, feeling normal); and knowledge gaps (practical advice, access to information, pathology results, diagnostic ambiguity). Selected illustrative quotations for each theme are provided in Table 5.2. The conceptual links and thematic schema are depicted in Figure 5.1.

Medical attentiveness

Shared decision making:

Participants who had been diagnosed with CKD for a longer period of time were aware that dialysis and transplant were the options for renal replacement therapy. They wanted involvement in treatment decisions, particularly in choosing between dialysis types and transplantation. Some participants did

not want a kidney transplant in order to preserve "body wholeness." One older participant stated that patients should not be forced to have dialysis especially if the quality of life benefits do not outweigh survival gain. She felt conservative therapy should be discussed more often with patients and that they should be allowed to make their own choices.

Indifference and insensitivity:

Some participants felt ignored by their general practitioner in that their concerns about their symptoms were not addressed and thus were forced to advocate for themselves to get a diagnosis. They were frustrated about receiving a "delayed diagnosis" and felt their opinions were not being heard. Some also felt a lack of empathy from their general practitioner who they believed should have provided more advice about prevention of progression and treatment, rather than providing an estimate of survival.

Rapport:

Some participants felt intimidated and anxious when they saw their specialist. They were hesitant to ask questions as they were uncertain about what was relevant to ask. Others felt their specialists did not provide adequate information about their health, which made them feel bewildered and exasperated. During consultation, some participants felt their concerns were not addressed and at times ignored.

Learning self-management

New diet and nutritional goals:

The participants believed that they could prevent disease progression by maintaining a specific diet and monitoring fluid intake. They felt frustrated as they perceived a lack of or contradictory dietary advice, and were concerned that the wrong foods and inadequate amounts of fluid will aggravate their condition. They wanted practical advice about meal preparation and foods to avoid.

Barriers to physical activity:

Although participants perceived it was important to maintain a healthy weight, some felt helpless as they were unable to participate in physical activity due to comorbidities, pain, or older age. Other participants who had increased their physical activity and lost weight, became discouraged and unmotivated when their blood pressure and kidney function had not improved.

Apprehension about medication safety:

Some participants considered that medication was damaging to their kidneys. They felt hesitant about taking medications and concerned about medication interactions, how it worked, and side effects. Some were anxious about the toxicity of medications particularly if they were taken orally or over a long period of time.

Contextualizing comorbidities

Prominence of chronic kidney disease:

Participants had to contend with multiple comorbidities such as systematic lupus erythematosus, diabetes and hypertension as well as their kidney disease. They expressed a feeling of anxiety and ill-fate due to having multiple afflictions. Some participants realized that their kidney disease was a direct

outcome of their high blood pressure and diabetes, and wished they had known earlier that adequate blood pressure management could retard disease progression.

Contradictory treatment:

Having to manage both prevention of CKD and treatment for other comorbidities was challenging and overwhelming. Participants were concerned about potential drug interactions and adverse effects; and some felt confused about taking medications for their kidneys if it was primarily indicated for another health condition, for example high blood pressure or cholesterol.

Prognostic uncertainty

Defeat and hopelessness:

Participants felt overwhelmed as they believed that CKD progression to ESKD was inevitable. There was a sense of fear and of hopelessness in knowing that no therapeutic cure was available for CKD, a disease they perceived as life threatening.

Anxiety about disease progression:

Participants were anxious about being unable to predict how quickly their disease would progress and how this would affect their health, lifestyle and family. They felt they had no control over their kidney function which fluctuated over time. They were fearful about dialysis and believed they would no longer be able to work, and worried about the impact this would have on their family.

Disbelief regarding diagnosis:

One participant did not want to accept her diagnosis of polycystic kidney disease as she felt healthy and well at the time. Other participants were shocked when diagnosed with kidney disease as they had not experienced any physical symptoms. They were also not aware of any predisposing risk factors or health problems and therefore their diagnosis was completely unexpected.

Motivation and coping mechanisms

Engage in research:

Participants were optimistic about new treatments to prevent ESKD. Some felt that patients needed more awareness about current research and about how they could get involved in clinical trials and access research findings. Research gave them hope of finding a cure to prevent their offspring from developing the disease, one participant felt taking part in research studies would give him the opportunity to contribute to a cause.

Pro-active management:

A sense of empowerment was felt by participants who were able to discuss changes to treatment with their physician. It motivated them to take more control in managing their disease. They emphasized the importance of having adequate blood pressure management and would seek other advice if they felt their current treatment was ineffective. One participant experimented with alternate natural therapies, such as grape seed oil which he felt helped to stabilize his diabetes and kidney function. Their trust in alternative therapies was strengthened as they observed improvements with their condition.

Optimism:

Participants believed that a positive outlook about life and life's circumstances enabled them to cope with their illness and enjoy life. Others were hopeful of a bright future and felt reassured and encouraged by their physician to make lifestyle changes to improve their health.

Feeling normal:

Some participants felt they could continue living "normally" as CKD was not perceived to be affecting their daily lives. Their general well-being was unchanged and they considered themselves to be healthy. They would consider learning more about their health management once the signs and symptoms become more evident.

Blame and resentment:

One participant with hereditary CKD blamed his parents when he was diagnosed. He was young at the time, but had learnt to come to terms with the condition and with the concept of dying. It helped to know that he has a milder form of polycystic kidney disease and he has had years to learn more about the condition.

Knowledge gaps

Prioritize practical advice:

Most participants sought practical advice which they could apply in their daily lives and enhance their self-management skills. Participants wanted specific information about CKD such as the physiology of the kidneys, causes of kidney disease, and more importantly how it is managed and what could they do to prevent its progression. Some participants felt they could benefit from patient support groups where they could meet people in similar circumstances to share experiences and knowledge about CKD.

Limited access to information:

Participants believed information should be readily available in nephrology and general practice clinics as well as in community settings such as pharmacies. They urged that information about CKD be published or reported in the public media to target the general population and the younger generation. They felt information should be delivered in various formats such as in print and electronic media. Many participants expressed the need for general practitioners to be educated about CKD and other genetic kidney diseases, as they would be a great source of information for them if they were better informed.

Perplexing pathology results:

Many participants felt bewildered as they were unable to understand` their pathology results. The results were "meaningless" to them and felt that their physicians should interpret and explain the pathology report.

Diagnostic ambiguity:

Some participants thought that only those with polycystic kidney disease were the ones who end up having dialysis. They had not realized that CKD can be caused by other conditions and risk factors. Some perceived that they lacked knowledge about what kidney function meant and how it related to CKD.

5.5 Discussion

We have shown that chronic kidney disease is a very difficult diagnosis for patients to comprehend. What to nephrologists appears routine and self-evident, appears very different and complex to patients.

Participants in our study felt overwhelmed, confused and unable to control their condition. Many had fears and anxieties about inevitable disease progression, the impending burden of dialysis, and premature mortality. Despite being willing to be proactive in their own healthcare, they have limited confidence in disease management, due to a perceived potential harm of prescribed medications and lack of knowledge about their condition, or strategies to improve their outcomes.

Patients urged for early, comprehensive and practical information to enable them to regain a sense of control over their condition. Their priorities for educational information focused on learning about dietary advice, medication safety and side effects, managing multiple co-morbidities, and kidney function. Patients with inherited CKD appeared better prepared, were more aware of their disease and actively sought information to improve their outcomes, as compared to participants who developed CKD due to other comorbidities such as diabetes and hypertension.

As has been reported elsewhere, we found that patients want to know more about the biological function of the kidneys, signs and symptoms of the disease, and what means to prevent or delay progression are available [18, 22-25]. Patients want specific advice regarding diet and fluid management and safety of medications [18]. The need for better patient-physician communication, and more public awareness to de-stigmatize kidney disease have also been identified [22]. Patients with other chronic diseases have also emphasized the importance of shared-decision making and effective communication between physicians and patients [26, 27]. Patients in our study felt uncertain and intimidated about forming “relevant” questions to ask during consultations and they also sensed that consultations were too limited in time to permit questions**.**

Our study provides insight on the perspectives of patients with early CKD, their information priorities and reasons underpinning their preferences for information and treatment. However, there are some limitations. Patient recruitment was challenging as some patients with CKD Stage 1-3 did not identify as having CKD. Participants from primary care settings were not recruited. It is uncertain whether

patients managed in primary care have different perspectives. Also, Non-English speaking patients were excluded to maintain the flow of the focus group discussions. Therefore the transferability of our findings may be limited particularly for patients of culturally and linguistically diverse backgrounds.

The diagnosis of CKD can have a detrimental psychosocial impact on patients [28, 29]. Patients with genetic predisposition to CKD may experience fear and resentment. If the diagnosis was unexpected, patients can feel overwhelmed by prognostic uncertainty [29], lifestyle changes, hopelessness and loss of control. We suggest that health care providers acknowledge patients' concerns, encourage open communication, suggest positive coping strategies, and provide access to psychosocial support.

Patient support and self-management education promote their active role in shared decision making in healthcare, which has been shown to improve patient health outcomes and treatment satisfaction [3, 4]. In chronic kidney disease, lack of education for patients and carers can lead to inadequate awareness about the signs and symptoms of kidney disease, poor coping skills, depression and anxiety, faster progression of disease, reduced participation in treatment planning and inferior quality of life [13, 18]. Several renal organizations have developed educational resources for both patients and primary care providers [30-32], but we suggest that more active and wider implementation and dissemination of these resources is needed. For example, the nephrology community could take further initiative in facilitating regular workshops and training for primary health care providers about CKD, including information specific to common inherited and autoimmune kidney diseases, such as polycystic kidney disease, IgA nephropathy and lupus nephritis.

Dietary management and medications to prevent risk factors are key interventions in CKD prevention. We recommend that a renal dietician should be involved in the care of patients with CKD to provide education about diet and nutrition, focusing on practical recommendations such as recipes. Advice about medications should encompass information regarding possible side-effects, interactions with

other medications, and clear explanation of its direct benefits in CKD prevention. As the diagnosis of CKD can be unexpected, education about CKD should be accessible in the primary healthcare setting particularly targeted at individuals with risk factors for CKD including diabetes and hypertension. Information should be disseminated at the community level to improve awareness among patients even prior to being referred to a nephrologist.

More research is needed to develop and evaluate educational interventions for patients with stages 1-3 CKD [33]. It is recommended that these interventions be multifaceted [33-35] incorporating interactive educational sessions supplemented with printed material such as an educational booklet or electronic medium such as a video. In assessing the effectiveness of an education program, we suggest that outcome measures include: clinical parameters for renal function (estimated glomerular filtration rate), albumin/creatinine and protein/creatinine ratios, blood pressure and blood glucose levels; patient knowledge (improved CKD awareness and understanding); attitudes to CKD prevention, quality of life, psychosocial factors; and behavioural factors such as lifestyle modification encompassing self-management, increase in exercise, smoking cessation and weight reduction.

Development of comprehensive educational resources including practical lifestyle recommendations, such as adequate diet according to CKD stage and types of appropriate physical activities, combined with active multidisciplinary and physician engagement in prevention, are likely to promote patient satisfaction, positive coping mechanisms, and increase their ability and motivation to make lifestyle modifications for prevention of CKD progression.

Acknowledgements

We thank all the participants who participated in the study. We thank Martin Howell, Nicola Vakusin and Rachael Kearns for assisting with running the focus group sessions by taking field notes.

Table 5.1 Participant characteristics (n = 38)

Characteristics	Number (%)
Gender	
Males	23 (60.5)
Females	15 (39.5)
Age (years)	
20-29	5 (13)
30-39	5 (13)
40-49	4 (10.5)
50-59	6 (15.8)
60-69	9 (23.7)
70-79	9 (23.7)
Time diagnosed with CKD (years)	
≤ 1	5 (13)
> 1 to 5	10 (26)
>5	15 (39.5)
Uncertain	8 (21)
Cause of CKD	
Diabetes	5 (13)
Hypertension	4 (10.5)
Cancer / Radiotherapy	3 (7.9)
Hereditary	6 (15.8)
Autoimmune	4 (10.5)
Other	5 (13)
Uncertain	11 (29)
Stage of chronic kidney disease	
I	1 (2.6)
II	6 (15.8)
III	21(55)
IV	9 (23.7)
V[†]	1 (2.6)
Level of education	
Primary	4 (10.5)
Secondary	15 (39.5)
Tertiary	19 (50)
English as first language	
Yes	31 (81.5)
No	7 (18.4)
Level of employment	
Full-time	8 (21)
Part-time	5 (13)
Other (home duties, unemployed, student, retired)	25 (66)
Received CKD information	
Yes	20 (53)
No	18 (47)

Abbreviations: CKD – chronic kidney disease
[†]At the time of the focus groups, one participant had progressed to CKD Stage 5

Table 5.2 Illustrative quotations

Theme	Quotations
Medical attentiveness	
Shared decision making	**"**My body, I take it as a temple I don't want anybody to invade it. I would never have a transplant, even if I know that I'm going to die." (Man, 75 years, CKD stage 3) "When they offered I should have dialysis, I said sorry no, I don't want to. But their insistence is really strong and because of my experience I said no. I'm not going through dialysis, it's my choice." (Woman, 73 years, CKD stage 4)
Indifference and insensitivity	"From the age of 18 I'd been having undiagnosed pain. I went to my doctor about 20 years ago,…and said I wanted to be tested for polycystic kidneys. He actually just brushed it aside …and said nobody ever died of polycystic kidneys." (Woman, 57 years, CKD stage 3) "In 2004, I noticed that most of the renal parameters rose where they shouldn't and declined when they shouldn't. My doctor was quite blasé about it. It was only until I told him that my creatinine had risen between 2004 and 2008 from 87 to 135 that I alerted him, that it's obviously going the wrong way" (Man, 75 years, CKD stage 3) "The last time I saw him [specialist] was last month and he just said 'you got the disease'. The first thing I asked him was, 'would I end up doing dialysis?' He said, 'probably in 5 to 10 years'." (Man, 38 years, CKD stage 2) "My GP [general practitioner] said to me, 'you're not going to make 80'. He already told me that and I was 39 at the time." (Woman, 56 years, CKD stage 3)
Rapport	"You know as soon as he [specialist] calls you, ah my God, I can feel my heart racing and I'm stressing out and you start sweating. Just shoots my blood pressure up… It's just that they make you feel a bit stupid sometimes like you should know. It's taken me 12 years to actually feel comfortable with him." (Woman, 39 years, CKD stage 3) "Basically there is nothing they [doctors] can do, 'just do what you're doing', that's all they ever tell me. I say well what am I doing? I get no answers." (Woman, 56 years, CKD stage 3) "It's like the older [doctors] say 'I know what I'm talking about and I live and breathe this every day, you don't need to know the ins and outs." (Man, 45 years, CKD stage 2)
Learning self-management	
New diet and nutritional goals	"I suppose mine being genetic… It's been very difficult to find what kind of diet you're supposed to follow. You read one bit of information and it tells you this and you read another bit and it tells you don't eat that, which the other one said you must eat… there's no clear guideline on what it is you can or can't eat." (Man, 38 years, CKD stage 3) "Hydration levels and how to assess hydration. I would really like to get more information about that. I mean, I know you can look at the color of your urine but - I was a bit paranoid about hydration levels because of my kidneys." (Man, 44 years, CKD stage 2) "When I go to the shop I look [food label] and if it's got too much saline, I can't buy that product. But the diet is a bit of a concern." (Man, 69 years, CKD stage 3) "I don't know what type of food is good for the kidney and is bad for the kidney. Like is chilli good for the kidney? I like to drink Scotch on Saturday. Will that affect my kidney? Wine?" (Man, 75 years, CKD stage 3)
Barriers to physical activity	"We both find it difficult we used to love gardening… we had a small farm there for many years but neither of us can bend down anymore….we can't walk the dogs for instance- And it's very hard to exercise, if you know when you're going to move it's going cause you pain, so it tends to put you off a bit." (Man, 72 years, CKD stage 2) "I'm a person 75 years old now, going on 76 in a few months, changing my lifestyle now?**"**(Man, 75 years, CKD stage 3) "I'll go to weight watchers and follow a good diet, and I lost 20 kilos. I came to the specialist, he took my blood pressure and it's still the same… I was really peeved off because I had done all this work and it didn't help me…I looked better and I felt better but it still didn't help my condition. You kind of get a bit disheartened as well." (Woman, 39 years, CKD stage 3)
Apprehension about medication safety	"I am also very concerned with the medications I take (a) for my kidneys and (b) for other things, that they are having an effect on my kidneys. Especially when you're taking permanent long term medication…." (Man, 44 years, CKD stage 2) "I keep getting asked, just when I get a function check-up; 'are you a regular taker of pain killers?' But I take away from that, that pain killers are bad for your kidneys. So was being quite cautious with my son not to unnecessarily use pain killers and then I was subsequently told that Panadol affects the liver and not the kidneys(Man, 39 years) "Tablet has the residue; it's poison, very light poison probably. If you take 5 or 6 of them in one go, they are going to cause some harm isn't it?"(Man, 75 years, CKD stage 3) "I take 10 tablets in the morning and 9 tablets at night. I've been taking them for years and years it was for everything, definitely I think they attack your kidneys. Why don't they give you injections anymore? It dissipates a lot faster, than tablets." (Woman, 67 years, CKD stage 4)
Contextualizing comorbidities	
Prominence of chronic kidney	"At the moment, my blood pressure is always really high, up to 200/120. So, now I'm going, the kidney, the heart, what else is going to go wrong? Because they said [doctors], 'you're diabetic and all these things will happen'." (Man, 38 years, CKD stage 2)

Theme	Quotations
disease	"I don't know why it's hit me, it's not a hereditary situation, I put it down to the fact that my blood pressure was too high for too long and that's what killed my kidneys as it did my aneurysm, that's why I acted on it." (Man, 72 years, CKD stage 2)
	"I now think that although I was on blood pressure medication, it was not adequate. So it's my suspicion that's the major cause [of progression to end-stage kidney disease]." (Woman, 76 years, CKD stage 5)
Contradictory treatment	"The tablets that I'm on for my SLE affect my blood pressure… But if he [doctor] drops some of them [blood pressure medication], then my blood pressure goes up, but then my kidney function goes down. So I just say, you tell me what I have to take and I just take it." **(**Woman 39 years, CKD stage 3)
	"About 4 years ago the doctor said to me, your kidney function, it's a bit low. I said what could we do about it? She said 'nothing really it's your diabetes that caused it'. I said, well, give me some tablets to put my diabetes down then and she said, 'yes take those tablets two in the morning and two in the evening'. I was taking the tablet, the diabetes went down, but my kidney went down as well." (Man, 75 years, CKD stage 3)
	"I take another one for cholesterol but I haven't got high cholesterol but they said it's for my kidneys. I can't understand why I take it." (Woman, 60 years, CKD stage 3)
Prognostic uncertainty	
Defeat and hopelessness	"So I said if he dies [Kerry Packer] with kidney disease… what are they going do about me, I'm a poor man. His helicopter pilot gave him a kidney but it didn't help him either. I ask my doctor, I said but nobody really could do anything about people sick with kidney? She said 'no, they haven't reached that point yet'…" (Man, 75 years, CKD stage 3)
	"I think it was 98 [creatinine] but maintained a fairly level playing field up until early last year, …it jumped almost a hundred points in three months. So the rate of decline has increased which, doesn't excite me very much. But I can't really put it down to anything in particular nor can any of the specialists or doctors." (Man, 72 years, CKD stage 4)
	"I Google things and I don't like what I read [about CKD], I might as well just go get a gun and shoot myself. If that's going to be the end, like it's not very encouraging." (Woman, 39 years, CKD stage 3)
Anxiety about disease progression	"I've got a double concern because I've got the lupus always in the background and it can affect any organ in your body, which that was fabulous news when I was told that. So I've got pulmonary fibrosis in my lungs and then I've got the kidneys. I try not to think about it, but it's there." (Woman, 68 years)
	"My GFR went down to 34/35, on my next visit it went up to 40. I don't know why it just happens, I hadn't changed anything. On my last visit it had gone up to 47… I'm due to go back in two weeks' time and I'm starting to get anxious, has it gone up? Or have we slipped back down again. It's that anxiety of not knowing." (Woman, 66 years, CKD stage 3)
	"Well I'm sure there's a certain fear about the manner in which it's all going to eventually progress and end up. I've got a ten month old son, a bit of a concern that I've passed it on to him." (Man 39 years)
	"When you've gotten married and you've got kids, it starts to affect you and you think oh crikey, in three or four years I won't be able to work, won't be any money to pay for this and that. Who's going to drive me?" (Man, 51 years CKD stage 4).
Disbelief regarding diagnosis	"Had the results and sort of floored me a bit. It was sort of out of the blue, I didn't comprehend. When they said, you'll have to have both kidneys out and go on dialysis, it still wasn't penetrating that much, but obviously starting to now." (Man, 71 years)
	"I didn't think anyone knew what they were talking about. It really didn't present that many problems to me. So I guess I was in denial really, because it wasn't affecting me. I knew, at the back of my mind, that I had it" (Woman, 62 years, CKD stage 4)
	"Last November I just got sick and I didn't know what was wrong with me and the next thing I found out that I had kidney disease. A bit of a kick in the butt, but I think I'm getting over it." (Man, 69 years CKD stage 3)
Motivation and coping mechanisms	
Engage in research	"How do you find out whether you can volunteer for tests or studies? Couldn't we have been given an opportunity to try on them? I mean in my case, because it's genetic my son's got the disease as well, and he's 8 now. But you're hoping, probably for me it's too late but maybe there's something they can do for him." (Man, 38 years, CKD stage 3)
	"I've probably got about 10 years left on the kidneys and then they are gone. There's a timeline there now. So you try your best to do whatever you can to extend that period. But you really want to know, what else is there, that we can do to extend those times." (Man, 38 years, CKD stage 3)
Pro-active management	"I never took the medication without knowing what it was or what the side effects were….. I have even come back and said to the doctor, 'this is crap I'm changing, what else can you give me?' Especially with the blood pressure medication, I have always been very proactive about that." (Woman, 27 years, CKD stage 3)
	"A lot of GPs [general practitioners] have got their favourite medications for one reason or another. It pays to shop around if you've got a blood pressure problem unless you are dead lucky and strike a good one [physician]. If you know you've got a problem you've got to be pro-active." (Man, 72 years, CKD stage 2)
	"The diabetes association put out a magazine and one of the articles talked about grape seed. I bought it and my levels [of kidney function] stopped dropping. My nephrologist

Theme	Quotations
	doesn't believe in it but I'm not willing to stop taking it to find out." (Man, 70 years, CKD stage 3)
Optimism	"You've been dealt this blow, what can I do about it? I think the first thing is to be very positive in your own mind…and not sit in the corner and sulk it out… sitting in the corner is only going to pull you down. You get on with life and you enjoy it, because you never know whether tomorrow is your first day or your last..." (Woman, 66 years, CKD stage 3)
	"My wife says, get on with it and enjoy yourself…. We've both had cancer, so we just do what we can and we ignore it." (Man, 71 years)
	"Hearing what my doctor said: live life as normal and live life to the fullest. Just control your blood pressure, maintain a healthy diet and take your medicine and you should have a normal life. I still have goals ahead of me." (Man, 33 years, CKD stage 3)
Feeling normal	"I don't want to know about it. I know I've got it. I'll put it in the back drawer, go on with my life. When it gets serious, then I'll open that box up and start reading up on it more, because things change so much. Dialysis machines have changed dramatically, techniques, drugs. So I don't know a lot about it at the moment, because it's not really affecting me that much at all." (Man, 51 years, CKD stage 4)
	"I wouldn't say I was concerned when it hasn't really impacted the family... When I have a blood test, the only thing not normal is my creatinine, everything else is in the normal range. So, I don't think it impacts on me at the moment because I feel fine and I play tennis, I walk and I do things so I don't really feel I'm sick." (Woman, 60 years, CKD stage 3)
	"Was I scared? No not at all, I have no physical discomfort, I have no loss of concentration, I sleep well, I have ravenous appetite, so I was rather unconcerned, and I still am." (Man, 75 years, CKD stage 3)
Blame and resentment	"It wasn't a total shock and it's probably one of the more fortunate versions of kidney disease. It sets in later in life and doesn't knock you over straight away. One of the problems of being younger at the time I was a bit resentful of the fact that I was sick at all and perhaps blamed my parents in some part of me. It's alright, I don't feel too bad now." (Man, 39 years)
Knowledge gaps	
Prioritize practical advice	"Basically what we need to know is: what it is, how it works…. Obviously it's an impairment of some kind, but impairment of what? What part of the kidney? What we can do?" (Man, 62 years)
	"I think what is missing from most of these [brochures] is - WHY? They tell you about it but they don't give you the reason why it's like this." (Man, 38 years, CKD stage 3)
	"I want to get some mind and body help. How do you get in touch with people with similar conditions and those sorts of things? Some of this stuff [in brochures] for me, it's a bit more ideas as opposed to practical advice." (Woman, 27 years, CKD stage 3)
Limited access to information	"When my husband was diagnosed with this prostate problem, the specialist had two books there [clinic] about the disease. Here you are, take it away, read it, I'll see you next week; make a note of your questions. Maybe you could actually have them at the urologist clinics." (Woman, 58 years, CKD stage 4)
	"I think if you were going to publicize anything to do with polycystic kidneys, even though she [other participant] doesn't think it would help, I think it would help if it was published in something like Cleo, or Cosmopolitan, or the magazines that young people read - or even on Triple J [radio station] or something like that." (Woman, 57 years, CKD stage 3)
	"The hospital should do a CD or DVD with information about the kidneys. Then you go home and watch it comfortably in your lounge room." (Man, 75 years, CKD stage 3)
	"Education for GPs. Whenever I've picked up any information pamphlets, it's always been in association with a renal centre in a hospital. It's not generally available [in the community]." (Woman, 76 years, CKD stage 5)
Perplexing pathology results	"I understand the function of the kidneys. I understand the general progression of it, so a goodly amount. But still each period when I get renal function tests, it's still a bit of a mystery when those numbers come out and you're sort of looking and think well I'm glad they mean something to you doc." (Man, 39 years)
	"To tell you the truth, I don't know. She [physician] always says ah you went up 2 points. Next time, ah, too bad you went down 5. But, I don't know what point she is talking about." (Man, 75 years, CKD stage 3)
	"When I do get my blood tests I don't know what anything of them [results] are. All I know is that I've things there that are highlighted in black, but I don't know what it is. If they put it into words what it is, then I'd know. " (Man, 69 years, CKD stage 3)
Diagnostic ambiguity	"I don't even know like how you're supposed to know your kidney function. Do you guys know how it works?" (Woman, 21 years, CKD stage 1)
	"I always thought anyone on a [dialysis] machine must have had polycystic kidneys." (Man, 51 years, CKD stage 4)
	"It wasn't till about 2 years ago, until I fully understood and I've had the kidney disease from the age of 15, what exactly my [kidney] function was and I got a fright. No one had ever told me." (Man, 38 years, CKD stage 3)

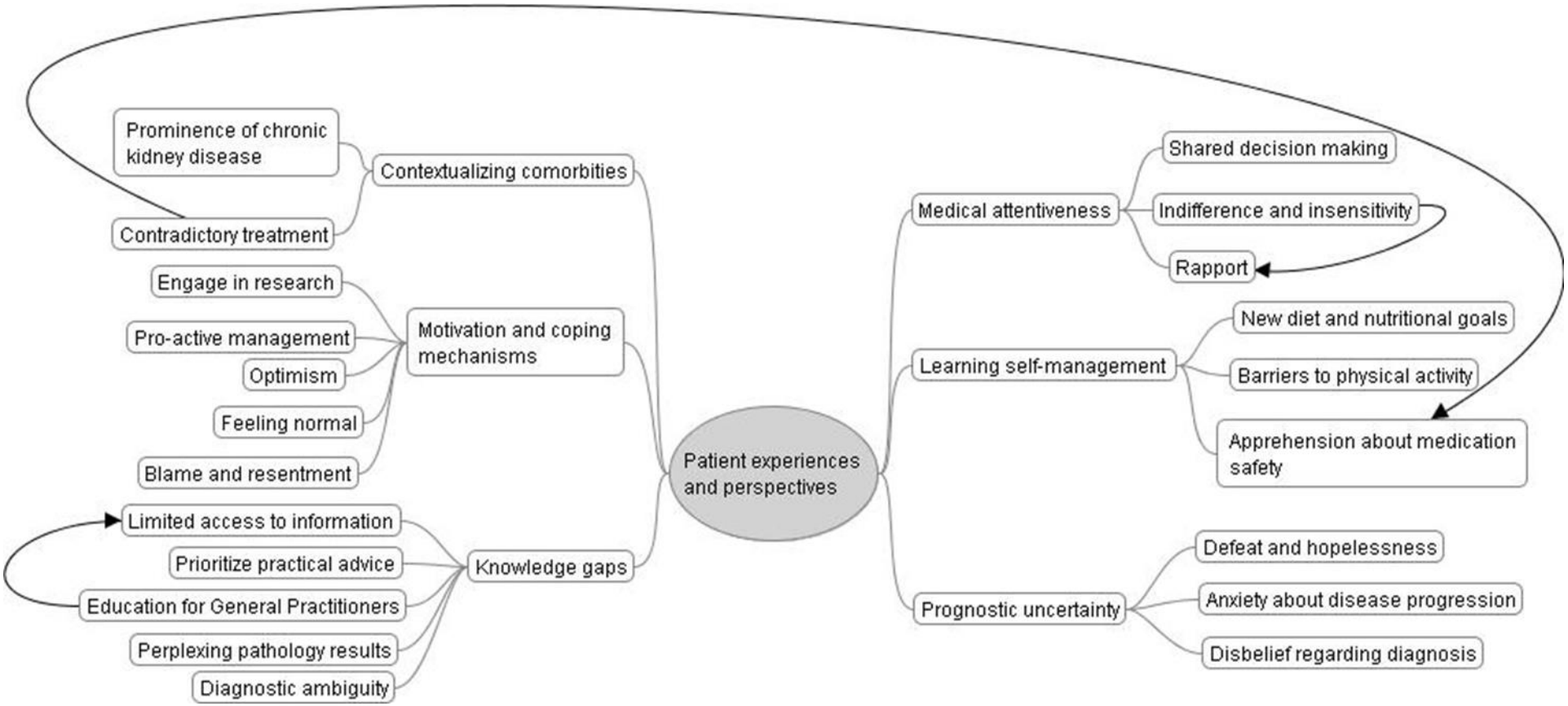


Figure 5.1. Schematic diagram of themes

5.6 References

1. Chadban SJ, Briganti EM, Kerr PG, Dunstan DW, Welborn TA, Zimmet PZ, et al. Prevalence of Kidney Damage in Australian Adults: The AusDiab Kidney Study. *J Am Soc Nephrol*. 2003;14(suppl 2):S131-S8.
2. White SL, Polkinghorne KR, Cass A, Shaw J, Atkins RC, Chadban SJ. Limited knowledge of kidney disease in a survey of AusDiab study participants. *Med J Aust*. 2008;188(4):204-8.
3. Bodenheimer T, Lorig K, Holman H, Grumbach K. Patient self-management of chronic disease in primary care. *JAMA*. 2002;288(19):2469-75.
4. Anderson LA, Zimmerman MA. Patient and physician perceptions of their relationship and patient satisfaction: a study of chronic disease management. *Patient Educ Couns*. 1993;20(1):27-36.
5. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu C-y. Chronic Kidney Disease and the Risks of Death, Cardiovascular Events, and Hospitalization. *N Engl J Med*. 2004;351(13):1296-305.
6. Jørgensen L, Heuch I, Jenssen T, Jacobsen BK. Association of albuminuria and cancer incidence. *J Am Soc Nephrol*. 2008;19(5):992-8.
7. Matsushita K, van der Velde M, Astor BC, Woodward M, Levey AS, de Jong PE, et al. Association of estimated glomerular filtration rate and albuminuria with all-cause and cardiovascular mortality in general population cohorts: a collaborative meta-analysis. *Lancet*. 2010;375(9731):2073.
8. Shlipak MG, Fried LF, Cushman M, Manolio TA, Peterson D, Stehman-Breen C, et al. Cardiovascular mortality risk in chronic kidney disease. *JAMA*. 2005;293(14):1737-45.
9. Johnson DW, Atai E, Chan M, Phoon RKS, Scott C, Toussaint ND, et al. KHA-CARI guideline: Early chronic kidney disease: detection, prevention and management. *Nephrology*. 2013;18(5):340-50.

10. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. *Kidney Int*. 2013;3(1):S1-S150.

11. Finkelstein FO, Story K, Firanek C, Barre P, Takano T, Soroka S, et al. Perceived knowledge among patients cared for by nephrologists about chronic kidney disease and end-stage renal disease therapies. *Kidney Int*. 2008;74:1178-84.

12. Devins GM, Mendelssohn DC, Barre PE, Binik YM. Predialysis psychoeducational intervention and coping styles influence time to dialysis in chronic kidney disease. *Am J Kidney Dis*. 2003.

13. Tong A, Sainsbury P, Chadban S, Walker RG, Harris DC, Carter SM, et al. Patients' experiences and perspectives of living with CKD. *Am J Kidney Dis*. 2009;53(4):689-700.

14. Fisher EB, Thorpe CT, DeVellis BM, DeVellis RF. Healthy Coping, Negative Emotions, and Diabetes Management: A Systematic Review and Appraisal. *Diabetes Educ*. 2007;33(6):1080-103.

15. Chen SH, Tsai YF, Sun CY, Wu IW, Lee CC, Wu MS. The impact of self-management support on the progression of chronic kidney disease - A prospective randomized controlled trial. *Nephrol Dial Transplant*. 2011;26(11):3560-6.

16. Devins GM, Mendelssohn DC, Barré PE, Taub K, Binik YM. Predialysis psychoeducational intervention extends survival in CKD: a 20-year follow-up. *Am J Kidney Dis*. 2005;46(6):1088-98.

17. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care*. 2007;19(6):349-57.

18. Ormandy P. Information topics important to chronic kidney disease patients: a systematic review. *J Ren Care*. 2008;34(1):19-27.

19. Johnson DW, Atai E, Chan M, Phoon RKS, Scott C, Toussaint ND, et al. KHA-CARI Guideline: Early chronic kidney disease: Detection, prevention and management. *Nephrology*. 2013;18(5):340-50.

20. National Collaborating Centre for Chronic Conditions (NICE). *Chronic kidney disease: national clinical guideline for early identification and management in adults in primary and secondary care.* London: Royal College of Physicians,2008.

21. Strauss A, Corbin J. *Basics of Qualitative Research*. 2nd ed. Thousand Oaks, Califormia: Sage Publications; 1998.

22. Jennette C, Vupputuri S, Hogan S, Shoham D, Falk R, Harward D. Community perspectives on kidney disease and health promotion from at-risk populations in rural North Carolina, USA. *Rural Remote Health*. 2010;10(2):1388.

23. Tong A, Lopez-Vargas P, Howell M, Phoon R, Johnson D, Campbell D, et al. Consumer involvement in topic and outcome selection in the development of clinical practice guidelines. *Health Expect*. 2012;15(4):410-23.

24. Costantini L, Beanlands H, McCay E, Cattran D, Hladunewich M, Francis D. The self-management experience of people with mild to moderate chronic kidney disease. *Nephrol Nurs J*. 2008;35(2):147.

25. Lewis AL, Stabler KA, Welch JL. Perceived informational needs, problems, or concerns among patients with stage 4 chronic kidney disease. *Nephrol Nurs J*. 2010;37(2):143.

26. Hack TF, Degner LF, Parker PA. The communication goals and needs of cancer patients: a review. *Psychooncology*. 2005;14(10):831-45.

27. Wikblad KF. Patient perspectives of diabetes care and education. *J Adv Nurs*. 1991;16(7):837-44.

28. Kimmel PL. Depression in patients with chronic renal disease: what we know and what we need to know. *J Psychosom Res*. 2002;53(4):951-6.

29. Perez Dominguez TS, Rodriguez Perez A, Buset Rios N, Rodriguez Esparragon F, Garcia Bello MA, Perez Borges P, et al. Psychonephrology: psychological aspects in autosomal dominant polycystic kidney disease. *Nefrologia*. 2011;31(6):716-22.

30. Kidney Health Australia. *For patients*. 2008 [29 June 2013]; Available from: http://www.kidney.org.au/ForPatients/HealthFactSheets/HealthPublications/tabid/618/Default.aspx.

31. National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) and the National Institutes of Health (NIH). *National Kidney Disease Education Program (NKDEP)*. USA: U.S. Department of Health & Human Services (HHS); 2008 [29 July 2013]; Available from: http://www.nkdep.nih.gov/learn.shtml

32. Johnson D, Mathew T, Ludlow M, Robson B, Polkinghorne K, Phoon R, et al. *Chronic Kidney Disease (CKD) Management in General Practice*. 2nd ed. Melbourne Australia: Kidney Health Australia 2012.

33. Mason J, Khunti K, Stone M, Farooqi A, and Carr S. Educational interventions in kidney disease care: a systematic review of randomised trials. *Am J Kidney Dis*. 2008;51(6):933-51.

34. Binik YM, Devins GM, Barre PE, Guttmann RD, Hollomby DJ, Mandin H, et al. Live and learn: patient education delays the need to initiate renal replacement therapy in end-stage renal disease. *J Nerv Ment Dis*. 1993;181(6):371-6.

35. Manns BJ, Taub K, Vanderstraeten C, Jones H, Mills C, Visser M, et al. The impact of education on chronic kidney disease patients' plans to initiate dialysis with self-care dialysis: a randomized trial. *Kidney Int*. 2005;68(4):1777-83.

Chapter 6 Educational interventions for patients with early stage chronic kidney disease: a systematic review

6.1 Abstract

Background: Preventing the progression of chronic kidney disease (CKD) to end-stage kidney disease and minimising the risk of cardiovascular events and other complications is central to the management of CKD. Patients' active participation in their own care is critical but may be limited by their lack of awareness and understanding of CKD. We aimed to evaluate educational interventions for primary and secondary prevention of CKD.

Methods: Systematic review. Electronic databases were searched to December 2014 for Randomised and non-randomised studies of educational interventions for people with CKD. Primary outcomes included Knowledge, self-management, quality of life and clinical endpoints Study quality assessed using the Cochrane Collaboration risk of bias tool.

Results: Twenty-five studies, 12 trials and 13 observational studies, involving 5,345 participants were included. Risk of bias was high in most studies. Interventions were multifaceted, including face-to-face teaching (25 studies), written information (19 studies) and telephone follow-up (13 studies). Nineteen studies involved one-on-one patient/educator interaction and 13 incorporated group sessions. Nine studies showed improved outcomes for quality of life, knowledge and self-management; eight had improved clinical endpoints; and two studies showed improvements in both patient reported and clinical outcomes. Characteristics of effective interventions included teaching sessions that were interactive - workshops/practical skills (12/14 studies); integrated negotiated goal setting (9/12 studies); involved groups of patients (11/13 studies), their families (4/4 studies) and a multidisciplinary team (6/6 studies); and had frequent [weekly (4/5 studies) or monthly (7/7 studies)] participant/educator encounters.

Conclusions: Interactive, frequent, and multifaceted educational interventions that include both individual and group participation appear to improve knowledge, self-management and patient outcomes.

6.2 Introduction

Individuals with chronic kidney disease (CKD) have an increased risk of cardiovascular events including myocardial infarction, stroke, heart failure and peripheral vascular disease, as well as the risk of progression to end-stage kidney disease (ESKD), and early death [1-11]. The 1999 – 2008 National Health Survey showed that up to 90% of participants with two to four markers of CKD, including hyperkalemia, hyperphosphatemia, acidosis, increased blood urea nitrogen, albuminuria, anemia and hypertension, were unaware of their disease when surveyed [12]. Similarly patients with more advanced stages of CKD also showed poor knowledge regarding their treatment options [13].

In addition to older age, lower socioeconomic status and level of education, risk factors associated with CKD include smoking, hypertension and a sedentary lifestyle [14, 15]. Patient education about these risk factors for CKD and its management to ensure effective primary and secondary prevention is widely accepted as an essential element of the care of people with CKD [16-20]. Systematic reviews, focused on diet and fluid management, have shown that educational interventions may be effective in pre-dialysis and dialysis patients [21] and self-management programs in stages 1-4 CKD have shown some improvement in knowledge and quality of life [22]. However, previous systematic reviews were primarily focused on dialysis patients, or were limited to self-management interventions, rather than educational interventions more broadly.

The aim of our study was to evaluate the effectiveness of education interventions for patients with early stage CKD, including their effects on knowledge, and clinical outcomes, and then to identify the characteristics of the more effective educational interventions.

6.3 Methods

We conducted a systematic review reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [23].

Selection criteria

We included randomized controlled trials (RCTs) and non-randomized studies on educational interventions for the primary and secondary prevention and management of CKD. Although the population of interest was patients with Stages 1-3 CKD, due to the limited number of studies with this specific population, we also included studies that had included those with Stages 4-5 CKD patients. Those studies that included only Stage 5 CKD, 5-T or 5-D were excluded. Interventions targeting conditions such as diabetes or hypertension were included only if they were in the context of CKD prevention and management. Citations were not excluded on the basis of language.

Literature search

Medical Subject Heading (MeSH) terms and text words for CKD were combined with MeSH terms and text words related to health education, patient education, self-care, health promotion, primary and secondary prevention, disease progression and risk factors (Table D1). We searched MEDLINE (1946 to Week 4 December 2014), Embase (1996 to 30 December 2014), CINAHL (1982 – 30 December 2014), The Cochrane Library (December 2014), and reference lists of relevant articles and reviews. Studies were first screened according to title and abstract. Those that did not satisfy the inclusion criteria were excluded. Full-text articles were retrieved and assessed for eligibility by two independent reviewers (PLV and MH).

Data extraction and critical appraisal

Study characteristics relevant to the population, intervention, comparator and outcomes, as well as sample size, study setting and duration were extracted and tabulated.

The risk of bias was performed using the Cochrane tool for randomized studies [24] and the Cochrane Effective Practice and Organisation of Care (EPOC) Review Group criteria [25] for controlled before-and-after studies. The risk of bias criteria as described in Ramsay et al. [26] as well as EPOC [25] were used for assessment of the interrupted time series studies. The bias domains included in the assessment were: reporting bias (completeness of outcome reporting); attrition (incomplete outcome data); detection (blinding of investigators and outcome assessors); performance (blinding of participants); and selection bias (random sequence generation and allocation concealment) [24]. Other criteria were included in the assessment of controlled before-and-after and interrupted time series studies. PLV and MH assessed the studies independently and any disagreements were resolved by discussion.

Synthesis of results

A detailed analysis of the intervention characteristics was made using a taxonomy framework for educational interventions including setting (one-on-one, group), delivery style (face-to-face, telecommunication, written), teaching method (didactic, goal setting, situational), intensity (frequency, number of episodes, duration), content and personnel [27].

Due to the heterogeneity in the interventions and outcomes, a formal meta-analysis could not be performed. The effect size for primary outcomes and their p-values, unless reported in the study, were calculated from the data provided using Review Manager (RevMan5) software (version 5.2.11) and expressed as relative risk or mean difference for dichotomous and continuous outcomes respectively. An intervention was considered effective if it had at least one primary outcome that was significantly improved in the intervention group compared to the control or from baseline in observational studies.

6.4 Results

Literature search and study characteristics

The initial search yielded 2,240 citations, from which we identified 25 eligible studies (n = 5,345 participants) (Figure 6.1). Studies (Table 6.1) were conducted in Canada [28-31], Taiwan [32-38], Australia [39-41], Spain [42-44], China [45], Japan [46], The Netherlands [47], The United States of America [48, 49], Brazil [50], South Korea [51], and New Zealand [52]. There were 12 (48%) randomized trials, including six (50%) that were multi- centre studies [28-30, 38, 40, 47]. Of the 13 non-randomized studies, which included one retrospective cohort, five controlled before and after and seven interrupted time series studies, eight (62%) were conducted in a single centre [35, 42-45, 48, 49, 51]. The median number of participants was 80 (range 19 [42] to 1,056 [51]) and the median study duration was 12 months (range 3 months [39] to 20 years [29]). Four studies (16%) included CKD Stages 1-3 [35, 37, 38, 52]; eight studies (32%) Stages 1-4 CKD [28, 31, 33, 40, 41, 46, 47, 51] and 13 (52%) studies included Stages 1-5 CKD [29, 30, 32, 34, 36, 39, 42-45, 48-50].

Risk of bias assessment (Figure 6.1; Table D2)

The reporting of both randomized and non-randomized studies was relatively incomplete. For trials, the methods for randomization and allocation concealment were either not defined or unclear in four (33%) [28, 29, 31, 33] and eight (67%) trials respectively [28-31, 33, 38, 40, 50]. There was a high risk of bias for blinding as participants were blinded in only one [30] (8%) trial and outcome assessors were blinded in four (33%) studies [30, 40, 41, 47]. High risk of incomplete outcome data was present in five (42%) trials [29, 33, 38, 40, 50] as was selective reporting [29, 31, 38, 40, 50].

Five observational studies showed a high risk for selection bias (42%) [34, 36, 48, 49, 51] and nine (75%) studies showed a high risk for detection bias [35-37, 42-44, 46, 49, 51]. There was a low risk of

bias for selective reporting in 11 studies (92%) [34-37, 42-44, 46, 49, 51, 52]. Six interrupted time series studies (86%) did not pre-specify the shape of the intervention [35, 37, 42-44, 52] and in one (14%) study this was also unclear [46]. The criteria for baseline outcome measurements, baseline characteristics and protection against contamination, had either low or unclear risk of bias.

Characteristics of the interventions (Table 6.2; Table D3a, Table D3b)

Mode of delivery: Nineteen studies (76%) provided a one-on-one (patient and educator) setting while 52% also provided a group setting. Only 16% of studies included the family or support person. Interventions were multifaceted and included face-to-face teaching (100%), conducted patient telephone follow-up (52%) and provided written material (76%). The teaching method was a combination of mainly didactic lessons (84%) and negotiated goal-setting (48%), where decisions regarding care were shared between provider and patient. Nineteen interventions (76%) also incorporated situational problem solving [35, 42, 43, 45] and interactive strategies such as skills coaching, patient group discussion [35, 42-45], patient mentors [42, 44] and interactive educational sessions [34].

Intensity: The range of intervention frequencies varied from weekly to a once-only event, with most being a combination of interactions (32%) [30, 32-36, 39, 40]. Many interventions had multiple components that had different frequencies. For example, many studies evaluated a primary, one-off, intervention that consisted of a slide lecture or counselling session [30, 32, 33, 35, 36, 39, 40], but also included a secondary intervention such as telephone follow up [30, 32, 36, 39, 40], active exercise [33], patient consultations [35], or workshops [32, 35, 36] which were delivered multiple times. The number of these teaching episodes ranged from one to 16. Nine studies (36%) included between one and five sessions and six studies (24%) incorporated six to ten sessions. Duration per teaching episode lasted between 60 and 90 minutes for 32% of studies, and the amount of time spent on telephone

follow-up or patient consultations was variable. The majority of interventions were delivered over three to twelve months.

Content: Fifteen studies (60%) included interventions related to nutritional counselling, with 15 others also focused on lifestyle modification such as weight management and smoking cessation. Fourteen (56%) included education about kidney disease pathology and treatment and 13 (52%) involved various practical skills such as blood pressure monitoring, food preparation, nutritional needs and medication adherence. Only four studies included management of psychosocial issues [35, 43, 44, 48].

Educator: Studies generally included a nephrologist and/or a nurse as the primary educator, but allied health professionals such as dietitians and social workers were also involved. Nurses were involved in 72% of studies, nephrologists in 17 (68%) and dietitians in 14 (56%) studies. Patient volunteers or mentors were involved in six (24%) studies [32, 34, 42-45].

Effects of the interventions (Table 6.3; Figure 6.2; Table D4)

The domains measured and reported and the instruments used were very heterogeneous. Primary outcomes included both patient reported outcomes: quality of life (QoL) (16% of studies), psychosocial function (8%), knowledge (28%), self-management (20%) and lifestyle modification (12%); as well as clinical end-points – estimated glomerular filtration rate (eGFR) (32%), dialysis commencement (20%), survival (20%), blood pressure (28%) and biochemical markers (32%).

Evaluation of patient reported outcomes was done using a variety of questionnaires (data available upon request) such as the Kidney Disease questionnaire [29, 30]; Kidney Disease Quality of Life – SF [28, 39]; World Health Organisation quality of life questionnaire [35, 46], the Medical Outcomes Studies 36-item Short Form health survey (SF-36) [30, 47], the Kidney Knowledge Survey [49] and many others. Other instruments were used for measuring medication adherence, fatigue, depression,

anxiety, exercise and behaviour modification. Some outcomes such as, nutritional status, symptoms of CKD, cognitive function and vitality were measured in multiple different ways. Psychosocial function was assessed with measures of emotional state, anxiety, coping mechanisms and depression. Knowledge was measured in terms of knowledge about the disease, treatment and prevention. Self-management outcomes included self-efficacy, medication adherence and self-care and lifestyle modification included measures of dietary changes primarily protein intake, physical activity and smoking. Clinical outcomes were evaluated using blood tests, blood pressure monitoring and other measures such as event incidence.

Most studies reported more than two primary outcomes. There were nine (36%) studies that showed significant improvements for Quality of life (QoL) [33, 39], psychosocial function [43, 44], knowledge [42, 43, 51], self-management and life-style modification [33, 37, 38, 50]. While clinical endpoints significantly improved in eight (32%) studies: survival [32, 34, 47], dialysis [30, 34, 36, 48], eGFR [32], blood pressure [45, 47] and biochemical markers [45, 47, 48, 52]; two (8%) studies demonstrated improvement in both patient and clinical outcomes [29, 46]. A significant reduction in QoL for the intervention group was reported in one study [35] and five studies had no significant changes [28, 31, 40, 41, 49].

Overall, there were 19 studies where outcomes were significantly improved in the intervention group or from baseline post intervention. Eight of these were trials which showed improved outcomes for: QoL [33, 39], knowledge [29], survival [29, 32, 47], dialysis [29, 30], lifestyle modification [33, 38, 50], eGFR [32], blood pressure and biochemical markers [47]. Whilst 11 non-randomized controlled studies had improved outcomes for: psychosocial function [43, 44], knowledge [42, 43, 51], self-management [37, 46], survival [34], dialysis [34, 36, 48], blood pressure [45] and biochemical markers [45, 46, 48, 52].

Characteristics of effective interventions

Common features of the interventions with improved outcomes (Figure 6.2, Table D4) included teaching sessions that involved groups of patients 11/13 studies (85%) [32-34, 36, 37, 42-45, 48, 51]; 4/4 studies (100%) included the patient's family [42, 43, 45, 48]; 12/14 studies (86%) were interactive, running workshops and teaching practical skills [32-34, 36-38, 42-45, 50, 51]; and 9/12 (75%) of studies integrated negotiated goal setting [32, 33, 37-39, 46, 48, 51, 52]. Effective interventions had frequent participant / educator encounters: 4/5 studies had weekly (80%) [32, 33, 37, 45] and 7/7 studies had monthly (100%) encounters [30, 32, 34, 36, 39, 44, 50]; they also had between six and ten teaching episodes, 6/6 studies (100%) [42-46, 52] and included a multidisciplinary team including patient volunteers/mentors, 6/6 studies (100%) [32, 34, 42-45].

6.5 Discussion

We identified twenty-five studies that evaluated a broad range of educational interventions and outcomes for patients with CKD Stages 1-5. Significant but inconsistent improvements were detected mainly for quality of life, psychosocial function, knowledge, self-efficacy, lifestyle modification (exercise and diet), mortality, dialysis commencement and biochemical (serum albumin, proteinuria, haemoglobin) outcomes. Very few studies showed improvement in estimated glomerular filtration rate and blood pressure. Intervention components which appeared most likely to be effective involved a group and patient family setting; include practical skills, workshops and goal setting that is negotiated with the patient; conduct frequent patient / educator encounters; and involved a multidisciplinary team including patient volunteers or mentors.

All studies reported on more than one outcome and most had a combination of significant improvements and non-significant results. Possible explanations for the negative or no change in outcome measures may be due to: study design (small sample size, short study duration); inappropriate use of evaluation tools; or inadequate intervention to meet patient's needs. There was a high risk of bias for blinding of participants, personnel and assessors as well as unclear risk for selection bias

particularly allocation concealment that may have led to an over-estimate of the effects of the interventions in question [53, 54]. This was also present in the non-randomized studies with high risk for selection bias, attrition and detection bias. Using the appropriate evaluation questionnaire to measure the desired outcomes is important. For example, for the interventions measuring exercise, one study used a self-management questionnaire which failed to report on exercise outcomes [31]. While another study used three evaluation instruments with one specific for reporting on exercise behaviour [33].

Another possible reason for inconsistencies in improved outcomes may be due to inadequate patient awareness and understanding. Patients with early stage CKD may be largely asymptomatic and be less aware of issues regarding complications and disease progression. As a consequence they may assign a lower priority to education compared to individuals with later stage CKD [16]. Providing education and information that is relevant to the patient's actual and perceived stage of CKD may enhance learning and improve outcomes. Care also needs to be taken with regard to cultural sensitivity as indicated in one of the studies on medication and self-management [40]. Patients of Greek, Italian and Vietnamese background were recruited and although they were given written material in their own language and interpreter services were used, almost 50% withdrew or were lost to follow-up, which may have led to bias, and of uncertain effects.

Previous reviews have reported on educational interventions for pre-dialysis and dialysis patients which focus on CKD management [21, 55]. Most of these studies were conducted with dialysis patients and as a result the interventions focused on improving diet, fluid management, modality choices and access placement. One of the reviews addressed similar outcomes to our study and also conducted a quality assessment of the individual studies but used the Jadad risk of bias scale [21]. The Jadad scale for RCTs covers three items: randomization, blinding (patients and assessors) and attrition [56]. A more recent review included five studies on self-management interventions for Stage 1-4 CKD patients [22]. Thus the number of studies addressing early stage CKD has been limited. The poor

quality of educational interventions for CKD and for chronic disease patients is well known [21, 57], however, no study has identified the intervention characteristics and components using a taxonomy framework.

The strengths of this review are that it included randomized and non-randomized educational interventions for patients with Stages 1-5 CKD. Study risk of bias was assessed using accepted instruments [24, 25]. To facilitate the analysis across heterogeneous studies, we undertook an in-depth analysis of the intervention characteristics [58] using a taxonomy framework which has been previously used in educational interventions for patients with diabetes [27]. Although this study relates to the CKD population, our findings are likely to be relevant for educational interventions in patients with other chronic diseases.

Limitations were also evident. Due to the heterogeneity of the interventions and outcomes measured, a formal meta-analysis could not be done. For the same reason, we were not able to statistically evaluate the effects of the outcome reporting bias. Also, protocols for the included studies were not available, so we were not able to determine the frequency of outcome reporting bias

Current guidelines for early CKD suggest early education focusing on the management of risk factors to delay progression as well as information tailored to the stage of CKD to allow patients to make informed decisions [59-61]. Patient education should be encouraged at the primary health care level via a model of care delivery [62] that facilitates partnership among nephrologists, general physicians and allied health care professionals. At a secondary care level, this process could be facilitated by a nurse or health educator who would refer patients to other providers as required. Further research is needed to develop high quality educational interventions that address the educational needs of patients with early stage CKD. Attention should focus on study design to minimize risk of bias and intervention characteristics to improve effectiveness. There is also a need to standardize outcome measures and evaluation methods to facilitate comparison between studies.

Interventions were directed at improving quality of life, psychosocial function, knowledge and self-management; as well as clinical measures including survival, dialysis and biochemical markers. Significant improvements in outcomes were detected but there were inconsistencies across studies. Educational interventions can help improve patient outcomes, however the development of well-designed studies that include effective interventions which are: multifaceted, group based, interactive and involve a multidisciplinary team, are needed.

Table 6.1 Characteristics of included studies

Study	N	Participants (CKD Stage)	Setting	Intervention	Comparator	Primary outcomes	Study duration (months)
Randomized controlled trials							
Binik et al (1993)[29] †	204	(4-5)	Multicentre, Canada	Individually administered slide-lecture, print material given plus psychosocial interview	Usual care as per hospital program (varied across centres)	Dialysis commencement; quality of life; long-term knowledge; survival	102 ± 86.76 (mean ± SD)
Devins et al (2003)[30]	297	(4-5)	Multicentre, Canada	Individually administered slide-lecture, print material given plus psychosocial interview	Usual care as per hospital program (varied across centres)	Time to dialysis therapy	18
Campbell et al (2008)[39]	56	(4-5)	Single centre, Australia	Individualized nutritional counselling and regular follow-up	Usual care (generic education)	Nutritional status and quality of life	3
Barrett et al (2011)[28]	474	(3-4), between 40 and 75 years of age, recruited from the community	Multicentre, Canada	Usual care by General Practitioner plus care provided by a nurse and nephrologists use of protocols	Usual care by General Practitioner	Surrogate endpoint targets: BP, biochemical markers, medication adherence. Quality of life	24
Chen et al (2011)[32]	54	(3-5), between 18 and 80 years of age	Single centre, Taiwan	Interactive individualized education sessions depending on patients' stage of CKD. Print material and dietary advice given	Usual care as per hospital program, print material given	Improved eGFR and number of hospitalizations.	12
Flesher et al (2011)[31]	40	(3-4), older than 19 years of age	Single centre, Canada	Individual dietary counselling; group nutrition class; CKD cooking classes; and exercise program	Usual care for CKD	Cardiovascular risk factors; progression of CKD; self-efficacy and self-management,	12
Van Zuilen et al (2012)[47] ‡	788	(2-4), older than18 years of age	Multicentre, The Netherlands	Multifactorial care provided by a nurse practitioner and nephrologist. Use of treatment guidelines and interviews	Usual care provided by Physician only. Treatment guidelines also used	MI, stroke and CV mortality. Composite renal endpoint of death, ESRD, and increase in serum creatinine	68.4 (median)
Kao et al (2012)[33]	94	eGFR ≥15 ml/min/1.73m^2,	Single centre, Taiwan	Group education lecture, individual exercise program based on patient's stage of change according to TTM.	Not specified	Exercise behaviour Depression Fatigue status	3
Williams et al (2012)[41]	80	(3-4), with Type 1 or 2 diabetes, on antihypertensive medication	Single centre, Australia	Individualized medication self-management including medication review and motivational DVD	Usual care as per nephrology and diabetes outpatients' clinics	Blood pressure control and medication adherence	12
Williams et al (2012)[40]	78	(2-4), CALD patients, ≥18 years of age with Type 1 or 2 diabetes and CVD.	Multicentre, Australia	Individualized medication self-management including medication review and DVD. Translated print material given	Usual care through outpatients' clinics and primary care	Medication self-efficacy and adherence.	12

Study	N	Participants (CKD Stage)	Setting	Intervention	Comparator	Primary outcomes	Study duration (months)
Paes-Barreto et al (2013)[50]	89	(3-5), 18 years of age or over	Single centre, Brazil	Intense counselling involving dietary program and nutrition education	Normal counselling involving dietary program only	Reduced protein intake Adherence to low protein diet	5 ± 1.5
Teng et al (2013)[38]	160	eGFR ≥ 30 ml/min/1.73m^2, 20 years of age or older	Multicentre, Taiwan	Targeted lifestyle modification program based on the Trans-Theoretical Model.	Standard education about diet and exercise plus information booklet	Diet modification Exercise behaviour Knowledge about CKD	12
Non-randomized studies							
Slowik et al (2001)[48]	114	eGFR <30mL/min, or expected dialysis within 12 to 24 months	Single centre, USA	Multidisciplinary education program. Basic CKD education to patient groups. Advanced education about renal replacement therapy given to individuals.	Control group not enrolled in education program	Albumin levels and vascular access type	Not specified
Gutiérrez et al (2007)[43]	24	(4-5), not on dialysis	Single centre, Spain	Group education workshops with discussions. Multidisciplinary care with a psycho-educational team and a patient support team.	Pre-intervention measures	Able to resolve problems Ability to control fear Improved knowledge	6
Yen et al (2008)[35]	66	(3), over 18 years of age	Single centre, Taiwan	Multidisciplinary education on CKD management, health promotion and prevention. Workshop and individual consultations.	Pre-intervention measures	Knowledge of disease Quality of life Physiological indicators (biochemical markers)	12
Gutiérrez et al (2009)[44]	41	(4-5), pre-dialysis patients	Single centre, Spain	Group education based on nursing interventions to evaluate psychological outcomes. Print material given.	Pre-intervention measures	Coping ability, control of fear and anxiety levels	9
Wu et al (2009)[34]	573	(3-5), between 18 and 80 years of age	Multicentre, Taiwan.	Interactive multidisciplinary dialysis education (MPE). Education topics varied according to CKD stage.	Usual care	Dialysis initiation All-cause mortality	12
Jia et al (2012)[45]	302	(3-5)	Single centre, China	Multidisciplinary group and individual education based on CKD, dietary skills and motivational activities. Education ≥ 12 hours.	Similar program as intervention group education but reduced exposure, < 12 hours.	Progression of CKD (decrease GFR, initiation of dialysis, or transplantation)	≥ 3
Aguilera Flórez et al (2012)[42]	19	(4-5)	Single centre, Spain	Multidisciplinary group education encompassing CKD management, psychological issues, lifestyle changes and self-management	Pre-intervention measures	Improved knowledge about CKD and its management.	3.5
Choi et al	61	(3-4), 20 years of age	Single centre,	Face-to-face self-management	Usual care	Knowledge of disease	2

Study	N	Participants (CKD Stage)	Setting	Intervention	Comparator	Primary outcomes	Study duration (months)
(2012)[51]		or over, not on RRT	South Korea	program and reinforcement		Self-care practice Physiological indicators for kidney function	
Kazawa and Moriyama (2013)[46]	30	(3-4), with diabetic nephropathy.	Multicentre, Japan	Multidisciplinary self-management skills acquisition program – one-on-one patient education, goal setting	Pre-intervention measures	Self-management and behaviour modification	6
Lin et al (2013)[37]	37	(1-3a), 18 years of age or older	Multicentre, Taiwan	CKD self-management program based on self-regulation theory. Includes education and self-regulation activities	Pre-intervention measures	Self-efficacy and self-management behaviour	1.25
Wright Nunes et al (2013)[49]	556	(1-5), 18 years of age or over.	Single centre, USA	Physician delivered 1-page educational worksheet during clinic visits	Usual care (historical cohort group)	Knowledge about kidney disease	18
Walker et al (2014)[52] [§]	52	(2), >18 years of age, with diabetes and / or hypertension	Multicentre, New Zealand	An education and implementation program of individualized care plans	Pre-intervention measures	Proteinuria (albumin / creatinine ratio)	12
Chen et al (2013)[36]	1056	(4-5), 20 – 80 years of age.	Multicentre, Taiwan	Multidisciplinary care based on K/DOQI guidelines and pre-ESRD care program.	Usual care	Dialysis initiation Mortality	36

Abbreviations: SD – standard deviation; eGFR – estimated glomerular filtration rate; BP – blood pressure; MI – myocardial infarct; CV – cardiovascular; ESRD – end-stage renal disease; TTM – Transtheoretical Model; DVD – digital versatile disc; CVD – cardiovascular disease; CALD – culturally and linguistically diverse; RRT – renal replacement therapy.

Note:
[†] Binik[29] has an extended study, results are reported in Devins et al[63]
[‡] Van Zuilen[47] has an extended follow-up study, some results are reported in Peeters et al[64]
[§] Walker[52] was written first but published after the second Walker et al[65] paper

Table 6.2 Characteristics of the education interventions

Characteristics	Randomized controlled studies (n=12) (%)	Non-randomized studies (n=13) (%)
Setting		
One-on-one	12 (100)	7 (54)
Group	3 (25)	10 (77)
Patient with family	0 (0)	4 (31)
Delivery technique		
Face-to-face (slide-lectures, counselling, interviews)	12 (100)	13 (100)
Telecommunication [phone, DVD]	7 (58)	6 (46)
Written	11 (92)	8 (62)
Other (medication charts, patient diary)	2 (17)	5 (38)
Teaching method		
Didactic	9 (75)	12 (92)
Goal-setting – dictated	4 (33)	2 (15)
Goal-setting – negotiated (self-management)	7 (58)	5 (38)
Situational problem solving (practical skills)	3 (25)	6 (46)
Other (support group discussions, workshops)	2 (17)	8 (62)
Frequency of interventions		
Once only	5 (42)	3 (23)
Weekly	3 (25)	3 (23)
Fortnightly	3 (25)	3 (23)
Monthly	4 (33)	3 (23)
3^{rd} – 6^{th} monthly	2 (17)	4 (31)
Unspecified / Unclear	1 (8)	1 (8)
Quantity of teaching episodes (n)		
1 - 5	6 (50)	3 (23)
6 - 10	0 (0)	6 (46)
>10	1 (8)	0 (0)
Unspecified / Unclear	5 (42)	4 (31)
Duration per episode (minutes)		
<60	1 (8)	0 (0)
60 - 90	3 (25)	5 (38)
91 – 150	0 (0)	3 (23)
Variable duration	5 (42)	4 (31)
Unspecified / Unclear	5 (42)	4 (31)
Total duration of intervention (months)		
< 3	1 (8)	3 (23)
3 ≥ ≤ 12	6 (50)	5 (38)
13 > ≤ 24	2 (17)	0 (0)
Unspecified / Unclear	3 (25)	5 (38)
Content		
Kidney physiology / pathology / treatment	3 (25)	11 (85)
Diet and kidney failure	3 (25)	11 (85)
Pharmacological and medical protocols	2 (17)	0 (0)
Nutrition counselling / dietician advice	5 (42)	10 (77)
Lifestyle modification (weight / smoking)	5 (42)	10 (77)
Exercise program / information / participation	5 (42)	4 (31)
Medication management / adherence	5 (42)	8 (62)
Self-management skills	6 (50)	7 (54)
Self-monitored blood pressure	3 (25)	2 (15)
Self-management nutritional needs	4 (33)	2 (15)
Guideline implementation	1 (8)	1 (8)
Psychosocial / psychological adaptation	0 (0)	4 (31)
Educator		
Social worker	2 (17)	5 (38)
Nephrologist	6 (50)	11 (85)
Dietician	5 (42)	9 (69)
Nurse	7 (58)	11 (85)
General practitioner	2 (17)	1 (8)
Patient volunteers / mentors	1 (8)	5 (38)
Other (health educator, research assistant, interpreter, pharmacist, physiotherapist)	5 (42)	4 (31)

Table 6.3 Effect size for primary outcomes

Primary outcome	Study	Intervention	Control	Risk Ratio [95%CI]	Mean Difference [95%CI]	P – value [ ]*	Direction
Quality of life / Psychosocial function							
Quality of life measured with EQ-5D	Van Zuilen[47]	-	-	-	-	[0.79]	↔
Global quality of life - mean (±SD)	Yen[35]	2.6 (0.8)	3.1 (0.6)	-	-0.50 [-0.74, -0.26]	<0.001	↓
Depression - adjusted mean (±SD)	***Kao[33]***	**8.99 (1.21)**	**9.95 (1.19)**	**-**	**-0.96 [-1.45, -0.47]**	***<0.001***	↑
Fatigue - adjusted mean (±SD)	***Kao[33]***	**48.75 (2.82)**	**51.76 (2.80)**	**-**	**-3.01 [-4.15, -1.87]**	***<0.001***	↑
Improved nutritional status	***Campbell[39]***	**-**	**-**	**-**	**-**	***< 0.01***	↑
Symptoms of CKD - (mean change for scores)	Campbell[39] †	-	-	-	7.1 [0.1, 14.1]	[0.05]	↔
Cognitive functioning - (mean change for scores)	***Campbell[39] †***	**-**	**-**	**-**	**14.6 [5.4, 23.7]**	***[0.003]***	↑
Vitality (difference in mean change for scores)	***Campbell[39] †***	**-**	**-**	**-**	**12.0 [4.6, 19.5]**	***[0.002]***	↑
Social function - problem solving	***Gutierrez[43]***	**-**	**-**	**-**	**-**	***[<0.001]***	↑
Emotional function – control of fear	***Gutierrez[43]***	**-**	**-**	**-**	**-**	***[<0.001]***	↑
Coping: decrease in stress - mean (±SD)	***Gutierrez[44]***	**3.4 (0.9)**	**1.3 (0.5)**	**-**	**2.10 [1.78, 2.42]**	***<0.001***	↑
Seeks information about illness - mean (±SD)	***Gutierrez[44]***	**3.7 (0.9)**	**2.3 (0.90)**	**-**	**1.40 [1.01, 1.79]**	***<0.001***	↑
Seeks information to reduce fear - mean (±SD)	***Gutierrez[44]***	**3.6 (0.9)**	**2.2 (0.9)**	**-**	**1.40 [1.01, 1.79]**	***<0.001***	↑
Controls fear response - mean (±SD)	***Gutierrez[44]***	**3.5 (1.0)**	**1.7 (0.5)**	**-**	**1.80 [1.46, 2.14]**	***<0.001***	↑
State-Trait Anxiety Inventory – mean (±SD)	***Gutierrez[44]***	**16.8 (10.6)**	**24.8 (11.7)**	**-**	**-8.00 [-12.83, -3.17]**	***<0.001***	↑
Knowledge							
About CKD and treatment - score (±SD)	***Binik[29]***	**2.62 (2.47)**	**-0.26 (2.06)**	**-**	**2.88 [2.21, 3.55]**	***<0.001***	↑
About renal function - mean (±SD)	*Yen[35]*	84.2 (6.0)	85.6 (6.0)	-	-1.40 [-4.10, 1.30]	0.18	↔
About renal disease and medical treatment (score)	***Gutierrez[43]***	**3.7**	**2.0**	**-**	**-**	***[<0.001]***	↑
About CKD and management (mean score)	***Aguilera[42]***	**9.3**	**7.0**	**-**	**-**	***[0.01]***	↑
About CKD management – mean (±SD)	***Choi[51]***	**15.41 (2.32)**	**11.40 (3.82)**	**-**	**4.01 [2.42, 5.60]**	***<0.001***	↑
About renal protection	Teng[38]	-	-	-	-	0.20	↔
Kidney Knowledge Survey – general score	Wright Nunes[49]	-	-	-	-	0.5	↔
Self-management / lifestyle modification							
Dietician involvement (%)	Barrett[28]	21	13	-	-	[0.09]	↔
Physical activity (%)	Van Zuilen[47]	62	58	-	3.8 [-1.30, 8.90]	[0.15]	↔
Smoking (%)	Van Zuilen[47]	14	14	-	0.0 [-0.01, 0.01]	[0.73]	↔
Self-efficacy scale score - mean (±SD)	**Kazawa[46]**	**80.9 (9.0)**	**77.8 (9.2)**	**-**	**3.10 [-1.51, 7.71]**	**0.19 [0.01]**	↑
Exercise behaviour modification - adj mean (±SD)	**Kao[33]**	**12.82 (2.75)**	**10.38 (2.73)**	**-**	**2.44 [1.33, 3.55]**	**<0.001**	↑
Medication adherence (%)	Williams[41]	58.4	66	-	-	[0.16]	↔
Medication adherence	Williams[40]	-	-	-	-	>0.05	↔

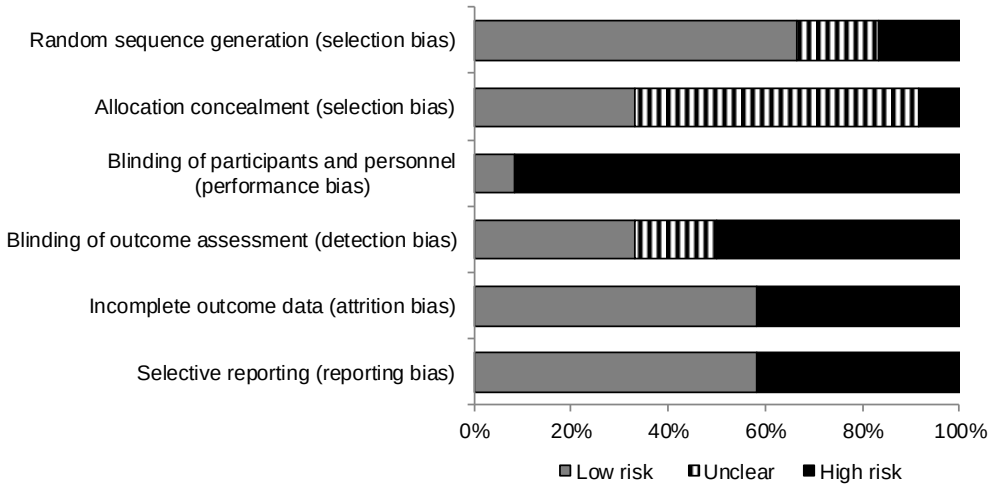
Primary outcome	Study	Intervention	Control	Risk Ratio [95%CI]	Mean Difference [95%CI]	P – value [ ]*	Direction
Self-efficacy behaviour (mean score)	**Lin[37]**	**231.78**	**218.48**	**-**	**13.55 [2.63, 24.48]**	**[0.01]**	↑
Self-management behaviour (mean score)	Lin[37]	88.68	87.45	-	-	[0.66]	↔
Self-care practice – mean (±SD)	Choi[51]	3.88 (0.41)	3.85 (0.42)	-	0.03 [-0.18, 0.24]	0.78	↔
Adherence to low protein diet – n (%)	Paes-Barreto[50]	29 (69)	22 (47.8)	1.41 [0.98, 2.03]	-	0.06	↔
Change in protein intake	**Paes-Barreto[50]**	**-**	**-**	**-**	**-**	**0.04**	↑
Diet lifestyle behavioural change	**Teng[38]**	**-**	**-**	**-**	**-**	**0.001**	↑
Exercise lifestyle behavioural change	Teng[38]	-	-	-	-	0.08	↔
Clinical endpoints							
Survival							
Survival from time of intervention (mean years)	Devins[63] ‡	9.36	7.96	HR 1.32 [1.00, 1.74]	-	[0.05]	↔
Survival after initiation of dialysis (mean years)	**Devins[63] ‡**	**6.52**	**5.67**	**HR 1.35 [1.02, 1.78]**	**-**	**[0.04]**	↑
MI, stroke, CV mortality – rate/1000 person-years	Van Zuilen[47]	21.3	23.8	HR 0.90[0.58, 1.39]	-	[0.63]	↔
Death, ESRD, 50% SCr increase - events/n	**Peeters[64] §**	**180/395**	**208/393**	**0.86 [0.75, 0.99]**	**-**	**0.04**	↑
All-cause mortality – events/n (%)	**Wu[34]**	**5/287 (1.7)**	**29/286 (10)**	**0.17 [0.07, 0.44]**	**-**	**<0.001**	↑
Hospitalization – events/n (%)	**Chen[32]**	**5/27 (18.5)**	**12/27 (44.47)**	**0.42 [0.17, 1.02]**	**-**	**0.06 [<0.05]**	↑
Mortality – events/n (%)	Chen[36]	17/528 (3.2)	30/528 (5.7)	0.57 [0.32, 1.01]	-	0.05	↔
Dialysis							
Time from intervention to dialysis start - mean (±SD)	**Binik[29]**	**14.9 (12.44)**	**10.3 (11.78)**	**-**	**4.60 [1.05, 8.15]**	**0.01**	↑
Patients starting dialysis – events/n (%)	**Devins[30]**	**89/149 (59.7)**	**106/148 (71.6)**	**0.83 [0.71, 0.98]**	**-**	**0.03**	↑
Patients requiring dialysis – events/n (%)	**Wu[34]**	**40/287 (13.9)**	**123/286 (43)**	**0.32 [0.24, 0.44]**	**-**	**<0.001**	↑
Fistula placement – events/n (%)	**Slowik[48]**	**25/57 (43)**	**8/57 (14)**	**3.13 [1.54, 6.33]**	**-**	**0.001**	↑
Patients starting dialysis – events/n (%)	**Chen[36]**	**46/528 (8.7)**	**21/528 (4.0)**	**2.19 [1.33, 3.62]**	**-**	**0.002**	↑
eGFR							
eGFR decline ≥4 ml/min/1.73m^2 – events/n (%)	Barrett[28]	28/238 (11.8)	23/236 (9.7)	1.21 [0.72, 2.03]	-	0.48	↔
MDRD (ml/min/1.73m^2)	Van Zuilen[47]	36.6	35.8	-	0.82 [-0.14, 1.78]	[0.10]	↔
eGFR (ml/min/1.73m^2) - mean (±SD)	**Chen[32]**	**29.11 (20.3)**	**15.72 (10.67)**	**-**	**13.39 [4.74, 22.04]**	**0.004**	↑
eGFR (≤10% reduction) – events/n (%)	Flesher[31]	19/23 (82.6)	8/17 (47.1)	1.76 [1.03, 3.01]	-	0.04 [0.21]	↔
eGFR (ml/min) – mean (±SD)	Jia[45]	37 (16)	38 (15)	-	-1.00 [-4.50, 2.50]	0.58	↔
eGFR (ml/min/1.73m^2) - mean (±SD)	Yen[35]	41.2 (11.7)	42.1 (10.6)	-	-0.90 [-4.71, 2.91]	0.64	↔
eGFR (ml/min/1.73m^2) – mean (±SD)	Kazawa[46]	34.8 (15)	33.2 (11.6)	-	1.60 [-5.19, 8.39]	0.64 [0.40]	↔
Change in eGFR – mean (±SD)	Choi[51]	-0.37 (5.81)	-0.06 (4.89)	-	-0.31 [-3.00, 2.38]	0.82	↔
Blood pressure							
BP ≤ 130/80 (mmHg) – events/n (%)	Barrett[28]	81/128 (63.2)	64/136 (47)	1.34 [1.08, 1.68]	-	0.01 [0.76]	↔

Primary outcome	Study	Intervention	Control	Risk Ratio [95%CI]	Mean Difference [95%CI]	P – value [ ]*	Direction
Mean systolic BP (mmHg)	**Van Zuilen[47]**	**132**	**135**	**-**	**-3 [-4.51, -1.49]**	**[<0.001]**	↑
Mean diastolic BP(mmHg)	**Van Zuilen[47]**	**77**	**79**	**-**	**-2 [-2.88, -1.12]**	**[<0.001]**	↑
Reduced systolic BP by ≥13 mmHg and diastolic BP by ≥8 mmHg – events/n (%)	Flesher[31]	14/23 (60.9)	3/17 (17.6)	3.45 [1.17, 10.14]	-	0.02 [0.07]	↔
Systolic BP reduction (mmHg) – mean [95%CI:]	Williams[41]	-6.9 [-13.8,0.02]	-3.0 [-8.4,2.4]	-	-	[0.37]	↔
Diastolic BP reduction (mmHg) - mean [95%CI:]	Williams[41]	-2.25 [-5.2,0.7]	-3.1 [-5.9, -0.3]	-	-	[0.68]	↔
Systolic BP (mmHg) – mean (±SD)	Jia[45]	128 (15)	131 (15)	-	-3.00 [-6.39, 0.39]	0.08 [0.05]	↔
Diastolic BP (mmHg) - mean (±SD)	**Jia[45]**	**72 (9)**	**77 (10)**	**-**	**-5.00 [-7.16, -2.84]**	**<0.001 [0.03]**	↑
Systolic BP (mmHg) - mean (±SD)	Yen[35]	141.9 (15.9)	141.5 (16.0)	-	0.40 [-5.04, 5.84]	0.89	↔
Diastolic BP (mmHg) - mean (±SD)	Yen[35]	84.7 (7.6)	84.2 (8.3)	-	0.50 [-2.22, 3.22]	0.72	↔
Systolic BP (mmHg) - mean (±SD)	Kazawa[46]	130 (14.4)	134.1 (18.4)	-	-4.10 [-12.46, 4.26]	0.34 [0.59]	↔
Diastolic BP (mmHg) - mean (±SD)	Kazawa[46]	69.6 (10)	72.2 (11.5)	-	-2.60 [-8.05, 2.85]	0.35 [0.44]	↔
Biochemical markers							
LDL<2.5 (mmol/L) – events/n (%)	Barrett[28]	78/122 (63.9)	76/128 (59.4)	1.08 [0.89, 1.31]	-	0.46 [0.74]	↔
HbA_{1c} ≤ 7.0% in diabetics – events/n (%)	Barrett[28]	40/49 (81.6)	43/52 (82.7)	0.99 [0.82, 1.18]	-	0.89 [0.76]	↔
Hb ≥ 105 (g/L) – events/n (%)	Barrett[28]	125/128 (97.7)	130/136 (95.6)	1.02 [0.98, 1.07]	-	0.35 [0.64]	↔
Low-density lipoprotein - mean (mmol/L)	**Van Zuilen[47]**	**2.39**	**2.50**	**-**	**-0.11 [-0.18, -0.03]**	**[0.01]**	↑
HbA_{1c} in diabetics (%)	Van Zuilen[47]	7.0	7.1	-	0.10 [-0.08, 0.28]	[0.25]	↔
Urinary protein (≥25% reduction) – events/n (%)	Flesher[31]	12/23 (52.2)	8/17 (47.1)	1.11 [0.59, 2.10]	-	0.75 [0.54]	↔
Albumin level on dialysis start (µg/dL) – mean (±SD)	**Slowik[48]**	**3.9 (0.7)**	**3.5 (0.6)**	**-**	**0.40 [0.16, 0.64]**	**0.001 [<0.05]**	↑
Haemoglobin (g/L) - mean (±SD)	**Jia[45]**	**119 (26.6)**	**115.6 (21.2)**	**-**	**3.60 [-1.80, 9.0]**	**0.20 [0.03]**	↑
Serum albumin (g/L) - mean (±SD)	**Jia[45]**	**43.3 (3.78)**	**40.9 (4.01)**	**-**	**2.40 [1.52, 3.28]**	**<0.001 [0.04]**	↑
Serum creatinine - mean (±SD)	Yen[35]	2.1 (0.7)	2.1 (0.5)	-	0.00 [-0.21, 0.21]	1.00	↔
HbA_{1c} (%) - mean (±SD)	**Kazawa[46]**	**6.3 (0.9)**	**6.6 (1.1)**	**-**	**-0.30 [-0.81, 0.21]**	**0.25 [0.04]**	↑
Decrease in proteinuria (ACR) (mg/mmol/month)	**Walker[52]**	**-**	**-**	**-**	**-**	**0.002**	↑

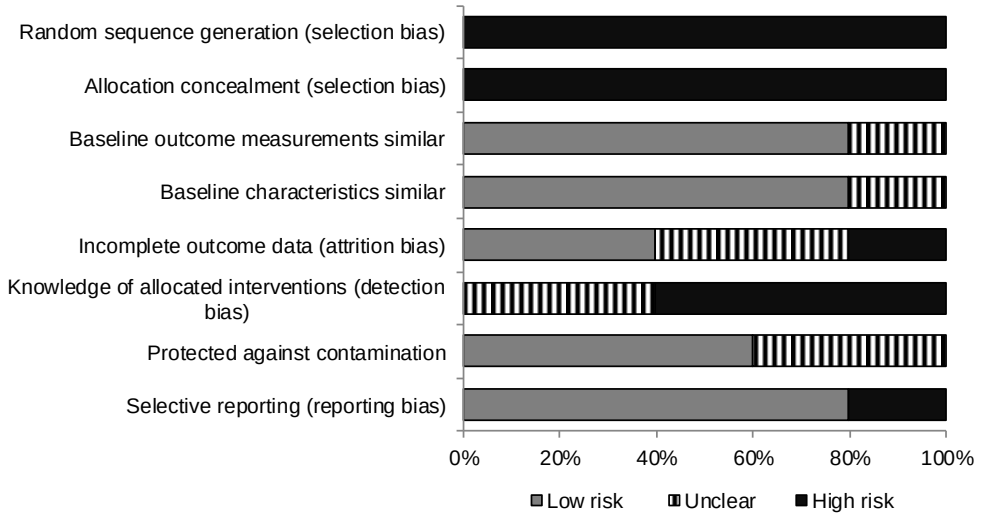
Abbreviations: EQ-5D – European Quality of Life-5 Dimensions; SD - standard deviation; CKD – chronic kidney disease; MI – myocardial infarction; CV – cardiovascular; ESRD – end-stage renal disease; SCr – serum creatinine; eGFR- estimated Glomerular Filtration Rate; MDRD – Modification of Diet in Renal Disease formula; BP – Blood Pressure; 95%CI – 95% confidence interval; LDL – Low Density Lipoprotein; HbA1c – glycated haemoglobin; Hb – haemoglobin; ACR – albumin / creatinine ratio

Note: [ ]* = p-values provided by the respective studies, which have been calculated using a number of statistical tests including, Fisher's exact test[31], Friedman test[46], adjusted for baseline measurements[28], two-group T-test and chi-square statistics[48]. These may differ from the P value calculated in this assessment.
[†]Difference in mean change as provided in the study.
[‡] Cox proportional hazards as provided by Devins et al[63], this study was an extension of Binik et al[29].
[§] Results provided by Peeters et al[64], this was an extension of the van Zuilen et al[47] study.

a)



b)



c)

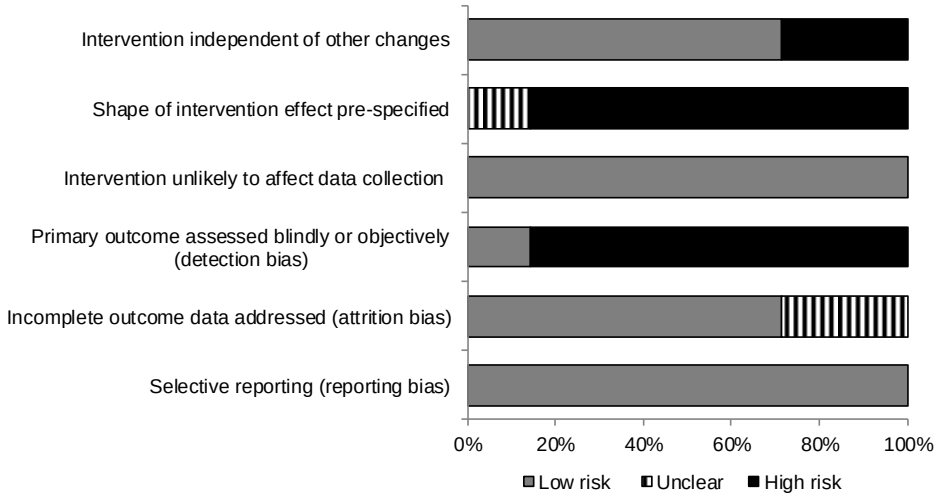
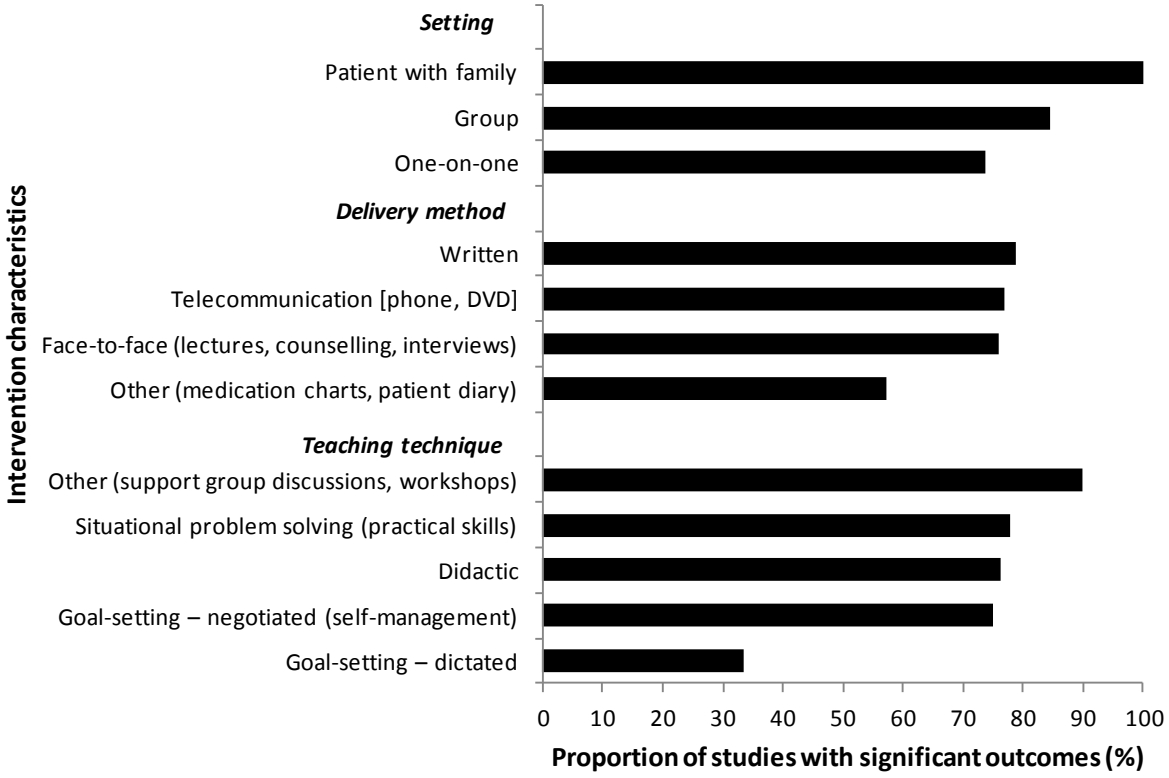
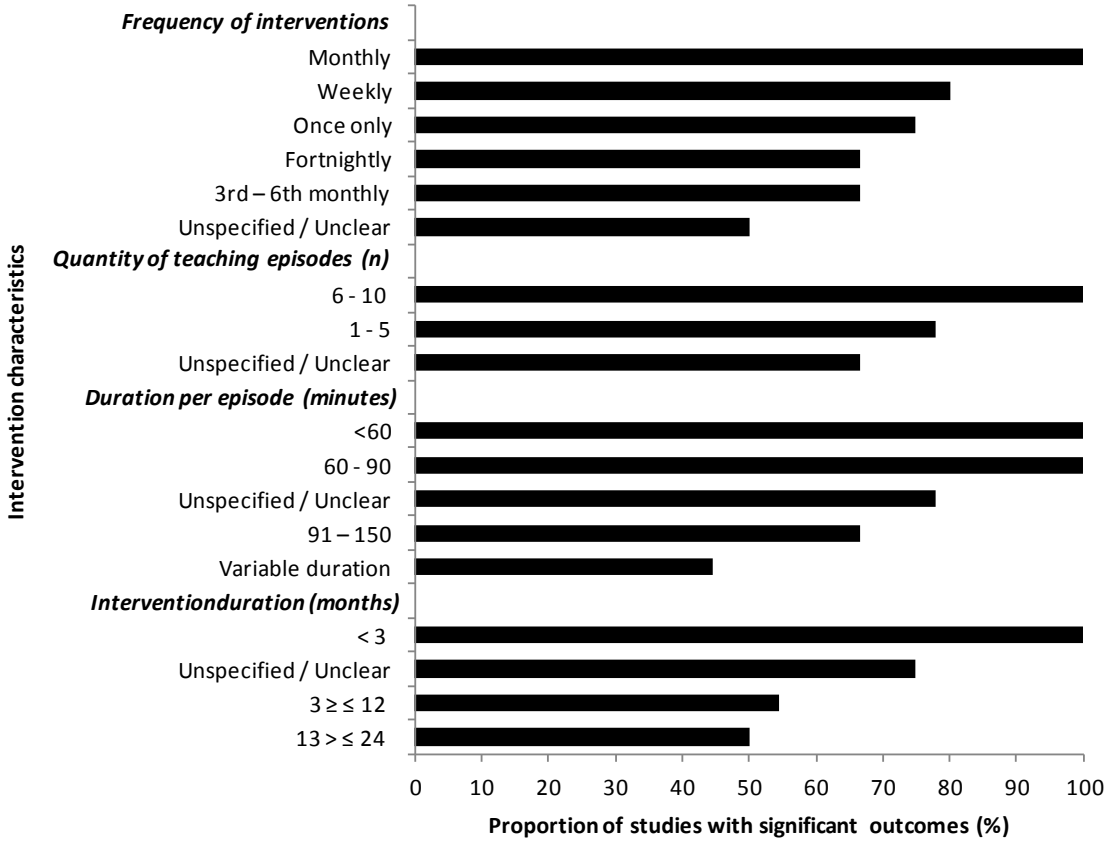


Figure 6.1 Combined risk of bias for each study type – a) randomised controlled trials; b) controlled before and after studies; and c) interrupted time series

a)


Setting
Patient with family
Group
One-on-one
Delivery method
Written
Telecommunication [phone, DVD]
Face-to-face (lectures, counselling, interviews)
Other (medication charts, patient diary)
Teaching technique
Other (support group discussions, workshops)
Situational problem solving (practical skills)
Didactic
Goal-setting – negotiated (self-management)
Goal-setting – dictated
Intervention characteristics
0 10 20 30 40 50 60 70 80 90 100
Proportion of studies with significant outcomes (%)

b)


Frequency of interventions
Monthly
Weekly
Once only
Fortnightly
3rd – 6th monthly
Unspecified / Unclear
Quantity of teaching episodes (n)
6 - 10
1 - 5
Unspecified / Unclear
Duration per episode (minutes)
<60
60 - 90
Unspecified / Unclear
91 – 150
Variable duration
Interventionduration (months)
< 3
Unspecified / Unclear
3 ≥ ≤ 12
13 > ≤ 24
Intervention characteristics
0 10 20 30 40 50 60 70 80 90 100
Proportion of studies with significant outcomes (%)

c)

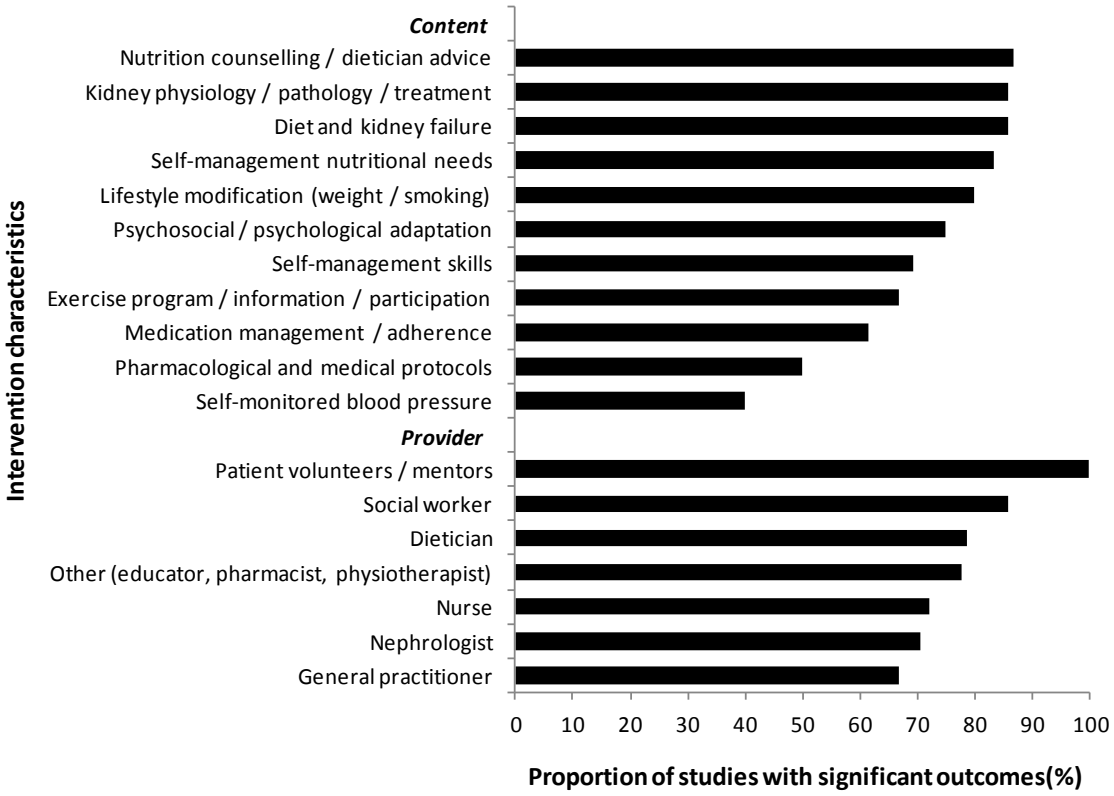


Figure 6.2 Characteristics of interventions where a significant improvement in at least one primary outcome was reported in a study. The proportion shown is for the number of studies that included the specific characteristic for: a) mode of delivery b) intensity c) content / educator.

6.6 References

1. Coresh J, Turin T, Matsushita K, et al. Decline in estimated glomerular filtration rate and subsequent risk of end-stage renal disease and mortality. *JAMA*. 2014;311(24):2518-31.
2. Das M, Aronow WS, McClung JA, Belkin RN. Increased prevalence of coronary artery disease, silent myocardial ischemia, complex ventricular arrhythmias, atrial fibrillation, left ventricular hypertrophy, mitral annular calcium, and aortic valve calcium in patients with chronic renal insufficiency. *Cardiol Rev*. 2006;14(1):14-7.
3. Foley RN. Clinical epidemiology of cardiovascular disease in chronic kidney disease. *J Ren Care*. 2010;36 Suppl 1:4-8.
4. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu C-y. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. *N Engl J Med*. 2004;351(13):1296-305.
5. Hemmelgarn BR, Manns BJ, Lloyd A, et al. RElation between kidney function, proteinuria, and adverse outcomes. *JAMA*. 2010;303(5):423-9.
6. Herzog CA, Asinger RW, Berger AK, Charytan DM, Díez J, Hart RG, et al. Cardiovascular disease in chronic kidney disease. A clinical update from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney Int*. 2011;80(6):572-86.
7. Levin A, Stevens PE. Early detection of CKD: The benefits, limitations and effects on prognosis. *Nat Rev Nephrol*. 2011;7(8):446-57.
8. Matsushita K, van der Velde M, Astor BC, Woodward M, Levey AS, de Jong PE, et al. Association of estimated glomerular filtration rate and albuminuria with all-cause and cardiovascular mortality: a collaborative meta-analysis of general population cohorts. *Lancet*. 2010;375(9731):2073.
9. Tong A, Sainsbury P, Chadban S, Walker R, Harris D, Carter S, et al. Patients' experiences and perspectives of living with CKD. *Am J Kidney Dis*. 2009;53:689 - 700.
10. van der Velde M, Matsushita K, Coresh J, Astor BC, Woodward M, Levey A, et al. Lower estimated glomerular filtration rate and higher albuminuria are associated with all-cause and

cardiovascular mortality. A collaborative meta-analysis of high-risk population cohorts. *Kidney Int*. 2011;79(12):1341-52.

11. Wen CP, Cheng TYD, Tsai MK, Chang YC, Chan HT, Tsai SP, et al. All-cause mortality attributable to chronic kidney disease: a prospective cohort study based on 462 293 adults in Taiwan. *Lancet*. 2008;371(9631):2173-82.
12. Tuot DS, Plantinga LC, Hsu C-y, Jordan R, Burrows NR, Hedgeman E, et al. Chronic kidney disease awareness among individuals with clinical markers of kidney dysfunction. *CJASN*. 2011;6(8):1838-44.
13. Finkelstein FO, Story K, Firanek C, Barre P, Takano T, Soroka S, et al. Perceived knowledge among patients cared for by nephrologists about chronic kidney disease and end-stage renal disease therapies. *Kidney Int*. 2008;74(9):1178-84.
14. Lash JP, Go AS, Appel LJ, He J, Ojo A, Rahman M, et al. Chronic Renal Insufficiency Cohort (CRIC) Study: baseline characteristics and associations with kidney function. *CJASN*. 2009;4(8):1302-11.
15. Ricardo AC, Anderson CA, Yang W, Zhang X, Fischer MJ, Dember LM, et al. Healthy Lifestyle and Risk of Kidney Disease Progression, Atherosclerotic Events, and Death in CKD: Findings From the Chronic Renal Insufficiency Cohort (CRIC) Study. *Am J Kidney Dis*. 2015;65(3):412-24.
16. Costantini L, Beanlands H, McCay E, Cattran D, Hladunewich M, Francis D. The self-management experience of people with mild to moderate chronic kidney disease. *Nephrol Nurs J*. 2008;35(2):147.
17. Levey AS, Schoolwerth AC, Burrows NR, Williams DE, Stith KR, McClellan W. Comprehensive Public Health Strategies for Preventing the Development, Progression, and Complications of CKD: Report of an Expert Panel Convened by the Centers for Disease Control and Prevention. *Am J Kidney Dis*. 2009;53(3):522-35.

18. Lindström J, Eriksson JG, Valle TT, Aunola S, Cepaitis Z, Hakumäki M, et al. Prevention of diabetes mellitus in subjects with impaired glucose tolerance in the Finnish Diabetes Prevention Study: results from a randomized clinical trial. *J Am Soc Nephrol*. 2003;14(suppl 2):S108-S13.

19. Molitch ME, Fujimoto W, Hamman RF, Knowler WC. The diabetes prevention program and its global implications. *J Am Soc Nephrol*. 2003;14(suppl 2):S103-S7.

20. Zhu LX, Ho SC, Wong TK. Effectiveness of health education programs on exercise behavior among patients with heart disease: a systematic review and meta-analysis. *Journal of Evidence-Based Medicine*. 2013;6(4):265-301.

21. Mason J, Khunti K, Stone M, Farooqi A, Carr S. Educational interventions in kidney disease care: a systematic review of randomized trials. *Am J Kidney Dis*. 2008;51(6):933-51.

22. Bonner A, Havas K, Douglas C, Thepha T, Bennett P, Clark R. Self-management programmes in stages 1-4 chronic kidney disease: a literature review *J Ren Care*. 2014;40(3):194-204.

23. Liberati A, Altman DG, Tetzlaff J, Mulrow C, Gøtzsche PC, Ioannidis JP, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *Ann Intern Med*. 2009;151(4):W-65-W-94.

24. Higgins JPT, Green, S. (eds),. *Cochrane handbook for systematic reviews of interventions.* Chichester: John Wiley & Sons Ltd; 2008.

25. Effective Practice and Organisation of Care (EPOC). Suggested risk of bias criteria for EPOC reviews. EPOC Resources for review authors. 2014; (30 October): Available from: http://epocoslo.cochrane.org/epoc-specific-resources-review-authors.

26. Ramsay CR, Matowe L, Grilli R, Grimshaw JM, Thomas RE. Interrupted time series designs in health technology assessment: lessons from two systematic reviews of behavior change strategies. *Int J Technol Assess Health Care*. 2003;19(04):613-23.

27. Elasy TA, Ellis SE, Brown A, Pichert JW. A taxonomy for diabetes educational interventions. *Patient Educ Couns*. 2001;43(2):121-7.

28. Barrett BJ, Garg AX, Goeree R, Levin A, Molzahn A, Rigatto C, et al. A nurse-coordinated model of care versus usual care for stage 3/4 chronic kidney disease in the community: a randomized controlled trial. *CJASN*. 2011;6(6):1241-7.

29. Binik YM, Devins GM, Barre PE, Guttmann RD, Hollomby DJ, Mandin H, et al. Live and learn: patient education delays the need to initiate renal replacement therapy in end-stage renal disease. *The Journal of nervous and mental disease*. 1993;181(6):371-6.

30. Devins GM, Mendelssohn DC, Barré PE, Binik YM. Predialysis psychoeducational intervention and coping styles influence time to dialysis in chronic kidney disease. *Am J Kidney Dis*. 2003;42(4):693-703.

31. Flesher M, Woo P, Chiu A, Charlebois A, Warburton DE, Leslie B. Self-management and biomedical outcomes of a cooking, and exercise program for patients with chronic kidney disease. *J Ren Nutr*. 2011;21(2):188-95.

32. Chen SH, Tsai YF, Sun CY, Wu IW, Lee CC, Wu MS. The impact of self-management support on the progression of chronic kidney disease - A prospective randomized controlled trial. *NDT*. 2011;26(11):3560-6.

33. Kao Y-H, Huang Y-C, Chen P-Y, Wang K-M. The effects of exercise education intervention on the exercise behaviour, depression, and fatigue status of chronic kidney disease patients. . *Health Educ* [serial on the Internet]. 2012; (6): Available from: http://onlinelibrary.wiley.com/o/cochrane/clcentral/articles/837/CN-00852837/frame.html.

34. Wu IW, Wang SY, Hsu KH, Lee CC, Sun CY, Tsai CJ, et al. Multidisciplinary predialysis education decreases the incidence of dialysis and reduces mortality-a controlled cohort study based on the NKFDOQI guidelines. *NDT*. 2009;24(11):3426-33.

35. Yen M, Huang J, Teng H. Education for patients with chronic kidney disease in Taiwan: a prospective repeated measures study. *J Clin Nurs*. 2008;17(21):2927-34.

36. Chen Y-R, Yang Y, Wang S-C, Chiu P-F, Chou W-Y, Lin C-Y, et al. Effectiveness of multidisciplinary care for chronic kidney disease in Taiwan: a 3-year prospective cohort study. *NDT*. 2013;28:671-82.

37. Lin C-C, Tsai F-M, Lin H-S, Hwang S-J, Chen H-C. Effects of a self-management program on patients with early-stage chronic kidney disease: A pilot study. *Appl Nurs Res*. 2013;26(3):151-6.

38. Teng HL, Yen M, Fetzer S, Sung JM, Hung SY. Effects of Targeted Interventions on Lifestyle Modifications of Chronic Kidney Disease Patients: Randomized Controlled Trial. *West J Nurs Res*. 2013;35(9):1107-27.

39. Campbell KL, Ash S, Bauer JD. The impact of nutrition intervention on quality of life in pre-dialysis chronic kidney disease patients. *Clin Nutr*. 2008;27(4):537-44.

40. Williams A, Manias E, Liew D, Gock H, Gorelik A. Working with CALD groups: testing the feasibility of an intervention to improve medication self- management in people with kidney disease, diabetes, and cardiovascular disease. *RSA Journal*. 2012;8(2):62-9.

41. Williams A, Manias E, Walker R, Gorelik A. A multifactorial intervention to improve blood pressure control in co-existing diabetes and kidney disease: a feasibility randomized controlled trial. *J Adv Nurs*. 2012;68(11):2515-25.

42. Aguilera Flores I, Prieto Velasco M, González Romero L, Abad Toral B, Martínez Crespo E, Israel, et al. A little-used strategy in caring for patients with chronic kidney disease: multidisciplinary education of patients and their relatives [Spanish]. *Revista de la Sociedad Española de Enfermería Nefrológica*. 2012;15(1):14-21.

43. Gutierrez Vilaplana JM, Samso Pinol E, Cosi Ponsa J. Evaluation of the teaching intervention: group in the advanced chronic kidney disease clinic [Spanish]. *Revista de la Sociedad Española de Enfermería Nefrológica*. 2007;10(4):24-9.

44. Gutiérrez Vilaplana JM, Zampieron A, Craver L, Buja A. Evaluation of psychological outcomes following the intervention 'Teaching Group': study on predialysis patients. *J Ren Care*. 2009;35(3):159-64.

45. Jia T, Bi SH, Lindholm B, Wang T. Effect of multi-dimensional education on disease progression in pre-dialysis patients in China. *Ren Fail*. 2012;34(1):47-52.

46. Kazawa K, Moriyama M. Effects of a Self-Management Skills- Acquisition Program on Pre-Dialysis Patients with Diabetic Nephropathy. *Nephrol Nurs J*. 2013;40(2):141-8.

47. van Zuilen AD, Bots ML, Dulger A, van der Tweel I, van Buren M, ten Dam MAGJ, et al. Multifactorial intervention with nurse practitioners does not change cardiovascular outcomes in patients with chronic kidney disease. *Kidney Int*. 2012;82(6):710-7.

48. Slowik MM. Early education of patients with chronic renal insufficiency: the Healthy Start program. Case study of the anemic patient. *Nephrology Nursing Journal: Journal of the American Nephrology Nurses' Association*. 2001;28(6):643-6.

49. Wright Nunes J, Greene JH, Wallston K, Eden S, Shintani A, Elasy T, et al. Pilot Study of a Physician-Delivered Education Tool to Increase Patient Knowledge About CKD. *Am J Kidney Dis*. 2013;62(1):23-32.

50. Paes-Barreto JG, Silva MI, Qureshi AR, Bregman R, Cervante VF, Carrero JJ, et al. Can renal nutrition education improve adherence to a low-protein diet in patients with stages 3 to 5 chronic kidney disease? *J Ren Nutr*. 2013;23(3):164-71.

51. Choi ES, Lee J. Effects of a Face-to-face Self-management Program on Knowledge, Self-care Practice and Kidney Function in Patients with Chronic Kidney Disease before the Renal Replacement Therapy. *Journal of Korean Academy of Nursing*. 2012;42(7):1070-8.

52. Walker RC, Marshall MR, Polaschek NR. A prospective clinical trial of specialist renal nursing in the primary care setting to prevent progression of chronic kidney: a quality improvement report. *BMC Fam Pract*. 2014;15(1):155.

53. Kirkham JJ, Dwan KM, Altman DG, Gamble C, Dodd S, Smyth R, et al. The impact of outcome reporting bias in randomised controlled trials on a cohort of systematic reviews. *BMJ*. 2010;340:c365.

54. Schulz KF, Chalmers I, Hayes RJ, Altman DG. Empirical evidence of bias: Dimensions of methodological quality associated with estimates of treatment effects in controlled trials. *JAMA*. 1995;273(5):408-12.

55. Hayslip DM, Suttle CD. Pre-ESRD patient education: a review of the literature. *Adv Ren Replace Ther*. 1995;1:217-26.

56. Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJM, Gavaghan DJ, et al. Assessing the quality of reports of randomized clinical trials: Is blinding necessary? *Control Clin Trials*. 1996;17(1):1-12.

57. Cooper H, Booth K, Fear S, Gill G. Chronic disease patient education: lessons from meta-analyses. *Patient Educ Couns*. 2001;44(2):107-17.

58. Glasziou P, Chalmers I, Altman DG, Bastian H, Boutron I, Brice A, et al. Taking healthcare interventions from trial to practice. *BMJ*. 2010;341(c3852):384-7.

59. Johnson DW, Atai E, Chan M, Phoon RKS, Scott C, Toussaint ND, et al. KHA-CARI guideline: Early chronic kidney disease: Detection, prevention and management. *Nephrology*. 2013;18(5):340-50.

60. National Collaborating Centre for Chronic Conditions. *Chronic kidney disease: national clinical guideline for early identification and management in adults in primary and secondary care.* London: Royal College of Physicians,2008.

61. SIGN. *Diagnosis and management of chronic kidney disease: A national clinical guideline*: Scottish Intercollegiate Guidelines Network,2008.

62. Levin A, Stevens LA. Executing change in the management of chronic kidney disease: Perspectives on guidelines and practice. *Med Clin North Am*. 2005;89(3):701-9.

63. Devins GM, Mendelssohn DC, Barré PE, Taub K, Binik YM. Predialysis psychoeducational intervention extends survival in CKD: a 20-year follow-up. *Am J Kidney Dis*. 2005;46(6):1088-98.

64. Peeters MJ, van Zuilen AD, van den Brand JAJG, Bots ML, van Buren M, ten Dam MAGJ, et al. Nurse Practitioner Care Improves Renal Outcome in Patients with CKD. *J Am Soc Nephrol*. 2014:1-9.

65. Walker R, Marshall MR, Polaschek N. Improving self-management in chronic kidney disease: a pilot study. *RSA Journal*. 2013;9(3):116-25.

Chapter 7 Discussion and Conclusions

7.1 Summary of findings

Management of chronic kidney disease (CKD) is complex. Since the kidneys are involved in detoxifying the blood, urine production, blood pressure management, bone homeostasis, red blood cell production and maintenance of the acid base balance in the body [1], their impairment will affect a series of bodily functions and organs. During the initial stages of the disease (Stages 1-3a) the patient can be asymptomatic and they may be unaware of it. However in the later stages (Stages 3b-5) patients will require medication to lower their blood pressure and lipids, and they may also require anti-platelet therapy, vitamin D supplements and uric acid lowering therapy [2]. Patients with CKD are at higher risk of dying from heart attacks and cardiovascular disease [3], and also more likely to have other comorbidities such as diabetes and hypertension [4, 5].

Chapter 3

Guidelines for early CKD provided recommendations for the detection of the disease, medical management, lifestyle modification and education. However some discrepancies surfaced relating to recommendations for diagnostic testing of eGFR, blood pressure and glucose targets, protein and albumin excretion, treatment of hypertension and proteinuria, and dietary protein intake. Recommendations for health promotion and education were noted but were unsupported with tools or specific strategies for implementation. The guidelines were found to be comprehensive and consistent in scope, but their methodologies varied. Differences between the recommendations may be attributed to the methodology used and the evidence available at the time.

Chapter 4

The modifiable risk factors for CKD include hypertension, diabetes, obesity and smoking, while the non-modifiable factors include age, family history and being of Aboriginal/ Torres Strait Islander descent or other ethnic minority. Participants in our study were aware of most modifiable risk factors but not of the non-modifiable ones. They also considered alcohol and inadequate fluid intake as risk factors for CKD. Participants believed that consequences for people with CKD would be less severe than for those with diabetes, or cardiovascular disease (CVD). These findings may help illustrate participants' 'invisible' perceptions about CKD, as many demonstrated limited understanding of the risk factors and comorbidities associated with CKD.

Chapter 5

The diagnosis of CKD was very difficult for patients to comprehend. Participants were not generally aware of the effects of CKD progression, its multiple comorbidities and often felt overwhelmed, confused and unable to control their condition. Many had fears and anxieties about the future, including dialysis and premature mortality. Participants were willing to be proactive in their own healthcare, but they had limited confidence in disease management due to lack of knowledge about their condition, or strategies to improve their outcomes. They requested early, comprehensive and practical information that focussed on learning about kidney function, dietary advice, medication safety, and managing multiple co-morbidities.

Chapter 6

Educational interventions for patients with early stage CKD are uncommon and little is known about their effectiveness or quality. In our study we were able to evaluate 25 interventions for patients with CKD Stages 1-5. Results for quality of life, psychosocial function, knowledge, self-efficacy, lifestyle modification (exercise and diet), mortality, dialysis commencement and biochemical (serum albumin, proteinuria, haemoglobin) outcomes, showed significant but inconsistent improvements. Interventions

that involved a group and patient-family setting, included practical skills, workshops and goal setting, enabled frequent patient / educator encounters, and incorporated a multidisciplinary team including patient volunteers or mentors, appeared most likely to be effective.

Studies evaluated on multiple outcomes and most had a combination of significant and minor improvements. Study design (small sample size, short study duration), inappropriate use of evaluation tools, or inadequate intervention to meet patients' needs might be possible explanations for no change or negative outcome measures. The risk of bias for blinding of participants, personnel and assessors was high, and the risk for selection bias particularly allocation concealment was unclear; this may have led to an over-estimate of the effects of the interventions in question [6, 7]

7.2 Strengths and limitations

Chapter 3

Our study is the first to systematically review clinical practice guidelines for CKD. The AGREE II instrument was used to appraise the guidelines with satisfactory agreement between two reviewers who were affiliated with the KHA-CARI guideline group. This may be seen as a geographical bias however, the AGREE II instrument is solely focussed on guideline development and the reporting of methodology, making this bias unlikely. Due to resource limitations, the non-English guidelines included in the review were not assessed for methodological rigour.

Chapters 4 and 5

We have shown how patients' perceive the risks and comorbidities associated with CKD compared to diabetes and cardiovascular disease. Patients' attitudes, beliefs and thoughts about the risk factors of CKD, comorbidities, and future health were also analysed. In addition, we were able to identify their

information needs, priorities and the reasons underpinning their preferences for information and treatment. However, there were some limitations. The sample size was small, which was probably attributed to the difficulty in recruiting patients with early stage CKD. Many did not consider they were at risk nor believed they had kidney disease. Although the study was cross-sectional and non-English speaking participants were excluded, those from different ethnic populations were included. Nevertheless, the transferability of our findings may be particularly limited for patients of culturally and linguistically diverse backgrounds.

Chapter 6

The systematic review on education interventions for patients with Stages 1-5 CKD included both randomized and non-randomized studies. We used the Cochrane Collaboration risk of bias tools, which are accepted and validated instruments to assess the quality of the studies [8, 9].[8, 9] Due to the heterogeneity of the interventions, an in-depth analysis of the intervention characteristics was conducted [10] using a taxonomy framework, previously used in educational interventions for patients with diabetes [11]. The interventions and outcomes measured were varied and therefore a formal meta-analysis could not be done. Even though the study relates to the CKD population, our findings are likely to be relevant for educational interventions in patients with other chronic diseases.

7.3 Comparison with other studies

Chapter 3

Recommendations for the detection of early CKD in terms of the risk factors, appeared to be reflective of current epidemiological data supporting the association between obesity, hypertension, cardiovascular disease, and chronic kidney disease [12, 13]. All guidelines reported angiotensin converting enzyme inhibitors (ACEi) and angiotensin receptor blockers (ARB) for the treatment of

hypertension as first line therapy, however there were explicit inconsistencies in the regimens recommended. While some guidelines recommended ACEi and ARB as monotherapy, others recommended both as combination therapy. Combination therapy has been shown to increase the risk of cardiovascular death, hypotension, renal dysfunction and hyperkalaemia [14, 15]. This evidence was not available at the time of guideline development for most of the guidelines. Inconsistencies were also found in the recommendations for glucose control, where the HbA1c target ranged from 6.5 - 7.5% and protein restriction. Evidence suggests that intensive glucose lowering is associated with complications such as hypoglycaemia [16, 17]. There was also no conclusive evidence that protein reduction would delay CKD progression [18, 19].

Chapters 4 and 5

Although participants had received information about CKD, the majority still had limited knowledge about the disease, related risk factors and comorbidities. Almost half thought alcohol intake and about three quarters believed inadequate fluid intake were risk factors for CKD. These are similar to results from previous studies where participants thought that alcohol misuse caused kidney disease [20, 21]. Patients appeared to regard diabetes and CVD as more serious conditions than CKD. They consistently indicated higher event rates for stroke, heart attack and death when associated with diabetes and CVD. However evidence indicates that individuals with earlier stages of CKD are at significantly increased risk of CVD, independent of other CVD risk factors [22]. In another study, patients also identified diabetes and hypertension as the main risk factors for CKD, but unlike our study, their beliefs related to diabetes and CVD associated complications were not evaluated [23].

Many participants felt that learning about their condition commenced too late. They believed the onset of CKD could have been delayed if they had been more aware of the effects of having diabetes and hypertension, and wished they had managed them better. Previous studies have identified similar issues where patients perceive their disease to be less threatening in the initial stages compared to

those with advanced disease. Their perceived knowledge improved as the disease progressed [24, 25]. These studies have identified patients' knowledge gap about CKD, however, their perceptions about CKD-related co-morbidities were not assessed.

Like other studies, we have found that not only did patients want more information about CKD and the associated risk factors, they also wanted to be educated about dietary changes, medication safety, better patient-physician communication and more public awareness [26-30]. Although patients recognised it was important to ask questions and be involved in shared-decision making [31, 32], they felt intimidated and unable to formulate questions during consultations. They also sensed there was no opportunity to ask questions due to the limited time allocated.

Chapter 6

Previous reviews on CKD educational interventions have mainly involved studies for the management of pre-dialysis and dialysis patients [33, 34]. Thus outcomes focused on diet, fluid management and renal replacement therapy. One of the reviews addressed similar outcomes to our study. It also conducted a quality assessment of the individual studies but used a different risk of bias scale which only covers three risk of bias domains; randomization, blinding and attrition [34, 35]. A more recent review on interventions for Stage 1-4 CKD patients included only five studies on self-management [36], indicating the limited number of studies addressing early stage CKD. The poor quality of educational interventions for CKD and for chronic disease patients is well documented [34, 37]. Furthermore, no study has used a taxonomy framework to highlight intervention characteristics and components.

7.4 Implications for practice

Chapter 3

Although there were some inconsistencies with the guideline recommendations, clinicians should continue to use guidelines as the basis for clinical management. The guidelines were developed systematically and based on the best available evidence at the time. However they need to be updated regularly so that any new evidence can be integrated into patient care. Such is the case for the use of ACEi and ARB as first line therapy versus combination therapy for blood pressure management. New evidence for blood pressure targets suggests that a target below 125/75 to 130/80mmHg provides no extra benefit than a target of <140/90 for patients with CKD [38].

Chapter 4

In our study, it was evident that participants had limited awareness about risk factors and comorbidities, even though 40% of them had been diagnosed for over five years. Therefore, it is necessary for patients to be educated during the early stages of the disease. An education program needs to be implemented which meets patients' needs and allows patient learning barriers to be identified and addressed. Educational interventions that are based on a health care model or theory may facilitate the learning process as they can help address patients' beliefs and barriers to managing their disease [39, 40]. Public awareness about CKD can also be improved by promoting awareness programs and by encouraging patients and their families to access information from consumer based or nephrology organisations such as Kidney Health Australia (KHA) [41], the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) [42].

Chapter 5

The diagnosis of CKD can have a detrimental psychosocial impact on patients [31, 43]. They can feel overwhelmed by prognostic uncertainty, lifestyle changes, hopelessness and loss of control. Health care providers should encourage open communication, acknowledge patients' concerns, suggest positive coping mechanisms, and provide access to psychosocial support. Both patient support and

self-management education have been shown to improve patient health outcomes and treatment satisfaction [44, 45]. The development, dissemination and implementation of educational resources are necessary to facilitate patient education. At the same time, increasing awareness amongst primary health care providers is also necessary. The nephrology community could facilitate regular CKD workshops and training, and other common and inherited autoimmune renal diseases.

Participants voiced their concerns about the lack of knowledge related to dietary needs and medication safety. For this reason we believe it is imperative that newly diagnosed patients receive dietary advice including practical recommendations such as recipes and medical information that focuses on possible side-effects, drug interactions and clear explanation of their direct benefit in CKD prevention. Information about CKD should be accessible in the primary healthcare setting particularly targeted at individuals with risk factors for CKD including diabetes and hypertension.

To allow patients to make informed decisions about their care, education needs to be promoted at the primary health care level via a model of care [46] that allows collaboration among nephrologists, primary care physicians and allied health care professionals. A CKD patient care pathway may be useful for implementing strategies to increase patient awareness of CKD, promote self-management skills and patient education. The pathway would be initiated by the General Practitioner who would identify patients at high risk of developing CKD and those who have Stages 2-3 CKD (eGFR 90-30). The intervention would promote adequate screening, follow-up and education of patients and would involve a multidisciplinary team of health care professionals.

7.5 Implications for research

Chapter 3

Based on our assessment, guidelines scored consistently low in the applicability domain. This domain refers to the barriers and facilitators to implementation, provision of advice or tools to implement recommendations, potential resource implications, and provision of auditing and/or monitoring criteria [47]. To improve guideline uptake and implementation, we recommend that guidelines identify facilitators and barriers to consider additional resources such as quality indicators, algorithms, links to manuals, economic evaluations and cost analysis. We also suggest that guideline developers facilitate active consumer involvement in guideline development, and incorporate topics and outcomes that patients believe are important.

Chapter 4

Studies have shown that patients with hypertension were not any more aware that this was a risk factor for CKD compared to patients with normal blood pressure (3.3% versus 2.7%, respectively P=not significant). However, patients with diabetes did have greater awareness of the risk of developing CKD compared to those without diabetes (P<0.001) [21]. We suggest that research should aim to improve patient learning by addressing their learning needs and capabilities. Interventions that include dietary modification, medication adherence, self-management and education about risk factors and comorbidities should be considered.

Chapters 5 and 6

Further research is needed to develop high quality educational interventions that address the educational needs of patients with early stage CKD. It is recommended that these interventions be multifaceted [34, 48, 49], and incorporate interactive educational sessions with supplementary printed material such as an educational booklet or digital medium such as a DVD. Attention should focus on study design to minimize risk of bias and intervention characteristics to improve effectiveness. There is also a need to standardize outcome measures and evaluation methods to facilitate comparison

between studies. Outcome measures to consider include clinical parameters for renal function, blood pressure and glucose targets, patient knowledge, quality of life, psychosocial and behavioural factors. This is a research area I would like to consider and develop as a post doctorate.

7.6 Conclusions

The guidelines for the prevention, detection and management of CKD were evaluated for quality, comprehensiveness and scope. Although comprehensive, we identified some implicit and explicit discrepancies across guidelines in regards to detection of CKD, targets for management of risk factors and dietary intake of protein. This thesis also provides an in-depth assessment of patients' awareness, education needs and beliefs about CKD. Patients are not aware of the interaction between kidney disease and developing a heart or stroke and many perceived diabetes and CVD as more threatening to life compared to CKD. Participants lacked knowledge about the signs and symptoms of CKD and for many it was difficult to believe they had the disease due to its initial asymptomatic nature. Development of comprehensive educational resources including practical lifestyle recommendations, combined with active multidisciplinary and physician engagement in prevention, are likely to promote patient satisfaction. Educational interventions facilitated improvements in outcomes, but these were inconsistent across studies. There is a need for the development of well-designed studies that include effective interventions that are multifaceted, group based, interactive and involve a multidisciplinary team.

7.7 References

1. Ibels LS, Caterson R, Coleman P, Gallery E, Mahony J, Pollock C, et al. *The kidney and diseases of the kidney - a guide for patients*. Australia: Servier.
2. Johnson DW, Atai E, Chan M, Phoon RK, Scott C, Toussaint ND, et al. KHA-CARI Guideline: Early chronic kidney disease: detection, prevention and management. *Nephrology*. 2013;18(5):340-50.
3. Brantsma AH, Bakker SJ, Hillege HL, de Zeeuw D, de Jong PE, Gansevoort RT. Cardiovascular and renal outcome in subjects with K/DOQI stage 1–3 chronic kidney disease: the importance of urinary albumin excretion. *Nephrol Dial Transplant*. 2008;23(12):3851-8.
4. Jha V, Garcia-Garcia G, Iseki K, Li Z, Naicker S, Plattner B, et al. Chronic kidney disease: global dimension and perspectives. *Lancet*. 2013;382(9888):260-72.
5. Levey AS, Eckardt K-U, Tsukamoto Y, Levin A, Coresh J, Rossert J, et al. Definition and classification of chronic kidney disease: a position statement from Kidney Disease: Improving Global Outcomes (KDIGO). *Kidney Int*. 2005;67(6):2089-398.
6. Kirkham JJ, Dwan KM, Altman DG, Gamble C, Dodd S, Smyth R, et al. The impact of outcome reporting bias in randomised controlled trials on a cohort of systematic reviews. *BMJ*. 2010;340:c365.
7. Schulz KF, Chalmers I, Hayes RJ, Altman DG. Empirical evidence of bias: Dimensions of methodological quality associated with estimates of treatment effects in controlled trials. *JAMA*. 1995;273(5):408-12.
8. Effective Practice and Organisation of Care (EPOC). *Suggested risk of bias criteria for EPOC reviews. EPOC resources for review authors*. Oslo: Norwegian Knowledge Centre for the Health Services; 2014; [cited 2013 30 October]; Available from: http://epocoslo.cochrane.org/epoc-specific-resources-review-authors.
9. Higgins JPT, Green, S. (eds),. *Cochrane handbook for systematic reviews of interventions.* Chichester: John Wiley & Sons Ltd; 2008.

10. Glasziou P, Chalmers I, Altman DG, Bastian H, Boutron I, Brice A, et al. Taking healthcare interventions from trial to practice. *BMJ*. 2010;341(c3852):384-7.

11. Elasy TA, Ellis SE, Brown A, Pichert JW. A taxonomy for diabetes educational interventions. *Patient Educ Couns*. 2001;43(2):121-7.

12. Brosius FC, 3rd, Hostetter TH, Kelepouris E, Mitsnefes MM, Moe SM, Moore MA, et al. Detection of chronic kidney disease in patients with or at increased risk of cardiovascular disease: a science advisory from the American Heart Association Kidney and Cardiovascular Disease Council; the Councils on High Blood Pressure Research, Cardiovascular Disease in the Young, and Epidemiology and Prevention; and the Quality of Care and Outcomes Research Interdisciplinary Working Group: developed in collaboration with the National Kidney Foundation. *Circulation*. 2006;114(10):1083-7.

13. Haroun MK, Jaar BG, Hoffman SC, Comstock GW, Klag MJ, Coresh J. Risk factors for chronic kidney disease: a prospective study of 23,534 men and women in Washington County, Maryland. *J Am Soc Nephrol*. 2003;14(11):2934-41.

14. Chan K, Ikizler T, Gamboa J, Yu C, Hakim R, Brown N. Combined angiotensin-converting enzyme inhibition and receptor blockade associate with increased risk of cardiovascular death in hemodialysis patients. *Kidney Int*. 2011;80:978-85.

15. Yusuf S, Teo KK, Pogue J, Dyal L, Copland I, Schumacher H, et al. Telmisartan, Ramipril, or Both in Patients at High Risk for Vascular Events. *N Engl J Med*. 2008;358(15):1547-59.

16. Action to Control Cardiovascular Risk in Diabetes Study Group, Gerstein HC, Miller ME, Byington RP, Goff DC, Jr., Bigger JT, et al. Effects of intensive glucose lowering in type 2 diabetes. *N Engl J Med*. 2008;358(24):2545-59.

17. Advance Collaborative Group, Patel A, MacMahon S, Chalmers J, Neal B, Billot L, et al. Intensive blood glucose control and vascular outcomes in patients with type 2 diabetes. *N Engl J Med*. 2008;358(24):2560-72.

18. Klahr S, Levey AS, Beck GJ, Caggiula AW, Hunsicker L, Kusek JW, et al. The effects of dietary protein restriction and blood-pressure control on the progression of chronic renal

disease. Modification of Diet in Renal Disease Study Group. *N Engl J Med*. 1994;330(13):877-84.

19. Robertson L, Waugh N, Robertson A. Protein restriction for diabetic renal disease. *Cochrane Database Syst Rev*. 2007(4):CD002181.
20. Burke M, Kapojos J, Sammartino C, Gray N. Kidney disease health literacy among new patients referred to a nephrology outpatient clinic. *Intern Med J*. 2014;44(11):1080-6.
21. White SL, Polkinghorne KR, Cass A, Shaw J, Atkins RC, Chadban SJ. Limited knowledge of kidney disease in a survey of AusDiab study participants. *Med J Aust*. 2008;188(4):204.
22. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu C-y. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. *N Engl J Med*. 2004;351(13):1296-305.
23. Tan AU, Hoffman B, Rosas SE. Patient perception of risk factors associated with chronic kidney disease morbidity and mortality. *Ethn Dis*. 2010;20(2):106-10.
24. Pagels AA, Klang B, Susanne Heiwe S. Differences in illness representations in patients with chronic kidney disease. *J Ren Care*. 2015.
25. Finkelstein FO, Story K, Firanek C, Barre P, Takano T, Soroka S, et al. Perceived knowledge among patients cared for by nephrologists about chronic kidney disease and end-stage renal disease therapies. *Kidney Int*. 2008;74:1178-84.
26. Costantini L, Beanlands H, McCay E, Cattran D, Hladunewich M, Francis D. The self-management experience of people with mild to moderate chronic kidney disease. *Nephrol Nurs J*. 2008;35(2):147.
27. Hack TF, Degner LF, Parker PA. The communication goals and needs of cancer patients: a review. *Psychooncology*. 2005;14(10):831-45.
28. Lewis AL, Stabler KA, Welch JL. Perceived informational needs, problems, or concerns among patients with stage 4 chronic kidney disease. *Nephrol Nurs J*. 2010;37(2):143.
29. Ormandy P. Information topics important to chronic kidney disease patients: a systematic review. *J Ren Care*. 2008;34(1):19-27.

30. Tong A, Lopez-Vargas P, Howell M, Phoon R, Johnson D, Campbell D, et al. Consumer involvement in topic and outcome selection in the development of clinical practice guidelines. *Health Expect*. 2012;15(4):410-23.

31. Kimmel PL. Depression in patients with chronic renal disease: what we know and what we need to know. *J Psychosom Res*. 2002;53(4):951-6.

32. Wikblad KF. Patient perspectives of diabetes care and education. *J Adv Nurs*. 1991;16(7):837-44.

33. Hayslip DM, Suttle CD. Pre-ESRD patient education: a review of the literature. *Adv Ren Replace Ther*. 1995;1:4.

34. Mason J, Khunti K, Stone M, Farooqi A, Carr S. Educational interventions in kidney disease care: a systematic review of randomized trials. *Am J Kidney Dis*. 2008;51(6):933-51.

35. Jadad AR, Moore RA, Carroll D, Jenkinson C, Reynolds DJM, Gavaghan DJ, et al. Assessing the quality of reports of randomized clinical trials: Is blinding necessary? *Control Clin Trials*. 1996;17(1):1-12.

36. Bonner A, Havas K, Douglas C, Thepha T, Bennett P, Clark R. Self-management programmes in stages 1-4 chronic kidney disease: a literature review. *J Ren Care*. 2014;40(3):194-204.

37. Cooper H, Booth K, Fear S, Gill G. Chronic disease patient education: lessons from meta-analyses. *Patient Educ Couns*. 2001;44(2):107-17.

38. Upadhyay A, Earley A, Haynes SM, Uhlig K. Systematic Review: Blood Pressure Target in Chronic Kidney Disease and Proteinuria as an Effect Modifier. *Ann Intern Med*. 2011:E-335.

39. Glanz K, Rimer BK, Lewis FM, Editors. *Health behavior and health education: theory, research, and practice*. 3rd ed. San Francisco, CA: John Wiley & Sons; 2002.

40. Lorig K, Associates. *Patient education: a practical approach*. Thousand Oaks, California: Sage; 2001.

41. Kidney Health Australia (KHA). *Support*. 2015 [cited 2015 22 May]; Available from: http://www.kidney.org.au/your-kidneys/support.

42. National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). *Health Information*. 2015 [cited 2015 22 May]; Available from: http://www.niddk.nih.gov/health-information/healthcare-professionals/Pages/default.aspx.

43. Perez Dominguez TS, Rodriguez Perez A, Buset Rios N, Rodriguez Esparragon F, Garcia Bello MA, Perez Borges P, et al. Psychonephrology: psychological aspects in autosomal dominant polycystic kidney disease. *Nefrologia*. 2011;31(6):716-22.

44. Anderson LA, Zimmerman MA. Patient and physician perceptions of their relationship and patient satisfaction: a study of chronic disease management. *Patient Educ Couns*. 1993;20(1):27-36.

45. Bodenheimer T, Lorig K, Holman H, Grumbach K. Patient self-management of chronic disease in primary care. *JAMA*. 2002;288(19):2469-75.

46. Levin A, Stevens LA. Executing change in the management of chronic kidney disease: Perspectives on guidelines and practice. *Med Clin North Am*. 2005;89(3):701-9.

47. Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, et al. AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ*. 2010;182(18):E839-42.

48. Binik YM, Devins GM, Barre PE, Guttmann RD, Hollomby DJ, Mandin H, et al. Live and learn: patient education delays the need to initiate renal replacement therapy in end-stage renal disease. *J Nerv Ment Dis*. 1993;181(6):371-6.

49. Manns BJ, Taub K, Vanderstraeten C, Jones H, Mills C, Visser M, et al. The impact of education on chronic kidney disease patients' plans to initiate dialysis with self-care dialysis: a randomized trial. *Kidney Int*. 2005;68(4):1777-83.

Appendix A

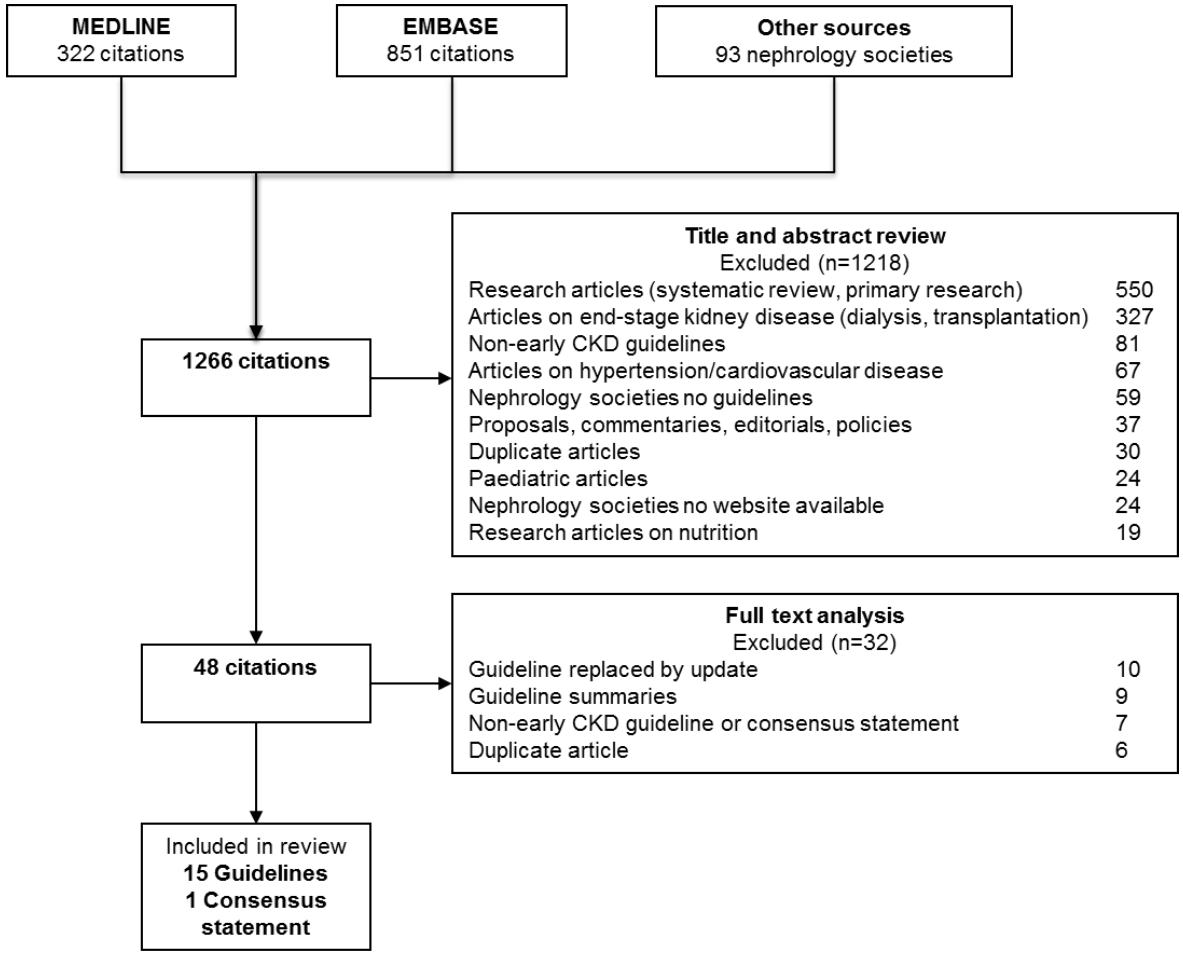


Figure A1. Literature search results

Table A2. Search strategy

Medline search 1948 to November Week 3 2011

1. Kidney diseases/
2. Renal insufficiency/
3. exp renal insufficiency, chronic/
4. Kidney disease$.ti.
5. (chronic kidney or chronic renal).ti.
6. Or/1-5
7. exp guideline/
8. Guideline$.ti
9. (guideline or practice guideline).pt
10. Or/7-9
11. 6 and 10
12. Or/1-3
13. 7 or 9
14. 12 and 13

Embase search 1980 to 2011 week 50

1. exp Chronic kidney disease/
2. exp Kidney failure/
3. exp Chronic kidney failure/
4. Pre-dialysis or predialysis.ti
5. Kidney disease$.ti
6. Or/1-5
7. practice guideline.ti
8. Guideline$.ti
9. 7 or 8
10. 6 and 9

Nephrology societies searched

Nephrology society	Source
Asia Pacific	
Australian and New Zealand Society of Nephrology	www.nephrology.edu.au
Hong Kong Society of Nephrology	www.hksn.org
Japanese Society of Nephrology	www.jsn.or.jp/en/
The Korean Society of Nephrology	www.ksn.or.kr/english
Taiwan Society of Nephrology	www.tsn.org.tw
Bangladesh Renal Society / Kidney Foundation Bangladesh	www.kidneybangla.org
Chinese Society of Nephrology	No website access
Indian Society of Nephrology	www.isn-india.com
Indonesian Society of Nephrology	No website access
Malaysian Society of Nephrology	www.msn.org.my/index.jsp
Nepal Society of Nephrology	No website access
Nephrology Society of Thailand	www.nephrothai.org
Pakistan Society of Nephrology	No website
Philippine Society of Nephrology	www.psn.ph; www.mypsn.org
Singapore Society of Nephrology	www.ssn.org.sg
Sri Lankan Society of Nephrology	No website
Latin America	
Latin American Society of Nephrology and Hypertension (SLANH)	www.slanh.org
Venezuelan Society of Nephrology	www.svnefrologia.org
Peruvian Society of Nephrology	www.spn.pe
*Argentinian society of Nephrology	www.san.org.ar
Brazilian society of Nephrology	www.sbn.org.br
Cuban society of Nephrology	www.sld.cu/sitios/nefrologia
Mexican Society of Nephrology and Transplantation	No website
Uruguayan society of Nephrology	www.nefrouruguay.com
*Chilean society of nephrology	www.sociedaddenefro.cv.cl; www.nefro.cl
Paraguayan society of Nephrology	www.spn.org.py
Sociedad Boliviana de nefrologia La Paz society of Nephrology (Bolivia)	No website for Bolivia but yes for La Paz www.galenored.com/sopanefro
Sociedad Ecuatoriana de nefrologia	No website
Colombian Association of nephrology and hypertension	www.asocolnef.com
Sociedad Panamena de nefrologia	No website
Sociedad Dominicana de nefrologia	No website
Sociedad Hondurena de nefrologia	No website
Sociedad Nicaraguense de nefrologia	No website
Sociedad Puertorriquena de nefrologia	No website
Sociedad Costarricense de nefrologia	No website

Nephrology society	Source
Nephrolgy and hypertension Association of El Salvador	www.medicosdeelsalvador.com;www.nefrologiaelsalvador.com
Sociedad Guatemalteca de nefrologia	No website
North America	
Canadian Society of Nephrology	www.csncn.ca
American Society of Nephrology	www.asn-online.org
Europe	
European Renal Association	www.era-edta.org
Albanian Society of Nephrology	No website
Algerian Society of Nephrology, Dialysis and Transplantation	www.sandt.asso.dz
Austrian Society of Nephrology	www.nephro.at
Belarus Society of Nephrology	No website
Belgian Society of Nephrology	www.bvn-sbn.be
Society of Nephrology, Dialysis and Kidney Transplantation in Bosnia and Herzegovina	www.undt.ba
Bulgarian Society of Nephrology	www.bgnephrology.com
Croatian Society for Nephrology, Dialysis and Transplantation	www.hdndt.org
Cypriot Society of Nephrology	No website
Czech Society of Nephrology	www.nefrol.cz
Danish Society of Nephrology	www.nephrology.dk
The Egyptian Society of Nephrology & Transplantation	www.esnonline.net
Estonian Society of Nephrology	No website
Macedonian Society of Nephrology, Dialysis, Transplantation & Artificial Organs	www.nephrologia.org.mk
Finnish Society of Nephrology	www.terveysportti.fi/kotisivut/sivut.koti?p_sivusto=580
* French Society of Nephrology	www.soc-nephrologie.org
Dialysis, Nephrology & Kidney Transplantation Union of Georgia	www.dntunion.ge/en
German Society of Nephrology	www.dgfn.eu
Hellenic Society of Nephrology	www.ene.gr
Hungarian Society of Nephrology	www.nephrologia.hu
Icelandic Renal Association	No website
Irish Nephrology Society	www.nephrology.ie
The Israeli Society of Nephrology and Hypertension	www.isnh.org.il
* Italian Society of Nephrology	www.sin-italy.org
Latvian Nephrologist Association	No website
Lebanese Society of Nephrology & Hypertension	www.lsnh.org
Lithuanian Nephrology, Dialysis & Transplantation Association	www.lndta.lt
Moldavian Society of Nephrology and Urology	No website
Montenegrin Society of Nephrology	No website
Moroccan Society of Nephrology	www.nephro-maroc.ma/index.action
* Dutch Federation of Nephrology	www.nefro.nl
Norwegian Society of Nephrology	www.nephro.no
Polish Society of Nephrology	www.PTNefro.org
Portuguese Society of Nephrology	www.spnefro.pt
Romanian Society of Nephrology	No website
Russian Society of Nephrology	www.nephro.ru
Scottish Society of Nephrology	www.show.scot.nhs.uk
Serbian Association of Nephrology	www.kns2010.org/kontakt
Slovak Nephrological Society	www.nefro.sk
Slovenian Society of Nephrology	www.nephro-slovenia.si
Spanish Society of Nephrology	www.senefro.org
Swedish Society of Nephrology	www.njur.se
Swiss Society of Nephrology	www.nephro.ch
Tunisian Nephrological Society	www.nephro-tn.org
Turkish Society of Nephrology	www.tsn.org.tr
The Renal Association (UK)	www.renal.org
Ukrainian Nephrology Association	www.nephrology.kiev.ua
Africa	No website
South African renal society	www.sa-renalsociety.org
African Association of Nephrology	www.afran.net
Nigerian Association of Nephrology	www.nanephrology.org
Sudanese society of kidney diseases and transplantation	www.sskdt.com
Kenya renal association	www.kenyarenal.org

Table A3. AGREE II Instrument: domains and definitions

Domain	Content	No. of items
Scope and purpose	Addresses the overall aim of the guideline, the specific clinical questions and the target patient population	3
Stakeholder involvement	Addresses the extent to which the guideline represents the views of its intended users (relevant professional groups, patients, target users defined, piloting among target users)	3
Rigour of development	Addresses the process used to collect and synthesize the evidence, the methods to formulate the recommendations, process for updating the guidelines, external review	8
Clarity and presentation	Addresses the language and format of the guideline (recommendations are specific and unambiguous, different options for management are presented, key recommendations are identifiable, tools for application are available)	3
Applicability	Addresses the likely organisational, behavioural, and cost implications of applying the guideline, key criteria for monitoring and/or audit purposes	4
Editorial independence	Addresses the independence of the recommendations and acknowledgement of possible conflict of interest from the guideline development group	2

Appendix B

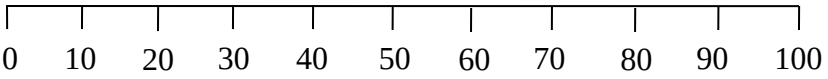
Item B1 – Participant survey

Age: _____ Male / Female

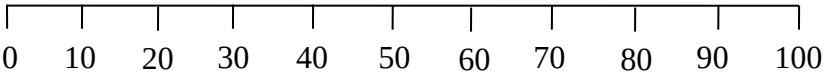
Please read the following questions and circle the answer in the scale provided.

a) Consider 100 people who have type 2 diabetes, for more than 5 years. How many people do you think will develop:

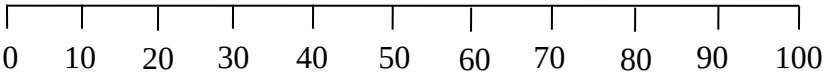
1. Kidney



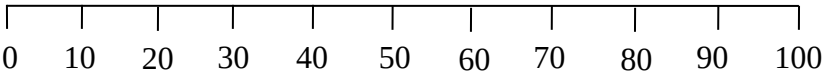
2. Stroke



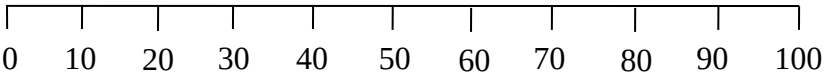
3. Heart attack



4. Cancer



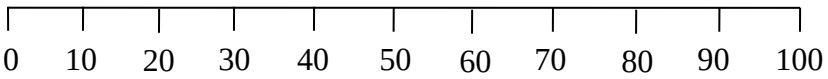
5. Death



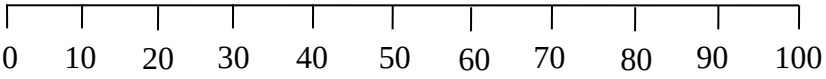
Comments: _____
_____
_____
_____
_____

b) Consider 100 people over the age of 50, who have moderate kidney damage (eGFR 30-59 mL/min), for 5 years. How many people do you think will develop:

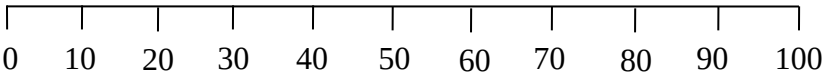
1. Heart attack



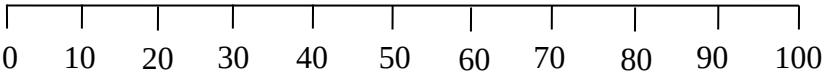
2. Stroke



3. Cancer



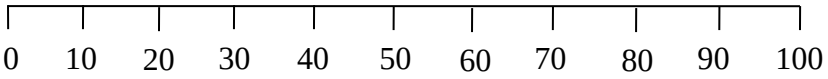
4. Death



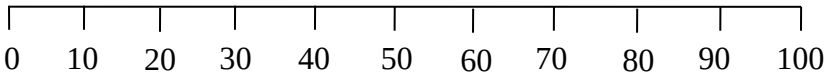
Comments: _____
_____
_____
_____
_____

c) Consider 100 people over the age of 50, with cardiovascular disease, for 10 years. How many people do you think will develop:

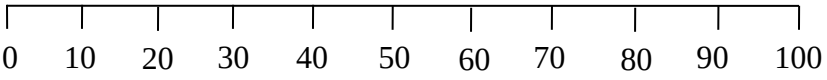
1. Heart attack



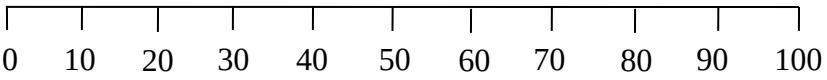
2. Stroke



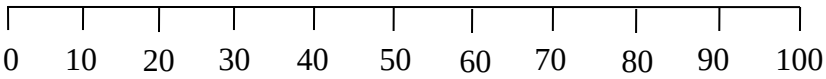
3. Kidney disease



4. Cancer



5. Death



Comments: _____
_____
_____
_____
_____

d) What factors can increase your chances of developing chronic kidney disease? Tick your answers.

1. Family history of kidney disease ☐
2. Over 60 years of age ☐
3. High blood pressure ☐
4. Obesity ☐
5. Alcohol consumption ☐
6. Aboriginal or Torres Strait ☐
7. Diabetes ☐
8. Over 50 years of age ☐
9. Cancer ☐
10. Smoking ☐
11. Inadequate fluid intake ☐
12. Other (please specify) _____
13. Other (please specify) _____

Comments: _____
_____
_____
_____
_____

Appendix C

Table C1: Running sheet for focus groups

Topic	Question Guides
Introduction	• Welcome and thank participants for attending • Introduce yourself (facilitator) and other study researchers present during the session. (State your workplace and affiliations) • Introduce the study: who is involved, types of participants, recruiting centres, the purpose of the study and intentions. • Remind participants that the study consists of: 1. Voluntary participation; leave at any time; discuss issues privately. 2. Confidential; nothing is traced back to you. 3. Free to agree or disagree with other's opinions. 4. Respectful and considerate of one another. 5. Ask questions but answer not guaranteed. 6. Discussion will be recorded; transcribed and analysed later on.
Ice breaker	As the participants introduce themselves, they should provide an answer to 'ice breaker' question provided by the facilitator. Example of a question: What is the one thing you really enjoy doing?
Experiences	**We'll start off this session by discussing your experiences since your diagnosis. The following questions were used by the facilitator to stimulate discussion about participants' experiences at the time of diagnosis and since then.** 1. How did you react or what were your initial thoughts and feelings when you were told you have kidney disease? 2. How did you find out that you had kidney disease? Did you have any signs / symptoms? 3. What sorts of things were you told about kidney disease? 4. Has kidney disease made an impact on your day-to-day living? How? **The facilitator can engage others into the conversation by asking questions such as:** 1. Do people agree? 2. Anyone have anything else to add/say? 3. Any other opinions/experiences that we haven't discussed?
Current concerns	**The following questions were sued to stimulate discussion about the participants' major concerns.** 1. Do you have any concerns about the short-term and long-term future? 2. Are you concerned about any long-term impacts of chronic kidney disease? 3. How has your diagnosis affected your family? 4. How are you coping (physically, emotionally, psychologically)? Do you get any support? (examples, services, financial, community nurse)
Current knowledge	**The following prompt questions were used to stimulate discussion about what participants know about kidney disease and about what they would like to know.** 1.Would anyone like to share what they know? 2.What do you know about chronic kidney disease? (diagnosis, prevention, treatment, lifestyle impact) 3.When you were diagnosed - What sorts of things did you want to know? Have you been given this information? 4.Is there anything else you would like to know about CKD? Any questions that have not been answered?

Topic	Question Guides
Suggestions for patient education	**The following prompt questions were used to discuss participant's ideas and opinions about patient education and available services.** 1. What kind of information do you think is important to people with CKD? 2. Where do you go to get your information? **Ormandy[1] (2008) topics – use as Prompts** 1. CKD information 2. Renal replacement therapy 3. Physical symptoms and body image 4. Complications of both disease and treatment 5. Family and social life 6. Work and finance 7. Diet and fluid restriction 8. Medication 9. Tests and blood results 10. Psychological impact 11. Other patients' experiences 12. Patient organizations 13. Service provision 3. Who should be educating patients? (GP, nephrologist, nurse) 4. In what format should the information/education be given? Lectures / seminars; pamphlets; DVD; internet site? 5. Do you think you would benefit from listening to and speaking with patients who have more advanced kidney disease? How do you think this will affect you? 6. Do you ask your doctor any questions? Why/Why not **These questions were used to prompt discussion about behavior modification and lifestyle changes.** 7. What do you think are the things that motivate people to make life style changes to improve their health? 8. What do you think are the things that stop people from making life changes?
Evaluation of current resources	**Participants were shown various information resources, which they evaluated and gave feedback on.** **The following questions were used to stimulate discussion for improving current resources or developing one.** **Evaluation** 1. Which resource do you think is the best one? Which is the most attractive to you? 2. Does it make you want to read it? Is it easy/hard to read? Is it interesting? Is it motivating or boring? Is it easy or difficult to understand? **Improvement** 3. What can be done to improve these publications/resources? E.g. Less writing? More writing? More pictures? 4. Should we include a question and answer section? 5. Should we include a section that advises on the type of questions you should be asking your doctor? 6. Should we include some form of track record sheet, which will be managed by you?
Close	Thank participants and give out reimbursements.

1. Ormandy P. Information topics important to chronic kidney disease patients: a systematic review. *Journal of Renal Care.* 2008;34(1):19-27.

Table C2 Kidney disease information

Organization	Type	Title	Web source
Kidney Health Australia	Pamphlet (2008)	Kidneys & Blood Pressure	www.kidney.org.au
	Pamphlet (2008)	Kidney & Urinary Health	
	Pamphlet (2008)	Kidneys & Diabetes	
	Handbook (2008)	Living with reduced kidney function – a handbook for self-management of chronic kidney disease	
North West Dialysis Service	Pamphlet (2007)	"I have kidney failure" What does that mean?	www.mh.org.au
	Pamphlet (2007)	Treatment for Chronic Kidney Failure and End Stage Kidney Failure	
New South Wales Department of Health – Aboriginal Vascular Health Program	Pamphlet (2004)	Kidney disease – What is it?	http://www.health.nsw.gov.au/pubs/bhc.asp
	Pamphlet (2004)	Blood pressure – Keepin' it under control	
	Pamphlet (2004)	Heart disease – Know your risks	
	Pamphlet (2004)	Stroke – Early warning signs	
South Sydney Western Area Health Service	Booklet	Kidney failure & treatment options – Information for patients & families	
Renal Resource Centre	Booklet (2009)	Eating Out: A Guide for Chronic Kidney Disease Patients	www.renalresource.com
	Pamphlet (2004)	Glomerulonephritis	
	Pamphlet (2006)	Understanding and Preventing Renal Bone Disease	
National Kidney Foundation	Pamphlet (2004)	What you need to know about Anemia and Chronic Kidney Disease	www.kidney.org

Appendix D

Table D1. Search strategies

Ovid MEDLINE(R) 1946 to 31 December 2014

Search line #	Searches	Results
1	exp Health Promotion/	55,447
2	exp Health Education/	136,638
3	exp Education/	625,763
4	exp Patient Education as Topic/	70,911
5	exp Self Care/	40,543
6	or/1-5	697,196
7	exp Renal Insufficiency/	126,833
8	exp Renal Insufficiency, Chronic/	84,668
9	chronic kidney disease.tw.	17,991
10	chronic renal disease.tw.	2,492
11	or/7-10	134,891
12	exp primary prevention/ or exp secondary prevention/	127,673
13	disease progression/	105,532
14	prevention of progression.tw.	308
15	exp risk factors/	574,942
16	or/12-15	787,077
17	6 and 11 and 16	273
18	exp Health Knowledge, Attitudes, Practice/	74,403
19	education.tw.	267,654
20	or/1-5,18-19	855,899
21	**11 and 16 and 20**	**555**

Embase 1996 to 31 December 2014

Search line #	Searches	Results
1	exp health promotion/	60,320
2	exp health education/	181,685
3	exp adult education/ or exp education/ or exp patient education/	749,765
4	education.tw.	281,327
5	exp self care/	40,217
6	exp attitude to health/	65,731
7	or/1-6	901,583
8	exp chronic kidney disease/	34,894
9	chronic kidney disease.tw.	31,097
10	exp primary prevention/	24,623
11	exp secondary prevention/	16,224
12	exp disease course/	1,803,810
13	prevention of progression.tw.	423
14	exp risk factor/	579,349
15	or/10-14	2,282,002
16	exp kidney disease/	466,647
17	8 and 9 and 16	23,571
18	**7 and 15 and 17**	**671**

CINAHL 1982 to 31 December 2014

Search line #	Search Terms	Results
S16	**S7 AND S11 AND S15**	**919**
S15	S12 OR S13 OR S14	248,785
S14	(MH "Risk Factors+")	75,320
S13	(MH "Disease Progression")	16,571
S12	(MH "Preventive Health Care+") OR (MH "Primary Health Care")	165,747
S11	S8 OR S9 OR S10	29,686
S10	"chronic kidney disease.tw"	0
S9	(MH "Kidney Diseases+")	29,686
S8	(MH "Renal Insufficiency+") OR (MH "Renal Insufficiency, Chronic+")	15,278
S7	S1 OR S2 OR S3 OR S4 OR S5 OR S6	180,380
S6	(MH "Attitude to Health+")	71,116
S5	(MH "Adult Education")	819
S4	(MH "Self Care+")	24,935
S3	(MH "Patient Education+")	47,331
S2	(MH "Health Education+")	75,340
S1	(MH "Health Promotion+")	32,040

The Cochrane Library December 2014

Search line #	Searches	Results
1	"renal insufficiency":ti,ab,kw or "chronic kidney":ti,ab,kw or "chronic kidney insufficiency":ti,ab,kw or "chronic renal insufficiency":ti,ab,kw or "chronic renal":ti,ab,kw (Word variations have been searched)	4,580
2	"pre-dialysis":ti,ab,kw or "predialysis":ti,ab,kw or "CKD":ti,ab,kw or "CRD":ti,ab,kw (Word variations have been searched)	1,578
3	"health promotion":ti,ab,kw or "health education":ti,ab,kw or "patient education":ti,ab,kw or "education":ti,ab,kw or "self care":ti,ab,kw (Word variations have been searched)	33,569
4	"health information":ti,ab,kw (Word variations have been searched)	635
5	#1 or #2	5,090
6	#3 or #4	33,968
7	**#5 and #6**	**85**

Table D2. Risk of bias for individual studies

a). Randomized controlled studies

Bias criteria	Barrett[28]	Binik[29]	Devins[30]	Flesher[31]	Chen[32]	Kao[33]	Campbell[39]	Williams[40]	Williams[41]	Van Zuilen[47]	Paes-Barreto[50]	Teng[38]
Random sequence generation (selection bias)	●	●	◌	▨	◌	▨	◌	◌	◌	◌	◌	◌
Allocation concealment (selection bias)	▨	▨	●	▨	◌	▨	◌	▨	◌	◌	▨	▨
Blinding of participants and personnel (performance bias)	●	●	◌	●	●	●	●	●	●	●	●	●
Blinding of outcome assessment (detection bias)	●	●	◌	●	▨	●	▨	◌	◌	◌	●	●
Incomplete outcome data (attrition bias)	◌	●	◌	◌	◌	●	◌	●	◌	◌	●	●
Selective reporting (reporting bias)	◌	●	◌	●	◌	◌	◌	●	◌	◌	●	●

b) Controlled before and after studies

Bias criteria	Wu[34]	Slowik[48]	Chen[36]	Choi[51]	Wright Nunes[49]
Random sequence generation (selection bias)	●	●	●	●	●
Allocation concealment (selection bias)	●	●	●	●	●
Baseline outcome measurements similar	◌	▨	◌	◌	◌
Baseline characteristics similar	◌	▨	◌	◌	◌
Incomplete outcome data (attrition bias)	▨	▨	●	◌	◌
Knowledge of allocated interventions (detection bias)	▨	▨	●	●	●
Protected against contamination	◌	▨	▨	◌	◌
Selective reporting (reporting bias)	◌	●	◌	◌	◌

c) Interrupted time series

Bias criteria	Yen[35]	Aguilera[42]	Gutierrez[43]	Gutierrez[44]	Kazawa[46]	Lin[37]	Walker[52]
Intervention independent of other changes	◌	◌	◌	◌	◌	●	●
Shape of intervention effect pre-specified	●	●	●	●	▨	●	●
Intervention unlikely to affect data collection	◌	◌	◌	◌	◌	◌	◌
Primary outcome assessed blindly or measured objectively	●	●	●	●	●	●	◌
Incomplete outcome data addressed (attrition bias)	◌	▨	◌	▨	◌	◌	◌
Selective reporting (reporting bias)	◌	◌	◌	◌	◌	◌	◌

◌ Low risk ▨ Unclear risk ● High risk

Table D3a. Characteristics of educational interventions for randomized controlled studies

Intervention	Barrett[28]	Binik[29]	Devins[30]	Flesher[31]	Chen[32]	Kao[33]	Campbell[39]	Williams[41]	Williams[40]	van Zuilen[47]	Paes - Barreto[50]	Teng[38]
Setting												
One-on-one	●	●	●	●	●	●	●	●	●	●	●	●
Group				●	●	●						
Patient with family												
Delivery method												
Face-to-face (slide-lectures, counselling, interviews)	●	●	●	●	●	●	●	●	●	●	●	●
Telecommunication [phone, DVD]			●		●	●	●	●	●		●	
Written		●	●	●	●	●	●	●	●	●	●	●
Other (medication charts, patient diary)								●	●			
Teaching method												
Didactic		●	●	●	●	●	●	●	●		●	
Goal-setting – dictated	●							●	●	●		
Goal-setting – negotiated (self-management)	●			●	●	●	●	●				●
Situational problem solving (practical skills)	●					●						●
Other (support group discussions, workshops)					●						●	
Frequency of interventions												
Once only		●	●			●	●		●			
Weekly				●	●	●						
Fortnightly							●	●	●			
Monthly			●		●		●				●	
3rd - 4th monthly	●											●
Unspecified / Unclear										●		
Quantity of teaching episodes (n)												
Number	5	1	1	16		1					5	4
Unspecified / Unclear					●		●	●	●	●		
Duration per episode												
Minutes		75	90			90					20	
Variable duration			●	●				●	●		●	
Unspecified / Unclear	●				●		●			●		●
Total duration of intervention												
Days		1										
Months	20		18			3	3	3	3		5	12
Unspecified / Unclear				●	●					●		
Content												
Kidney physiology / pathology / treatment		●	●		●							
Diet and kidney failure		●	●		●							
Pharmacological and medical protocols	●		●									
Nutrition counselling / dietician advice				●	●		●			●	●	
Lifestyle modification (weight / smoking)	●		●		●					●		●
Exercise program / information / participation	●			●		●				●		●
Medication management / adherence	●				●			●	●	●		
Self-management skills	●			●	●		●	●	●			
Self-monitored blood pressure				●				●	●			
Self-management nutritional needs				●			●				●	●
Guideline implementation										●		
Psychosocial / psychological adaptation												
Provider												
Social worker		●	●									
Nephrologist	●		●		●			●	●	●		
Dietician				●	●		●	●			●	
Nurse	●			●	●			●	●	●		●
General practitioner	●									●		
Patient volunteers / mentors					●							
Other (health educator, research assistant, interpreter, pharmacist, physiotherapist)		●		●		●			●			●

Table D3b. Characteristics of educational interventions – non-randomized studies

Characteristics	Wu[34]	Yen[35]	Aguilera[42]	Gutierrez[43]	Gutierrez[44]	Jia[45]	Kazawa[46]	Slowik[48]	Lin[37]	Choi[51]	Wright Nunes[49]	Walker[52]	Chen[36]
Setting													
One-on-one	●						●	●		●	●	●	●
Group	●	●	●	●	●	●		●	●	●			●
Patient with family			●	●		●		●					
Delivery method													
Face-to-face (slide-lectures, counselling, interviews)	●	●	●	●	●	●	●	●	●	●	●	●	●
Telecommunication [phone, DVD]	●	●					●	●	●				●
Written	●	●		●	●		●	●				●	●
Other (medication charts, patient diary, checklist)						●			●	●	●	●	
Teaching method													
Didactic	●	●	●	●	●	●	●	●		●	●	●	●
Goal-setting – dictated						●					●		
Goal-setting – negotiated (self-management)							●	●	●	●		●	
Situational problem solving (practical skills)		●	●	●		●			●	●			
Other (support group discussions, workshops)	●	●	●	●	●	●			●				●
Frequency of interventions													
Once only		●						●		●			
Weekly						●			●				●
Fortnightly			●				●					●	
Monthly	●				●								●
3^{rd} – 4^{th} monthly	●	●		●									●
Unspecified / Unclear											●		
Quantity of teaching episodes (n)													
Number		1	7	8	6	8	8		5	3		6	
Unspecified / Unclear	●							●			●		●
Duration per episode													
Minutes		150	90	120	120	90	60		90	90			
Variable duration		●					●	●		●			
Unspecified / Unclear	●										●	●	●
Total duration of intervention													
Days			7										
Months		12		6	6		6		1	2		12	
Unspecified / Unclear	●					●		●			●		●
Content													
Kidney physiology / pathology / treatment	●	●	●	●	●	●	●	●		●	●		●
Diet and kidney failure	●	●	●	●	●	●	●	●		●	●		●
Pharmacological and medical protocols													
Nutrition counselling / dietician advice	●	●	●	●	●	●	●	●				●	●
Lifestyle modification (weight / smoking)	●	●	●	●	●	●	●				●	●	●
Exercise program / information / participation		●	●		●		●						
Medication management / adherence	●	●	●				●	●			●	●	●
Self-management skills			●			●	●	●	●	●		●	
Self-monitored blood pressure							●					●	
Self-management nutritional needs						●				●			
Guideline implementation						●							
Psychosocial / psychological adaptation		●		●	●			●					
Provider													
Social worker	●	●		●				●					●
Nephrologist	●	●	●	●	●	●	●	●		●	●		●
Dietician	●	●	●	●		●	●	●		●			●
Nurse	●	●	●	●	●	●	●	●		●		●	●
General practitioner												●	
Patient volunteers / mentors	●		●	●	●	●							
Other (health educator, research assistant, interpreter, pharmacist, physiotherapist)					●		●		●				●

Table D4 Studies with significant results and their characteristics

Intervention characteristics	Studies with significant results	Total number of studies	Proportion (%)
Setting			
Patient with family	4	4	100
Group	11	13	85
One-on-one	14	19	74
Delivery method			
Written	15	19	79
Telecommunication [phone, DVD]	10	13	77
Face-to-face (lectures, counselling, interviews)	19	25	76
Other (medication charts, patient diary)	4	7	57
Teaching technique			
Other (support group discussions, workshops)	9	10	90
Situational problem solving (practical skills)	7	9	78
Didactic	16	21	76
Goal-setting – negotiated (self-management)	9	12	75
Goal-setting – dictated	2	6	33
Frequency of interventions			
Monthly	7	7	100
Weekly	4	5	80
Once only	6	8	75
Fortnightly	4	6	67
3^{rd} – 6^{th} monthly	4	6	67
Unspecified / Unclear	1	2	50
Quantity of teaching episodes (n)			
6 - 10	6	6	100
1 - 5	7	9	78
Unspecified / Unclear	6	9	67
Duration per episode			
<60	1	1	100
60 - 90	8	8	100
Unspecified / Unclear	7	9	78
91 – 150	2	3	67
Variable duration	4	9	44
Total duration of intervention			
< 3	4	4	100
Unspecified / Unclear	6	8	75
3 ≥ ≤ 12	6	11	55
13 > ≤ 24	1	2	50
Content			
Nutrition counselling / dietician advice	13	15	87
Kidney physiology / pathology / treatment	12	14	86
Diet and kidney failure	12	14	86
Self-management nutritional needs	5	6	83
Lifestyle modification (weight / smoking)	12	15	80
Psychosocial / psychological adaptation	3	4	75
Self-management skills	9	13	69
Exercise program / information / participation	6	9	67
Medication management / adherence	8	13	62
Pharmacological and medical protocols	1	2	50
Self-monitored blood pressure	2	5	40
Provider			
Patient volunteers / mentors	6	6	100
Social worker	6	7	86
Dietician	11	14	79
Other (educator, pharmacist, physiotherapist)	7	9	78
Nurse	13	18	72
Nephrologist	12	17	71
General practitioner	2	3	67