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Chronic Kidney Disease Nutritional Management: Developing a Guideline

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Abstract

The global prevalence and incidence of those with chronic kidney disease (CKD) are unknown. Thirty-seven million adults are estimated to have CKD and need nutritional assessment, education, and management to prevent further kidney damage and mortality (Centers for Disease Control and Prevention, 2022; United States Renal Data System, 2022). Maintaining the nutritional requirements for CKD is listed as a global concern in the Kidney Disease Outcomes Quality Initiative (KDOQI) Clinical Practice Guideline for Nutrition in CKD 2020 (Ikizler et al., 2020). After a review of more than 50 publications, five recommendations were developed and proposed. A team of multidisciplinary stakeholders, consisting of nephrologists, nurse practitioners, and registered dietitians was used to evaluate and rate the recommendations for developing a CKD nutritional guideline.

Keywords: Chronic kidney disease (CKD), nutritional assessment, nutritional education, nutritional management, nutritional guideline, Texas

Chronic Kidney Disease Nutritional Management: Developing a Guideline

CKD nutritional management is essential for the prevention of kidney damage and end-stage renal disease (ESRD), which increases morbidity and mortality. The requirements and utilization of various nutrients change with the progression of CKD. Chan (2021) indicated that dietary compliance for CKD is poor and ranges from 20%-46%; therefore, ongoing nutritional management is crucial to prevent CKD progression toward ESRD and the initiation of hemodialysis (HD). The state of Texas Health and Human Services established a task force to illustrate this in the report titled State Plan for Chronic Kidney Disease Treatment (Texas Health and Human Services, 2023). This report describes implementing a state plan for prevention, early detection and diagnosis, and management of CKD based upon education to the public regarding kidney disease emphasizing prevention of kidney disease (Texas Health and Human Services, 2023). According to findings from the Modification of Diet in Renal Disease study, the most effective dietary interventions incorporate regular dietary counseling, patient education related to self-monitoring, and regular feedback with dietary interventions by registered dietitians (RDs) (Chan, 2021); however, there is a gap in the number of RDs who can provide this service. There are 31,895 RDs in the United States, equating to approximately one dietitian for every 1,160 CKD patients (Zippia, 2022). Texas has 4,460 RDs, or approximately one for every 807 CKD patients (U.S Bureau of Labor Statistics, 2022). With limitations in the number of RDs, it is important to develop strategies to fill the gap in nutritional assessment and education of CKD patients. One such strategy is the development of a standardized guideline for multidisciplinary use to assess the nutritional status of those with CKD.

In terms of Medicare spending in 2017, the cost of CKD patients awaiting HD was $84 billion, and for those on HD, the cost was $120 billion (Saran et al., 2020). The complications of

HD financially, nutritionally, and for overall deterioration of health is high (Saran et al., 2020; Himmelfarb et al., 2020). Medically, for the 558,060 ESRD patients requiring HD, an increased cardiac mortality, of 143-500-fold increase, compared to those not on HD was reported (Himmelfarb et al., 2020; National Institute of Diabetes and Digestive and Kidney Diseases, 2023). The prevalence of CKD is high. If patients have appropriate education regarding their nutritional requirements, they may maintain acceptable renal function for a prolonged period and delay their progression to ESRD and possibly the need for HD. Health care professionals lack the education necessary to provide appropriate nutritional counseling to patients (Anderson & Nguyen, 2018; Cupisti et al., 2018); therefore, a standardized guideline for the nutritional management of CKD was established.

Literature Review

A systematic literature search was performed with consultation from a reference librarian. With assistance from the reference librarian, studies were assessed using Melnyk and Fineout-Overholt's (2019) rapid critical appraisal for validity, reliability, and applicability for keeper studies meeting the inclusion and exclusion criteria. The goal was to find relevant articles supporting CKD diagnosis, nutritional assessment and management, and nutritional guidelines. The following databases were searched: Cochrane Database of Systematic Reviews, Cumulative Index of Nursing and Allied Health Literature (CINAHL), Ovid (MEDLINE), and PubMed. The related search terms from keywords comprised the inclusion criteria chronic kidney disease (CKD), nutritional assessment, nutritional education, nutritional management, and nutritional guidelines. Medical subject headings were utilized for a systematic search from three different disciplines: nephrology, dietary, and nursing. The exclusion criteria, filters, or limiters depending upon the database used were end-stage renal disease (ESRD), hemodialysis (HD), publication

date after 2015, full text, and withholding Texas as a keyword. The results generated 288 and zero if Texas was added as a limiter. The inclusion and exclusion criteria indicated that research in this area was limited.

Nutritional assessment is the foundation for patient education and management. However, the assessment is only conducted annually, within 90 days if HD is required, or when indicated by biannual nutritional screening according to the KDOQI Clinical Practice Guideline (Ikizler et al., 2020). The literature review comprises articles related to nutritional management for CKD patients. With a lack of nutritional assessment, patient nutritional education regarding low-protein and plant-based diet, and nutritional management, CKD has been shown to deteriorate toward kidney death and require the lifesaving measure of HD (Adair & Bowden, 2020; Alvirdizadeh et al., 2020; Anderson & Nguyen, 2018; Betz et al., 2022; Campbell & Liebman, 2019; Carrero et al., 2020Evangelidis et al., 2019; Ikizler et al., 2020; Kelly et al., 2020; Lambert, 2023; Zarantonello & Brunori 2023).

Nutritional Assessment

To provide the largest potential benefit for CKD patients, nutritional assessments must be completed by a qualified and well-educated provider with CKD training or specialty. Yet research indicates a lack of CKD nutritionally educated providers (Anderson & Nguyen, 2018; Cupisti et al., 2018). Several authors mentioned nutritional assessment without describing who conducted the assessment to determine education, and no details related to the frequency were mentioned (Kelly et al., 2020; Lambert et al., 2018; Pérez-Torres et al., 2021; Teng et al., 2021). Research suggests that non-adherence with a renal diet, low-protein and plant-based, is a primary contributing factor to increased morbidity and mortality, patients report following the diet is very difficult because of its complexity (Adair & Bowden, 2020; Alvirdizadeh et al., 2020; Anderson

& Nguyen, 2018; Betz et al., 2022; Campbell & Liebman, 2019; Carrero et al., 2020; Evangelidis et al., 2019; Ikizler et al., 2020; Kelly et al., 2020; Lambert et al., 2018; Lambert, 2023; Zarantonello & Brunori 2023). Patient nutritional education, reliably provided by those with CKD nutrition education or preferably by a registered dietitian (RD) specializing in CKD management, is an area needing improvement. In addition, this educational gap widens, as noted through a limited nutritional education represented in medical training curricula (Anderson & Nguyen, 2018). With limited provider education and RDs with CKD experience to assess CKD nutrition, patients bear the burden of seeking nutritional education to maintain health and wellness (Lambert et al., 2018; Lambert, 2023).

Education

Patient education is essential in managing CKD; however, this was not listed as an indication for providers. If members of the health care team lack education related to the nutritional requirements for individuals with CKD, they will not be able to educate their patients and families on self-care. Nurses have reported limited nutrition education, and many nurses report a lack of understanding of current strategies to delay CKD progression including laboratory values for kidney function, physical indicators, and maintaining health-promoting behaviors, including physical activity, interpersonal relationships, spiritual growth, stress management, and lastly, nutrition (Teng et al., 2021). One study described the RD as the most beneficial healthcare team member to promote nutritional education (Ikizler et al., 2020). Based on national numbers of available RDs even if all of them were to assess CKD patients, the need for nutritional management would require additional support from other disciplines (Cupisti et al., 2018).

If diet has yet to be assessed and evidence-based education has not been provided, CKD patients can and will seek out their information on health and wellness (Lambert et al., 2017; Sing et al., 2020). Many individuals with CKD who have not received a nutritional assessment and evidence-based dietary education begin self-education. Due to the lack of available resources, they report this is a daunting task and that the information they find is conflicting (Lambert et al., 2018; Lambert, 2023; Pérez-Torres et al., 2021). The information patients encounter can have significant shortcomings related to lack of evidence noted through a lack of evidenced-based material, accuracy, rationale, and context. Further complicating the matter are issues surrounding the patient and family members, health literacy level (Lambert et al., 2017; Sing et al., 2020). For individuals and families with low health literacy level the problem is overwhelming. CKD patients have been assessed to read at a fifth-grade level, and the readability of high-quality website information is noted to be at a tenth-grade level (Lambert et al., 2017).

CKD patients will often seek out provider insight from information they have read, and it then is up to that provider to give proper education to the patient to maintain continuity of care; however, statistically, providers are not able to do this based upon limited education in this regard (Anderson & Nguyen, 2018). The frustrations from learning about CKD nutrition, which is complex and challenging, have been assessed and shown to be overwhelming, frustrating, and a source of negative emotions (Lambert et al., 2018). Research from CKD patients indicate the need for an RD with CKD experience to be available with support and develop problem-solving strategies from a multidisciplinary approach, as different specialties will be in contact with CKD patients at different stages of progression (Lambert et al., 2018). Interprofessional collaboration, if no RD with CKD experience is available, is essential and beneficial for patient understanding, adherence, and maintenance of a challenging nutritional renal diet (Anderson & Nguyen, 2018;

Cupisti et al., 2018; Evangelidis et al., 2019; Lambert et al., 2018; Sing et al., 2020; Teng et al., 2021).

Project Question

Does a standardized guideline for CKD nutritional management, compared to no standardized guideline, improve CKD nutritional management when the guideline is supported by literature, which includes graded recommendations and stakeholders, rating of recommendations?

Objectives

The objective of this project created an evidence-based educational nutritional management guideline by completing the following:

- Consultation with librarian for literature search to support the need to develop a standardized nutritional guideline for CKD nutritional management based on current evidence-based practice. Search was supported by the keywords.
- Creation of evidence-based table from the literature identified in the literature search.
- Project lead graded the literature based on the Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals (see Appendix A).
- Identified recommendations for the guideline based on the graded evidence.
- Sent recommendations to stakeholders for their rating of recommendations.
- Reviewed recommendations and comments and made a decision as to what was included in the final guideline.
- Developed guideline for assessing and managing CKD patients needing nutritional management by way of graded evidence-based recommendations and rated by stakeholders.

- Disseminated the final guideline to be published with the evaluation of guidelines by Appraisal of Guidelines for Research & Evaluation II (AGREE) II Instrument (see Appendix B)

Framework

The Agency for Healthcare Research and Quality (AHRQ)-National Quality Measures Clearinghouse (NQMC) Domain Framework (see Appendix C), has been established for guideline development to provide providers with healthcare delivery systems and health insurance plans, a bridge across practice and research (AHRQ, 2018). The AHRQ-NQMC Domain Framework is the most applicable framework for this EBP guideline project.

This project was focused on healthcare delivery, and the steps of the AHRQ-NQMC Domain Framework were followed for guidance and the development of an evidence-based practice (EBP) guideline. All five clinical quality measures to be EBP list evidence assessment as foremost for establishing a guideline. A review of the literature for best evidence was completed using the keywords. These studies covered the initial quality measure, process, or measures calculated for patient eligibility for a particular service and those who do or do not receive nutritional management of CKD. Access or attainment of timely and appropriate health care, the second quality measure, as research indicated, was a gap in care by way of limited CKD-educated providers or RD. Outcome, the third quality measure, is the health status of a patient from delivered health care, or measures used to detect the impact of the intervention, will be assessed upon implementation of guideline. Structure, the fourth quality measure, or the ability of a healthcare organization or provider to provide high-quality care, was identified as lacking for CKD patients. Patient experience, the fifth quality measure, or reported patients' preferences, values, or clinical quality domain, in participation in health care, or mean scores

from patient surveys, as aforementioned, was reported to be complex and challenging, has been assessed and shown to be overwhelming, frustrating, and a source of negative emotions. Nutritional management of CKD, with an evidence-based guideline, is needed to mitigate kidney death, offset the need for HD, decrease risk of death, and ensure improved health and wellness.

Method

The methodology for this project was collaborative for the development of an evidence-based guideline, and included a SWOT analysis (strengths, weakness, opportunities and threats, potential risks) (see Appendix D). The research was evaluated and recommendations for a nutritional guideline for CKD were developed. A multidisciplinary team of stakeholders was led by the project lead, a Doctor of Nursing Practice student, who conducted a systematic review of the literature for appropriate interventions for the five developed guidelines. An evidence table composed of summaries of the review of literature (ROL) was supplied to the stakeholders for consideration of how the recommendations were established. The stakeholders were given two weeks to review the evidence table and then rate the recommendations. Comments regarding the recommendations resulting in the guidelines were anonymous**.** The ratings were submitted to the statistician for descriptive analysis.

Population

The population for the guideline development includes stakeholders as well as patients benefiting from the guideline. The stakeholders included a nephrologist, nurse practitioners (NPs), and registered dietitians (RDs). These individuals were included because of their expertise on the topic and because they would be apt to use the guideline in practice. Those with CKD will be the intended beneficiaries of this guideline.

Setting

The setting for this CKD nutritional management guideline was Texas. The ROL included numerous systematic reviews which covered all inhabited continents and were considered for the development of the guideline. It is to be a universal standard for any CKD nutritional management setting.

Measurement and Data Analysis

With the assistance of the university statistician, the method for statistical analysis of data collected from the stakeholders was researched. A non-parametric test, Friedman's Two-Way Analysis of Variance (ANOVA) by Ranks, was used for the analysis of the stakeholder ratings. The completed database was sent to the statistician for descriptive statistical analysis and interpretation of the data. For a better understanding of the statistical analysis and understanding of the reliability and outcome of the ordinal level numerical data from the analysis, grading visualization tools such as graphs, pie-charts, and tables to better conceptualize the information was completed. Following the strength and quality of evidence from the Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals, the highest scores from the literature were assigned inclusion priority as recommendations reflecting the mean, median, mode, and percentage to establish percentages ranked and sorted, highest to lowest, so that in conjunction with the statistician the highest recommendations were included or regarded for consideration in the final guideline. Finally, a correlational analysis was conducted to better understand the associations between data. SPSS (Version 29) was used for the calculation of descriptive statistics.

Procedure

Creating the guideline for nutritional management required numerous steps. The subsequent activities focused on the development of the project. Once approval to develop the guideline was received, the project lead collaborated with the librarian to conduct a systematic review of the literature based on the keywords. Articles obtained were assessed using the Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals framework and placed in a review of literature database (see Appendix E). Recommendations for the guideline, identified from the literature, placed into a dashboard, and these recommendations were graded by the project lead using A for systematic reviews, meta-analyses, or random control trials. B was used for correlational/comparative studies and C for descriptive and expert opinions (see Appendix F). The project lead sent these graded recommendations to the stakeholders for their ratings using a survey via Question Pro. The survey asked them to rate the identified recommendations (see Appendix G). Recommendations rated by the stakeholders were placed onto a dashboard for final analysis and submission of rated guideline recommendations for statistical analysis.

Team Roles

The team included the project lead, librarian, statistician, stakeholders, nephrologist, NPs, and RDs. The project lead was responsible for establishing the roles, educating team members about roles and responsibilities, project planning, and implementation of the guideline development. This included identification of the recommendations from the evidence, grading the recommendations, sending recommendations to the stakeholders for rating, and final selection of recommendations. The project lead collaborated with the librarian to conduct a systematic search for articles to address the keywords. The stakeholders rated the

recommendations. The lead collaborated with a statistician to conduct an analysis of the final data collected from the stakeholders' ratings.

Education of Team

The team was educated regarding the guideline's purpose, the role each member or stakeholder had, how that was to be completed, and what the expectation was regarding the completion of the activity. An email was sent to all team members/stakeholders regarding project proposal development, the request of them as specialty professionals selected for guideline development. The implementation steps were presented to the team for transparency of project proposal development and understanding of the timeline and responsibilities involved. The stakeholders were educated regarding how meetings will be conducted, notification of article table completion, timeline notification of the team regarding the development of recommendations, and stakeholders were notified of anonymity for comments and grading. The project lead shared a survey link, using Question Pro, and provided stakeholders with access to a shared folder containing all articles and the evidence table if stakeholders wanted to review them.

Statistical Analysis

The initial ratings from the stakeholders were collected. Descriptive statistics and statistical analysis were conducted by way of SPSS Version 29 with assistance from the statistician. Mean, minimum, and maximum scores from the recommendations with standard deviation were generated from Friedman's Two-Way Analysis of Variance. The results from the project lead's results were reviewed with the statistician for analysis of correctness.

Ethical Consideration

The ethical considerations for this project proposal of guideline development have been taken under advisement. This guideline for evidence-based educational CKD nutritional management did not directly involve human subjects, yet this project aims to improve CKD nutritional management, so ethics have been considered for all aspects of this project. Human Subjects Protection training has been completed by the project lead (see Appendix H). This project proposal will be under the approval and authority of the Graduate Nurse Review Committee (GNRC). No human subjects were part of this project proposal.

Results

Project Outcomes

The graded review of the literature comprises over 50 articles comprising all levels of grading I-V from the Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals**.** After the review of literature was completed, five recommendations were conceptualized. After the rating of each recommendation by the stakeholders (see Appendix F) was entered into an Excel spreadsheet for an initial rating, descriptive statistics were computed with statistician assistance using SPSS (Version 29) to derive maximum, minimum, and mean for each recommendation (see Appendix I). Confirmation of the ranking was established for computation of Friedman's Two-Way Analysis of Variance by Ranks $X^2_{(4)} = 11.279$, $p<.024$ (see Appendix J). Results showed that the stakeholders' ratings (rankings) are significantly different, and the null hypothesis was rejected.

Not all recommendations were accepted by the stakeholders. Limited availability of RDs with three years of experience, and the availability of those with CKD education who are certified as Specialists in Renal Nutrition, which is a demanding and difficult specialty to obtain,

further limiting the preferred educators for CKD. All stakeholders agreed that CKD is generally not diagnosed until late into the disease trajectory, early case finding for prevention should be primary and education secondary to finding them earlier. Simplifying diagnosis such as having a kidney lab draw day for an estimated glomerular filtration rate rather than the problematic 24-hour creatinine clearance urine sample. March was stated as the National Kidney Month and there is a World Kidney Day website stating the objectives to prevent kidney disease with systematic screening but no mention of labs for baseline knowledge.

Discussion

Recommendation One: CKD patient education by RD with CKD education, experience, and knowledge; such as training in GRID and three years of CKD nutritional management, Recommendation Two: plant-based diet for CKD patients for prevention of incident CKD and progression of CKD, Recommendation Three: low-protein diet for CKD patients for prevention of incident CKD and progression of CKD, Recommendation Four: elevated follow-up, more than bi-annually, by RD with worsening of CKD or provider with CKD nutrition education or training, Recommendation Five: multidisciplinary approach to improve adherence, patient empowerment, individualization, and use of technology to improve CKD progression were all graded A. The review of literature indicated that the preeminent educator for CKD patients should be an RD, what was researched for limiting CKD progression regarding nutritional management, low-protein plant-based diet, how often they should be assessed, and the method for contact.

Summary

Key Findings

The strengths of this project are the highly graded articles indicating the gap with CKD nutritional management and consistent complications to prevent CKD progression. The multidisciplinary stakeholders had a minimum of 10 years of CKD experience. The continuation of this project will be the follow-up with the concerns regarding limited knowledge of CKD patients until late stages. This is another gap needing corrected. With the understanding of this project and continued research to find CKD patients this nutritional management guideline will be significant for better health, wellness, and increased life expectancy. This guideline should be utilized by all providers who care for persons with CKD. It is intended to provide a foundational guideline for the prevention of CKD by way of nutritional management. It is to assist those diagnosed with CKD informed of best practices for improved health and wellness. In keeping with the intention of this guideline for the prevention of CKD, the future project would be to establish a national time for laboratory assessment of CKD. Routine follow-up for individuals with CKD.

Limitations

The following were limitations noted for the development of this nutritional management guideline. A limited number of stakeholders, only four databases were utilized for systematic ROL, a limited number of articles in ROL, inclusion and exclusion criteria indicated are noted to be limitations based upon keywords, limited time for stakeholders to rate recommendations, and five recommendations based upon, who should educate, what they should recommend, how often they should assess, and how they should contact them. Limited information regarding specifics

of plant-based and low-protein diet. All of these have been listed for consideration of future projects.

Conclusion

With thirty-seven million adults estimated to have CKD and limited CKD nutritional management, decreased life expectancy from HD complications, and increased risk of morbidity and mortality use of this guideline will be essential (Centers for Disease Control and Prevention, 2022; United States Renal Data System, 2022). Dissemination will include publication, presentations at the local, state, and national levels. It will be best practice to find those with CKD; such as establishing a yearly lab assessment and then nutritional management of those found for CKD preservation of renal function. Finding, educating, and continuing assessments will be foundational for preventing kidney death**.**

References

Adair, K. E., & Bowden, R. G. (2020). Ameliorating chronic kidney disease using a whole food plant-based diet. *Nutrients*, *12*(4), 1007. https://doi.org/10.3390/nu12041007

Agency for Healthcare Research and Quality. (2018). *National guideline clearinghouse (NGC) inclusion criteria*. Agency for healthcare research and quality. Retrieved April 25, 2023, from https://www.ahrq.gov/gam/summaries/inclusion-criteria/index.html

Alvirdizadeh, S., Yuzbashian, E., Mirmiran, P., Eghtesadi, S., & Azizi, F. (2020). A prospective study on total protein, plant protein and animal protein in relation to the risk of incident chronic kidney disease. *BMC Nephrology*, *21*(1), 489. https://doi.org/10.1186/s12882-020-02079-y

Anderson, C. A. M., & Nguyen, H. A. (2018). Nutrition education in the care of patients with chronic kidney disease and end-stage renal disease. *Seminars in Dialysis, 31*(2), 115–121. https://doi.org/10.1111/sdi.12681

Ayat Ali, A. S., Lim, S. K., Tang, L. Y., Rashid, A. A., & Chew, B.-H. (2021). The effectiveness of nurse-led self-management support program for people with chronic kidney disease stage 3-4 (CKD-NLSM): Study protocol for a randomized controlled trial. *Science Progress (1916), 104*(2), 368504211026159–368504211026159. https://doi.org/10.1177/00368504211026159

Betz, M. V., Nemec, K. B., & Zisman, A. L. (2022). Plant-based diets in kidney disease: nephrology professionals' perspective. *Journal of Renal nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, *32*(5), 552–559. https://doi.org/10.1053/j.jrn.2021.09.008

Betz, M. V., Nemec, K. B., & Zisman, A. L. (2023). Patient perception of plant-based diets for kidney disease. *Journal of Renal nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, *33*(2), 243–248. https://doi.org/10.1053/j.jrn.2022.09.006

Bin Zarah, A., Feraudo, M. C., & Andrade, J. M. (2021). Development and relative validity of the chronic kidney disease short food frequency questionnaire (CKD SFFQ) to determine diet quality and dietary habits among adults with chronic kidney disease. *Nutrients, 13*(10), 3610-. https://doi.org/10.3390/nu13103610

Campbell, T. M., & Liebman, S. E. (2019). Plant-based dietary approach to stage 3 chronic kidney disease with hyperphosphataemia. *BMJ Case Reports, 12*(12), e232080-. https://doi.org/10.1136/bcr-2019-232080

Carrero, J. J., González-Ortiz, A., Avesani, C. M., Bakker, S. J. L., Bellizzi, V., Chauveau, P., Clase, C. M., Cupisti, A., Espinosa-Cuevas, A., Molina, P., Moreau, K., Piccoli, G. B., Post, A., Sezer, S., & Fouque, D. (2020). Plant-based diets to manage the risks and complications of chronic kidney disease. *Nature Reviews. Nephrology*, *16*(9), 525–542. https://doi.org/10.1038/s41581-020-0297-2

Cases, A., Cigarrán-Guldrís, S., Mas, S., & Gonzalez-Parra, E. (2019). Vegetable-based diets for chronic kidney disease? It is time to reconsider. *Nutrients*, *11*(6), 1263. https://doi.org/10.3390/nu11061263

Centers for Disease Control and Prevention. (2022, July 12). *Chronic kidney disease in the United States, 2021.* US Department of Health and Human Services, Centers for Disease Control and Prevention. https://www.cdc.gov/kidneydisease/publications-resources/CKD-national-facts.html

Chan W. (2021). Chronic kidney disease and nutrition support. *Nutrition in Clinical Practice: Official Publication of the American Society for Parenteral and Enteral Nutrition*, *36*(2), 312–330. https://doi.org/10.1002/ncp.10658

Chauveau, P., Koppe, L., Combe, C., Lasseur, C., Trolonge, S., & Aparicio, M. (2019). Vegetarian diets and chronic kidney disease. *Nephrology, Dialysis, Transplantation: Official Publication of the European Dialysis and Transplant Association - European Renal Association*, *34*(2), 199–207. https://doi.org/10.1093/ndt/gfy164

Cigarrán Guldris, S., Latorre Catalá, J. A., Sanjurjo Amado, A., Menéndez Granados, N., & Piñeiro Varela, E.. (2022). Fibre intake in chronic kidney disease: What fibre should we recommend? *Nutrients*, *14*(20), 4419. https://doi.org/10.3390/nu14204419

Cupisti, A., Brunori, G., Di Iorio, B. R., D'Alessandro, C., Pasticci, F., Cosola, C., Bellizzi, V., Bolasco, P., Capitanini, A., Fantuzzi, A. L., Gennari, A., Piccoli, G. B., Quintaliani, G., Salomone, M., Sandrini, M., Santoro, D., Babini, P., Fiaccadori, E., Gambaro, G., Garibotto, G., … Gesualdo, L. (2018). Nutritional treatment of advanced CKD: Twenty consensus statements. *Journal of Nephrology*, *31*(4), 457–473. https://doi.org/10.1007/s40620-018-0497-z

Ebrahim, Z., Esau, N., & Cilliers, L. (2020). Keeping the diet simple and natural in chronic kidney disease: A south African-based dietary infographic. *Journal of Renal Nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, *30*(4), e58–e65. https://doi.org/10.1053/j.jrn.2019.11.007

Eckardt, K.-U., Bansal, N., Coresh, J., Evans, M., Grams, M. E., Herzog, C. A., James, M. T., Heerspink, H. J. L., Pollock, C. A., Stevens, P. E., Tamura, M. K., Tonelli, M. A., Wheeler, D. C., Winkelmayer, W. C., Cheung, M., Hemmelgarn, B. R., Abu-Alfa, A. K., Anand, S., Arici, M., … Williams, A. W. (2018). Improving the prognosis of patients with severely decreased glomerular filtration rate (CKD G4+): Conclusions from a kidney disease: Improving global

outcomes (KDIGO) controversies conference. *Kidney International, 93*(6), 1281–1292. https://doi.org/10.1016/j.kint.2018.02.006

Evangelidis, N., Craig, J., Bauman, A., Manera, K., Saglimbene, V., Tong, A. (2019). Lifestyle behaviour change for preventing the progression of chronic kidney disease: A systematic review. *BMJ Open, 9*(10), e031625. https://dx.doi.org/10.1136/bmjopen-2019-031625

Fontes, B. C., Anjos, J. S. dos, Black, A. P., Moreira, N. X., & Mafra, D. (2018). Effects of low-protein diet on lipid and anthropometric profiles of patients with chronic kidney disease on conservative management. *Brazilian Journal of Nephrology, 40*(3), 225–232. https://doi.org/10.1590/2175-8239-jbn-3842

Fu, J., & Shin, S. (2023). The association of dietary patterns with incident chronic kidney disease and kidney function decline among middle-aged Korean adults: A cohort study. *Epidemiology and Health*, *45*, e2023037. https://doi.org/10.4178/epih.e2023037

Himmelfarb, J., Vanholder, R., Mehrotra, R., & Tonelli, M. (2020). The current and future landscape of dialysis. *Nature Reviews Nephrology*, *16*(10), 573–585. https://doi.org/10.1038/s41581-020-0315-4

Hou, Y. C., Huang, H. F., Tsai, W. H., Huang, S. Y., Liu, H. W., Liu, J. S., & Kuo, K. L. (2022). Vegetarian diet is associated with a lower risk of chronic kidney disease in diabetic patients. *Frontiers in Nutrition*, *9*, 843357. https://doi.org/10.3389/fnut.2022.843357

Hu, E. A., Coresh, J., Anderson, C. A. M., Appel, L. J., Grams, M. E., Crews, D. C., Mills, K. T., He, J., Scialla, J., Rahman, M., Navaneethan, S. D., Lash, J. P., Ricardo, A. C., Feldman, H. I., Weir, M. R., Shou, H., Rebholz, C. M., & CRIC Study Investigators (2021). Adherence to healthy dietary patterns and risk of CKD progression and all-cause mortality: Findings from the CRIC (Chronic Renal Insufficiency Cohort) Study. *American Journal of Kidney*

Diseases: The Official Journal of the National Kidney Foundation, *77*(2), 235–244. https://doi.org/10.1053/j.ajkd.2020.04.019

Ikizler, T. A., Burrowes, J. D., Byham-Gray, L. D., Campbell, K. L., Carrero, J.-J., Chan, W., Fouque, D., Friedman, A. N., Ghaddar, S., Goldstein-Fuchs, D. J., Kaysen, G. A., Kopple, J. D., Teta, D., Yee-Moon Wang, A., & Cuppari, L. (2020). KDOQI clinical practice guideline for nutrition in CKD: 2020 update. *American Journal of Kidney Diseases, 76*(3), S1–S107. https://doi.org/10.1053/j.ajkd.2020.05.006

Joshi, S., Brown-Tortorici, A., Sussman-Dabach, E. J., & Kalantar-Zadeh, K. (2022). Chapter 29 - Nutritional approaches and plant-dominant diets for conservative and preservative management of chronic kidney disease. *Nutritional Management of Renal Disease* (4th ed., 515–543). Elsevier Inc. https://doi.org/10.1016/B978-0-12-818540-7.00054-9

Joshi, S., Kalantar-Zadeh, K., Chauveau, P., & Carrero, J. J. (2023). Risks and benefits of different dietary patterns in CKD. *American Journal of Kidney Diseases: The Official Journal of the National Kidney Foundation*, *81*(3), 352–360. https://doi.org/10.1053/j.ajkd.2022.08.013

Kalantar-Zadeh, K., Bellizzi, V., Piccoli, G. B., Shi, Y., Lim, S. K., Riaz, S., Arronte, R. U., Lau, W. P., & Fouque, D. (2023). Caring for patients with advanced chronic kidney disease: Dietary options and conservative care instead of maintenance dialysis. *Journal of Renal nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, *33*(4), 508–519. https://doi.org/10.1053/j.jrn.2023.02.002

Kalantar-Zadeh, K., Joshi, S., Schlueter, R., Cooke, J., Brown-Tortorici, A., Donnelly, M., Schulman, S., Lau, W. L., Rhee, C. M., Streja, E., Tantisattamo, E., Ferrey, A. J., Hanna, R., Chen, J. L. T., Malik, S., Nguyen, D. V., Crowley, S. T., & Kovesdy, C. P. (2020). Plant-dominant low-

protein diet for conservative management of chronic kidney disease. *Nutrients*, *12*(7), 1931. https://doi.org/10.3390/nu12071931

Kelly, J. T., Conley, M., Hoffmann, T., Craig, J. C., Tong, A., Reidlinger, D. P., Reeves, M. M., Howard, K., Krishnasamy, R., Kurtkoti, J., Palmer, S. C., Johnson, D. W., & Campbell, K. L. (2020). A coaching program to improve dietary intake of patients with CKD: ENTICE-CKD. *Clinical Journal of the American Society of Nephrology: CJASN*, *15*(3), 330–340. https://doi.org/10.2215/CJN.12341019

Kelly, J. T., Jegatheesan, D. K., Dawson, J., Barnett, A., Khor, B. H., Chang, A. R., Carrero, J. J., & Campbell, K. L. (2023). Are digital health technologies and models of nutrition care the future of chronic kidney disease management? *Journal of Renal nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, *33*(6S), S80–S87. https://doi.org/10.1053/j.jrn.2023.02.004

Kelly, J. T., Palmer, S. C., Wai, S. N., Ruospo, M., Carrero, J. J., Campbell, K. L., & Strippoli, G. F. M. (2017). Healthy dietary patterns and risk of mortality and ESRD in CKD: A meta-analysis of cohort studies. *Clinical Journal of the American Society of Nephrology: CJASN*, *12*(2), 272–279. https://doi.org/10.2215/CJN.06190616

Khor, B.-H., Sumida, K., Scholes-Robertson, N., Chan, M., Lambert, K., Kramer, H., Lui, S.-F., & Wang, A. Y.-M. (2023). Nutrition education models for patients with chronic kidney disease. *Seminars in Nephrology.*, *43*(2). https://doi.org/10.1016/j.semnephrol.2023.151404

Kim, H., Caulfield, L. E., Garcia-Larsen, V., Steffen, L. M., Grams, M. E., Coresh, J., & Rebholz, C. M. (2019). Plant-based diets and incident CKD and kidney function. *Clinical Journal of the American Society of Nephrology: CJASN*, *14*(5), 682–691. https://doi.org/10.2215/CJN.12391018

Kirk, J., Karupaiah, T., Chan, M., Burrowes, J., Prest, M., & Kopple, J. (2022). The grid course facilitates nutritional education and medical nutrition therapy for patients with chronic kidney disease. (2022). *American Journal of Kidney Diseases*, 79(4), S57–S57. https://doi.org/10.1053/j.ajkd.2022.01.190

Ko, G. J., & Kalantar-Zadeh, K. (2021). How important is dietary management in chronic kidney disease progression? A role for low protein diets. *The Korean Journal of Internal Medicine*, *36*(4), 795–806. https://doi.org/10.3904/kjim.2021.197

Lambert, K. (2023). Designing dietary education materials for people with chronic kidney disease: Recommendations for improving the quality of resources. *Journal of Renal Nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation 33*(1), 208-213. https://dx.doi.org/10.1053/j.jrn.2022.06.005

Lambert, K., Mansfield, K., Mullan, J. (2018). How do patients and carers make sense of renal dietary advice? A qualitative exploration. *Journal of Renal Care, 44*(4), 238-250. https://dx.doi.org/10.1111/jorc.12260

Lambert, K., Mansfield, K., & Mullan, J. (2019). Qualitative exploration of the experiences of renal dietitians and how they help patients with end stage kidney disease to understand the renal diet. *Nutrition & Dietetics, 76*(2), 126–134. https://doi.org/10.1111/1747-0080.12443

Lambert, K., Mullan, J., Mansfield, K., Koukomous, A., & Mesiti, L. (2017). Evaluation of the quality and health literacy demand of online renal diet information. *Journal of Human Nutrition and Dietetics: The Official Journal of the British Dietetic Association*, *30*(5), 634–645. https://doi.org/10.1111/jhn.12466

Lu, L., M.M., Huang, Y., B.Sc, Wang, M., B.Sc, Chen, D., B.Sc, Wan, H., M.M., Wei, L., M.D., & Xiao, W., M.D. (2017). Dietary fiber intake is associated with chronic kidney disease (CKD)

progression and cardiovascular risk, but not protein nutritional status, in adults with CKD. *Asia Pacific Journal of Clinical Nutrition, 26*(4), 598-605. doi:https://doi.org/10.6133/apjcn.072016.08

McFarlane, C., Ramos, C. I., Johnson, D. W., & Campbell, K. L. (2019). Prebiotic, probiotic, and synbiotic supplementation in chronic kidney disease: A systematic review and meta-analysis. *Journal of Renal Nutrition*, *29*(3), 209–220. https://doi.org/10.1053/j.jrn.2018.08.008

Melnyk, B., & Fineout-Overholt, E. (2019) *Evidence-based practice in nursing & healthcare* (4th ed.). Wolters Kluwer Health.

Mirmiran, P., Yuzbashian, E., Asghari, G., Sarverzadeh, S., & Azizi, F. (2018). Dietary fibre intake in relation to the risk of incident chronic kidney disease. *British Journal of Nutrition, 119*(5), 479–485. https://doi.org/10.1017/S0007114517003671

Moloudpour, B., Jam, S. A., Darbandi, M., Janati, A., Gholizadeh, M., Najafi, F., & Pasdar, Y. (2023). Association between plant-based diet and kidney function in adults. *Journal of Renal Nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, S1051-2276(23)00152-8. Advance online publication. https://doi.org/10.1053/j.jrn.2023.09.002

Mocanu, C.-A., Simionescu, T. P., Mocanu, A. E., & Garneata, L. (2021). Plant-based versus animal-based low protein diets in the management of chronic kidney disease. *Nutrients, 13*(11), 3721-. https://doi.org/10.3390/nu13113721

Narasaki, Y., Kalantar-Zadeh, K., Rhee, C. M., Brunori, G., & Zarantonello, D. (2023). Vegetarian nutrition in chronic kidney disease. *Nutrients, 16*(1), 66-. https://doi.org/10.3390/nu16010066

National Institute of Diabetes and Digestive and Kidney Diseases. (2023). *Kidney disease statistics for the United States.* National Institute of Health. https://www.niddk.nih.gov/health-information/health-statistics/kidney-disease

Oliveira, M. C., Viney, A., Picard, E., Barnel, C., Fouque, D., & Koppe, L. (2024). Dietary intake and nutritional status in diabetic and nondiabetic patients with chronic kidney disease stage 4-5 (NutriDiab Study). *Journal of Renal Nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, *34*(1), 19–25. https://doi.org/10.1053/j.jrn.2023.06.006

Pereira, R. A., Alvarenga, M. S., Avesani, C. M., & Cuppari, L. (2021). Strategies designed to increase the motivation for and adherence to dietary recommendations in patients with chronic kidney disease. *Nephrology, Dialysis, Transplantation: Official Publication of the European Dialysis and Transplant Association - European Renal Association*, *36*(12), 2173–2181. https://doi.org/10.1093/ndt/gfaa177

Pérez-Torres, A., Caverni-Muñoz, A., & González García, E. (2022). Mediterranean diet and chronic kidney disease (CKD): A practical approach. *Nutrients, 15*(1), 97-. https://doi.org/10.3390/nu15010097

Pérez-Torres, A., Gonzalez Garcia, M. E., Ossorio-Gonzalez, M., Alvarez Garcia, L., Bajo, M. A., Del Peso, G., Castillo Plaza, A., Selgas, R. (2021). The effect of nutritional interventions on long-term patient survival in advanced chronic kidney disease. *Nutrients,* 13(2). https://dx.doi.org/10.3390/nu13020621N

Rashid, I., Tiwari, P., Cruz, S. D., & Jaswal, S. (2023). Rates and determinants of fast chronic kidney disease progression distinguished by nutritional status, and the impact of malnutrition on

mortality - Evidence from a clinical population. *Clinical Nutrition ESPEN*, *57*, 683–690. https://doi.org/10.1016/j.clnesp.2023.08.008

Rhee, C. M., Ahmadi, S., Kovesdy, C. P., & Kalantar-Zadeh, K. (2018). Low-protein diet for conservative management of chronic kidney disease: A systematic review and meta-analysis of controlled trials. *Journal of Cachexia, Sarcopenia and Muscle, 9*(2), 235–245. https://doi.org/10.1002/jcsm.12264

Rhee, C. M., Wang, A. Y., Biruete, A., Kistler, B., Kovesdy, C. P., Zarantonello, D., Ko, G. J., Piccoli, G. B., Garibotto, G., Brunori, G., Sumida, K., Lambert, K., Moore, L. W., Han, S. H., Narasaki, Y., & Kalantar-Zadeh, K. (2023). Nutritional and dietary management of chronic kidney disease under conservative and preservative kidney care without dialysis. *Journal of Renal Nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, *33*(6S), S56–S66. https://doi.org/10.1053/j.jrn.2023.06.010

Rysz, J., Franczyk, B., Rokicki, R., & Gluba-Brzózka, A. (2021). The influence of dietary interventions on chronic kidney disease–Mineral and bone disorder (CKD-MBD). *Nutrients, 13*(6), 2065-. https://doi.org/10.3390/nu13062065

Sakaguchi, Y., Kaimori, J.-Y., & Isaka, Y. (2023). Plant-dominant low protein diet: A potential alternative dietary practice for patients with chronic kidney disease. *Nutrients,* 15(4), 1002-. https://doi.org/10.3390/nu15041002

Saran, R., Robinson, B., Abbott, K. C., Bragg-Gresham, J., Chen, X., Gipson, D., Gu, H., Hirth, R. A., Hutton, D., Jin, Y., Kapke, A., Kurtz, V., Li, Y., Mccullough, K., Modi, Z., Morgenstern, H., Mukhopadhyay, P., Pearson, J., Pisoni, R., … Shahinian, V. (2020). US renal data system 2019 annual data report: Epidemiology of kidney disease in the United States. *American Journal of Kidney Diseases*, *75*(1), A6–A7. https://doi.org/10.1053/j.ajkd.2019.09.003

Singh, R., Jaar, B. G., Kazi, G., & Appel, L. J. (2020). Features of patient-education websites for patients with chronic kidney disease: An analysis of recommended websites. *BMC Nephrology*, *21*(1), 457. https://doi.org/10.1186/s12882-020-02128-6

Tao, S., Tao, S., Cheng, Y., Liu, J., Ma, L., & Fu, P. (2019). Effects of probiotic supplements on the progression of chronic kidney disease: A meta-analysis. *Nephrology (Carlton, Vic.)*, *24*(11), 1122–1130. https://doi.org/10.1111/nep.13549

Teng, H. L., Yen, M., Fetzer, S., Sung, J. M., Hung, S. Y. (2021). Tailoring health-promoting programs for patients with chronic kidney disease: Randomized controlled trial. *Western Journal of Nursing Research, 43*(2), 138-150. https://dx.doi.org/10.1177/0193945920942487

Texas Health and Human Services. (2023, January). *State plan for chronic kidney disease treatment.* https://www.hhs.texas.gov/search?search=state+plan+for+chronic+kidney+disease+

Torabikhah, M., Farsi, Z., & Sajadi, S. A. (2023). Comparing the effects of mHealth app use and face-to-face training on the clinical and laboratory parameters of dietary and fluid intake adherence in hemodialysis patients: A randomized clinical trial. *BMC Nephrology, 24*(1), 194–194. https://doi.org/10.1186/s12882-023-03246-7

Tseng, P. W., Lin, T. Y., & Hung, S. C. (2023). Association of frailty with nutritional status in patients with chronic kidney disease. *Journal of Renal Nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, S1051-2276(23)00153-X. Advance online publication. https://doi.org/10.1053/j.jrn.2023.09.003

Torreggiani, M., Fois, A., Lippi, F., Attini, R., Longhitano, E., Matarazzo, I., Masturzo, B., Cabiddu, G., Versino, E., & Piccoli, G. B. (2022). Plant-based diets for CKD patients: fascinating, trendy, but feasible? A green nephrology perspective. *Clinical Kidney Journal*, *16*(4), 647–661. https://doi.org/10.1093/ckj/sfac267

Torreggiani, M., Wang, A., Fois, A., & Piccoli, G. (2023). Personalized low-protein diet prescription in CKD population: Merging evidence from randomized trials with observational data. *Seminars in Nephrology.*, *43*(2). https://doi.org/10.1016/j.semnephrol.2023.151402

United States Renal Data System. (2022). *Incidence, prevalence, patient characteristics, and treatment modalities.* https://usrds-adr.niddk.nih.gov/2021/end-stage-renal-disease/1-incidence-prevalence-patient-characteristics-and-treatment-modalities

U.S. Bureau of Labor Statistics. (2022). *Occupation employment and wage statistics.* https://www.bls.gov/oes/current/oes291031.htm#(1)

van Westing, A. C., Küpers, L. K., & Geleijnse, J. M. (2020). Diet and kidney function: A literature review. *Current Hypertension Reports, 22*(2), 14–14. https://doi.org/10.1007/s11906-020-1020-1

Wu, C. L., Tsai, W. H., Liu, J. S., Liu, H. W., Huang, S. Y., & Kuo, K. L. (2023). Vegan diet is associated with a lower risk of chronic kidney disease in patients with hyperuricemia. *Nutrients*, *15*(6), 1444. https://doi.org/10.3390/nu15061444

Yee-Moon Wang, A., Kistler, B. M., Lambert, K., Sumida, K., Moore, L. W., & Kalantar-Zadeh, K. (2023). Nutrition and metabolism for kidney health and disease management: 45 years of development and future directions under the international society of renal nutrition and metabolism. *Journal of Renal Nutrition: The Official Journal of the Council on Renal Nutrition of the National Kidney Foundation*, *33*(6S), S1–S5. https://doi.org/10.1053/j.jrn.2023.08.012

Zarantonello, D., & Brunori, G. (2023). The role of plant-based diets in preventing and mitigating chronic kidney disease: More light than shadows. *Journal of Clinical Medicine, 12*(19), 6137-. https://doi.org/10.3390/jcm12196137

Appendix A

Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals

Strength of the Evidence	
Level I	Experimental study/randomized controlled trial (RCT) or meta analysis of RCT
Level II	Quasi-experimental study
Level III	Non-experimental study, qualitative study, or meta-synthesis.
Level IV	Opinion of nationally recognized experts based on research evidence or expert consensus panel (systematic review, clinical practice guidelines)
Level V	Opinion of individual expert based on non-research evidence. (Includes case studies; literature review; organizational experience e.g., quality improvement and financial data; clinical expertise, or personal experience)

Quality of the Evidence		
A High	Research	consistent results with sufficient sample size, adequate control, and definitive conclusions; consistent recommendations based on extensive literature review that includes thoughtful reference to scientific evidence.
	Summative reviews	well-defined, reproducible search strategies; consistent results with sufficient numbers of well defined studies; criteria-based evaluation of overall scientific strength and quality of included studies; definitive conclusions.
	Organizational	well-defined methods using a rigorous approach; consistent results with sufficient sample size; use of reliable and valid measures
	Expert Opinion	expertise is clearly evident
B Good	Research	reasonably consistent results, sufficient sample size, some control, with fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence
	Summative reviews	reasonably thorough and appropriate search; reasonably consistent results with sufficient numbers of well defined studies; evaluation of strengths and limitations of included studies; fairly definitive conclusions.
	Organizational	Well-defined methods; reasonably consistent results with sufficient numbers; use of reliable and valid measures; reasonably consistent recommendations
	Expert Opinion	expertise appears to be credible.
C Low quality or major flaws	Research	little evidence with inconsistent results, insufficient sample size, conclusions cannot be drawn
	Summative reviews	undefined, poorly defined, or limited search strategies; insufficient evidence with inconsistent results; conclusions cannot be drawn
	Organizational	Undefined, or poorly defined methods; insufficient sample size; inconsistent results; undefined, poorly defined or measures that lack adequate reliability or validity
	Expert Opinion	expertise is not discernable or is dubious.

**A study rated an A would be of high quality, whereas, a study rated a C would have major flaws that raise serious questions about the believability of the findings and should be automatically eliminated from consideration.*

Note. Adapted from Johns Hopkins Evidence-Based Practice Model for Nursing and Healthcare Professionals used with permission from https://www.ijhn-education.org/node/18409. © 2022 Johns Hopkins Health System/Johns Hopkins School of Nursing

Appendix B

AGREE II Instrument

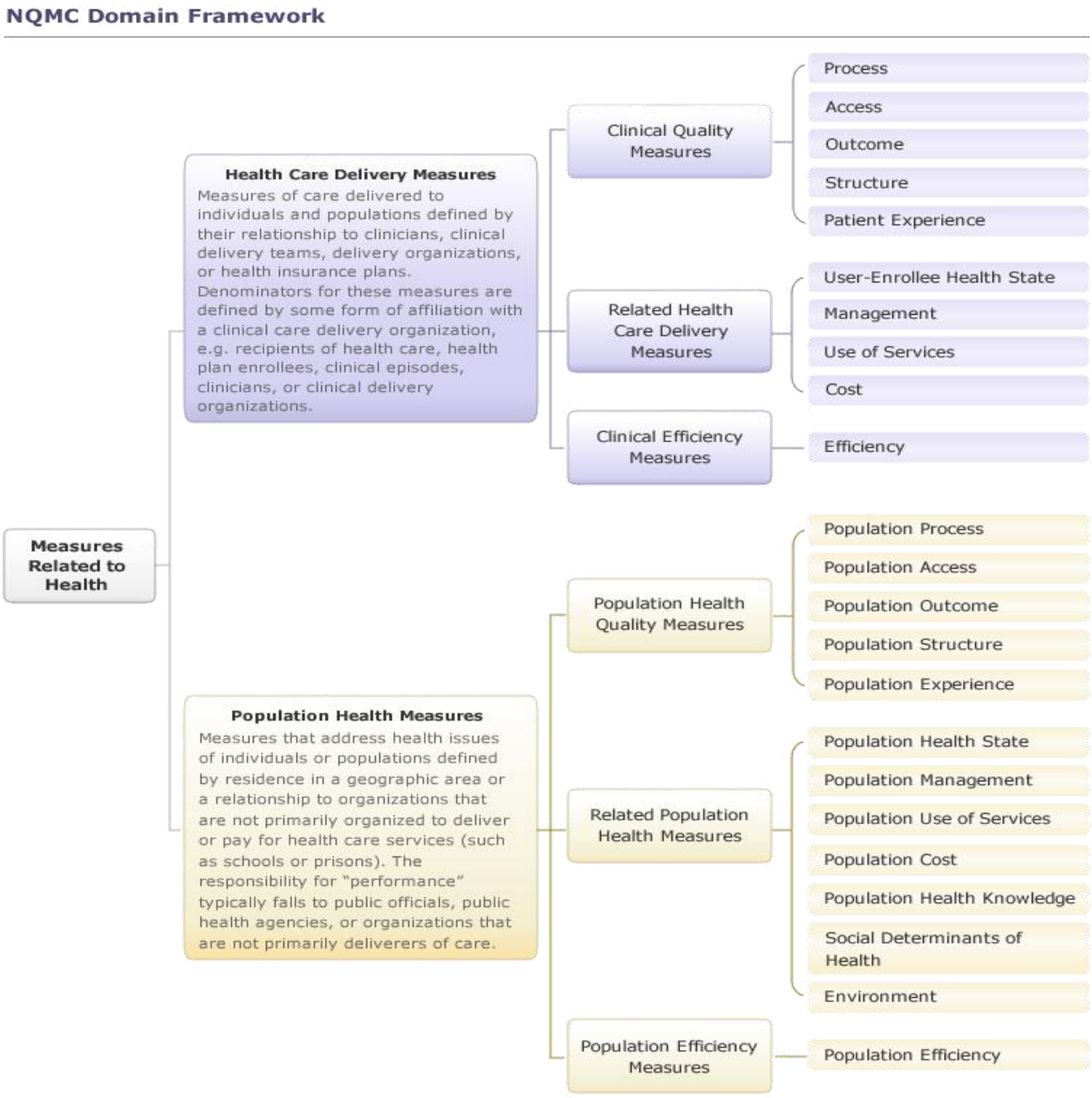
Items and domains of the AGREE II instrument[a].

Item	Content	Domain
1	The overall objective(s) of the guideline is (are) specifically described.	Scope and Purpose
2	The health question(s) covered by the guideline is (are) specifically described.	
3	The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.	
4	The guideline development group includes individuals from all relevant professional groups.	Stakeholder Involvement
5	The views and preferences of the target population (patients, public, etc.) have been sought.	
6	The target users of the guideline are clearly defined.	
7	Systematic methods were used to search for evidence.	Rigour of Development
8	The criteria for selecting the evidence are clearly described.	
9	The strengths and limitations of the body of evidence are clearly described.	
10	The methods for formulating the recommendations are clearly described.	
11	The health benefits, side effects, and risks have been considered in formulating the recommendations.	
12	There is an explicit link between the recommendations and the supporting evidence.	
13	The guideline has been externally reviewed by experts prior to its publication.	
14	A procedure for updating the guideline is provided.	
15	The recommendations are specific and unambiguous.	Clarity of Presentation
16	The different options for management of the condition or health issue are clearly presented.	
17	Key recommendations are easily identifiable.	
18	The guideline describes facilitators and barriers to its application.	Applicability
19	The guideline provides advice and/or tools on how the recommendations can be put into practice.	
20	The potential resource implications of applying the recommendations have been considered.	
21	The guideline presents monitoring and/or auditing criteria.	
22	The views of the funding body have not influenced the content of the guideline.	Editorial Independence
23	Competing interests of guideline development group members have been recorded and addressed.	

[a]: Extracted from the AGREE II instrument

Appendix C

AHRC NQMC Domain Framework



Note. Adapted from Agency for Healthcare Research and Quality (2018), AHRC-NQMC Measure Domain Framework. Retrieved from public domain with no permission for use listed https://www.ahrq.gov/gam/summaries/domain-framework/index.html.

Appendix D

SWOT Analysis Table

Strengths	**Weaknesses**
Standardized guideline for evidence-based practice	Stakeholders might not have time for meetings, rating, and comments
Interprofessional and multiprofessional collaboration with stakeholders	Stakeholders may have difficulty rating recommendations
Guideline may delay kidney death and required hemodialysis	Lack of CKD nutritional compliance
CKD nutritional health and wellness improved	Guideline may result in more appointments for CKD patients
Opportunities	**Threats**
Decrease in CKD patients needing hemodialysis	Lack of provider knowledge of guideline
Cost savings for local, state, and national health expenditures	Limited ability to educate providers of guideline
Increase in CKD educated registered dietitians and providers	Limited registered dietitians to provide education
Improved mental health from CKD stability	CKD patients making time for education

Appendix E

Summary of the Review of Literature Evidence Table Recommendations for Nutritional Management of CKD

	Author	Type of Design	Sample	Intervention/Recommendation	Grade Level of Evidence: **1 (I) =** Experimental studies inclusive of Systematic review (SR), Meta-analysis (MA), Randomized controlled trials (RCTs) **2 (II) =** Quazi-experimental studies inclusive of RCTs and MA **3 (III) =** Non-experimental studies **4 (IV) =** Opinion of nationally recognized experts based on research evidence, or expert consensus panel **5 (V) =** Expert opinion on non-research evidence, case studies, literature review, or quality improvement projects
1	Adair & Bowden, 2020 Title: Ameliorating chronic kidney disease using a WFPD diet	Design: Expert opinion by way of SR Aim Assess nutritional value of WFD for	Population: CKD patients Setting: N/A Sample Size: N/A	WFPB diet decreases CKD progression, CVD, diabetes, obesity, inflammation, and cholesterol based upon PRAL of common foods Plant protein intake was associated with numerous benefits for CKD patients but barriers in terms of availability and food insecurity 4.5%	IV, I

		slowing progression of CKD		of CKD patients, counter-culture in Western societies, and difficulty in adherence noted WFPB is noted to be high in fiber, vitamins and minerals, and healthy fat to slow the progression of CKD	
2	Alvirdizadeh et al., 2020 Title: A prospective study on total protein, plant protein and animal protein in relation to the risk of incident chronic kidney disease	Design: RCT Aim: Assess decline in eGFR in relation to plant vs. animal protein intake	Population: CKD patients Setting: N/A Sample Size: 1630 adults aged ≥ 27 years with CKD	Plant protein intake was associated with 70% decrease in incidence of CKD Animal protein intake has been researched and known to increase renal damage in animal models Animal protein intake has higher risk of developing CKD Inversely plant protein intake of 20g reduces the risk by 16% Animal protein correlates to increased saturated fat and sodium from red meat and processed meat and is damaging to and kidneys Research indicated that red meat and processed meat was adversely associated with CKD risk yet nuts and legumes were protective	I
3	Anderson & Nguyen, 2018 Title: Nutrition education in the care of patients with CKD and ESRD	Design: Expert opinion Aim: Characterize select nutritional resources for providers who manage CKD, Summarize specific dietary components relative to CKD, Practical nutritional educational efforts for CKD	Population: CKD patients & CKD providers Setting: N/A Sample Size: N/A	RD to counsel patients per KDOQI guidelines who is experienced with CKD, comprehensive dietary management and individualized diet plan, education into training, reimbursement for dietary education to improve nutrition counseling, care management teams to promote and implement nutrition education, patient specific technology integration	IV
4	Ayat et al; 2021	Design: RCT	Population: CKD patients	KiKS, CKD-SM, and SEMCD were used by CKD nurse-educators with	I

	Title: The effectiveness of nurse-led self-management support program for people with chronic kidney disease stage 3-4 (CKD-NLSM): Study protocol for a randomized controlled trial	Aim: Evaluate the effectiveness of a nurse-led self-management support program for CKD patients to improve kidney disease knowledge and self-efficacy	Setting: Kuala Lumpur Malaysia Sample Size: 154	experience in managing CKD and found to significantly improve behavioral and clinical outcomes Patients reported that face-to-face was preferred, then phone call, lastly internet for support Some reported that group learning would be beneficial to determine what others are experiencing If employed evening training was required whereas if unemployed morning was preferred	
5	Betz et al., 2022 Title: Plant-based diets in kidney disease: nephrology professionals' perspective	Design: Case study Aim: Understand nephrology professionals' familiarity, perception, and recommendation of plant-based diets to people with kidney disease	Population: CKD providers Setting: On-line survey Sample: 644 CKD providers	87% of providers reported knowledge of plant-based diet benefits for slowing CKD progression 56% of providers recommend plant-based diet and 21% regularly recommend Providers reported not mentioning diet related to perception that patient would not accept diet further research needed to understand patient acceptance	III
6	Betz et al., 2023 Title: Patient perception of plant-based diets for kidney disease	Design: Case study Aim: Understand nephrology patients' familiarity, perception, and use of plant-based diets	Population: CKD patients Setting: Online questionnaire via National Kidney Foundations social media channels Sample: 844 CKD patients	48-58% of patients were aware that plant-based diet is beneficial for kidney disease treatment Finding correlates with 56% of nephrology professionals recommend plant-based diets to patients with kidney disease ≥ 55% were aware of the benefits of plant-based diet upon comorbidities hypertension and heart disease Restrictions were listed as family preference, meal planning, meat preference, food cost, time, and ease of cooking	III

7	Bin-Zarah et al., 2021 Title: Development and relative validity of the chronic kidney disease short food frequency questionnaire (CKD SFFQ) to determine diet quality and dietary habits among adults with chronic kidney disease	Design: Case study Aim: Developing a short food frequency questionnaire that can detect diet quality among the CKD population	Population: CKD patients ≥ 18 years, not pregnant, and living in the US Setting: Southwestern kidney clinic Sample: 46 CKD patients 32 female	CKD SFFQ was validated at Southwestern University CKD SFFQ was assessed for criterion validity by comparison to Healthy-Eating Index 2015 a valid tool for assess adherence of dietary patterns CKD SFFQ was developed to estimate the diet quality among whole food components these were categorized into 9 main food components—total fruits (juices, canned, dried), whole fruits, total vegetables (canned, fresh), greens and beans, whole grains, refined grains, dairy, total protein foods, and seafood and plant proteins CKD SFFQ can assess diet quality on whole-food groups for adults with CKD CKD specific tool for assessment of diet quality by CKD providers	III
8	Campbell & Liebman, 2019 Title: Plant-based dietary approach to stage 3 chronic kidney disease with hyperphosphataemia	Design: Case study Aim: Case study review of patient with CKD and improvement of CKD with plant-based diet	Population: CKD patients Setting: N/A Sample: 69-year-old male with CKD, type 2 DM, hypertension, hyperkalemia, and hyperphosphatemia	WFPB diet was assessed as beneficial for patient in all regards DASH diet found to be beneficial and not contributory to elevated potassium with elevated potassium of diet Patient did have weight loss of 22.2kg in 4.5 months that could be contributory to improved health	III
9	Carrero et al., 2020 Title: Plant-based diets to manage the risks and complications of chronic kidney disease	Design: SR and MA Aim: Assess current evidence suggesting that promoting the adoption of plant-	Population: CKD patients Setting: N/A Sample: ROL	Research finds little risk and potentially marked benefits in promoting the adoption of plant-based diets for primary prevention of CKD, as well as for delaying CKD progression in patients with established CKD	I

		based diets has few risks but potential benefits for the primary prevention of CKD, as well as for delaying progression in patients with CKD	55 cohort studies with more than 4 million participants 4 RCTs 2 observational studies	Secondary benefits might result in reduced risk of vascular disease, cancer, and death Gaps are present in regard to plant - based diet for understanding fiber, olive oil, nuts, seed oils, whole grains, legumes, beans and inversely health implications of ultra-processed plant foods.	
10	Cases et al., 2019 Title: Vegetable-based diets for chronic kidney disease? It is time to reconsider	Design: SR Aim: Review of research to assess effects of plant-based diet on CKD	Population: CKD patients Setting: N/A Sample: ROL	Plant-based diet appears to offer benefits to CKD patients Plant-based diet has been shown to have restrictions regarding difficulty to follow Counseling may need to be improved/increased to improve compliance Highlight need of multidisciplinary teams to ensure adequate and safe nutrition with compliance	I
11	Chauveau et al., 2019 Title: Vegetarian diets and chronic kidney disease	Design: SR Aim: Review of literature to assess quality of ingested proteins on progression of CKD	Population: CKD patients Setting: N/A Sample: ROL	Plant-based diets have a kidney-protective effects Observational studies confirmed that dietary patterns usually rich in fruits, vegetables, legumes and whole grains and low in red meat, saturated fat, refined sugars and processed foods are more protective than usual diets in the primary prevention of CKD Proteins from vegetable and dairy sources were found to be protective and participants consuming the highest quintile of vegetable protein had a reduced risk of incident CKD Authors concluded that there was an association between the development of CKD and the type of dietary protein sources rather than the total protein intake	I

				High dietary acid load, typical of Western diet, is associated with an increased incidence and progression of CKD Plant-based diet is associated with significantly increased life span	
12	Cigarrán Guldris et al., 2022 Title: Fibre [sic] intake in chronic kidney disease: What fibre [sic] should we recommend?	Design: SR Aim: Review of increasing fiber consumption and the quality of fiber to recommend Increasing the consumption of foods that naturally have it in their design	Population: CKD patients Setting: N/A Sample: ROL	Mediterranean diet, vegetarian diet or the PLADO diet, seem to have a preventive effect on the associated risk factors and influence the progression of CKD DASH diet found to be the least stable of the mentioned diets Increased fiber is beneficial in many respects but with PLADO assessment is necessary to prevent PEW Fiber should be ≥ 20 grams daily Dietitian inclusion of multidisciplinary team for promotion in CKD diet	I
13	Cupisti et al., 2018 Title: Nutritional treatment of advanced CKD: Twenty consensus statements	Design: Expert opinion Aim: DNT and the development of 20 essential points to promote successful and safe integration of nutritional management of CKD patients	Population: CKD patients & CKD providers Setting: N/A Sample Size: N/A	Non-monitored diet has been found to decrease effectiveness of drug therapy Non-monitored diet in CKD worsens CKD progression adequate DNT provides reduction of: protein, phosphorus, sodium, potassium, and limitation of fixed acid load DNT effectiveness founded upon caloric needs, essential amino acids, correction of metabolic acidosis, proper glycometabolic control, protein-free products, of carbohydrate composition, are beneficial for having little phosphorus, sodium, and potassium If VLPD diet is considered essential amino acid and keto acid mixture is mandatory, regular evaluation of nutritional and functional status at start of treatment is essential for diet management	IV

				Proper low protein diet does not cause malnutrition in the short or long term DNT may delay the need for HD, has cost and resource savings for delay of HD or PD Organizational models for clinical management integrating various health professionals are effective and easier DNT support levels are: full/part-time nephrology RD, in-hospital RD, educational materials and digital support, regular physical activity should be promoted by all health professionals Adherence to a dietary prescription is critical, as with pharmacological therapies. Proper information and education when implementing a diet program remain at the basis of appropriate CKD management Promotion of regular physical exercise is essential	
14	Ebrahim & Cilliers, 2020 Title: Keeping the diet simple and natural in chronic kidney disease: A south African-based dietary infographic	Design: Case study Aim: Assessment of CKD dietary guidelines for decreasing restrictions	Population: CKD Patients Setting: N/A Sample Size N/A	Research finding indicate that renal diets are unpalatable, very restrictive, and expensive with major lifestyle changes required resulting in frustration, lack of autonomy, and motivation to follow the advice Research states that only two-thirds of CKD patents follow diet Simplified diet with six key messages was better managed by CKD patients Mediterranean diet is associated with a limited progression of CKD Protein and sodium restriction in CKD is recommended Plant-based protein has been shown to provide additional benefits to CVD health, blood pressure, cholesterol metabolism, decreased production of	III

				uremic toxins, and the progression of CKD Research has shown that diets that are more liberal in fruits, vegetables, and whole grains have benefits that outweigh the risks in CKD patients	
15	Eckerdt et al., 2018 Title: Improving the prognosis of patients with severely decreased glomerular filtration rate (CKD G4+): Conclusions from a kidney disease: Improving global outcomes (KDIGO) controversies conference	Design: Expert opinion by way of MA Aim: Better understand timing of clinical outcomes in CKD patients	Population: CKD patients Setting: N/A Sample Size MA	Recognition that patients want to be involved as equal partners in their care Utilizing strategies to elicit patients' values, identifying patient preferences, and finding agreement regarding therapy Identify, prevent, and manage CKD-specific complications (e.g., malnutrition, anemia, bone disease, and acidosis Uncertain if restricted salt intake in people with CKD and if so what level of intake should be advised Trail evidence indicates the priorities of clinicians and researchers rather than CKD patients and families	IV, I
16	Evangelidis et al., 2019 Title: Lifestyle behaviour [sic]change for preventing the progression of chronic kidney disease: A systematic review	Design: Expert opinion by way of SR Aim: Identify and evaluate behavior change techniques and functions in lifestyle interventions for preventing the progression of CKD	Population: CKD patients Setting: N/A Sample Size SR	Behavior change interventions in trials in patients with CKD mostly focused on diet and physical activity Few clinical or patient-reported and/or behavioral outcomes such as QOL, fatigue, knowledge, self-efficacy and self-management Education was the most frequent intervention function used across the studies, it has been consistently shown that patients with CKD lack awareness about lifestyle risk factors and have low health literacy Dietary interventions can involve complex dietary restrictions of sodium, protein, potassium and phosphate. Patients have sought practical advice about how to implement these	VI, I

				restrictions, yet most educational strategies used a didactic approach, with health professionals verbally conveying information or providing written materials. Patients with CKD prefer multiple problem-solving and collaborative approaches, in partnership with health professionals. Written materials for patients with CKD have a reading grade of 9 (age 14–15 years), which is higher than the recommended level (grade 5)	
17	Fontes et al., 2018 Title: Effects of low-protein diet on lipid and anthropometric profiles of patients with chronic kidney disease on conservative management	Design: Longitudinal clinical trail Aim: Evaluate the effects of LPD on the lipid and anthropometric profile in CKD patients	Population: CKD patients Setting: N/A Sample Size 40 CKD patients 20 men, 62.7 ± 15.2 years	LPD prescribed to CKD patients for six months was able to improve some cardiovascular risk factors as obesity and plasma lipid profile, suggesting that LPD can be also an important tool for protection against CVD LPD prescribed for six months to patients with CKD preserved renal function, aided in weight loss, and decreased serum levels of uric acid, and total cholesterol Decrease in the daily intake of proteins was statistically significant, and protein intake was positively correlated with dietary cholesterol intake, supporting the theory that LPD also promote decreases in the intake of dietary cholesterol LPD (0.6g/kg/day) for six months to patients with CKD might delay the progression of CKD and help manage two traditional risk factors for CVD, obesity and dyslipidemia	III
18	Fu & Shin, 2023 Title:	Design: Cohort study Aim:	Population: CKD patients ≥40 years of age	Flour-based food and meat dietary pattern was positively associated with the risk of CKD and kidney function decline	III

	The association of dietary patterns with incident chronic kidney disease and kidney function decline among middle-aged Korean adults: A cohort study	Assess the association of dietary patterns with the incidence of CKD and kidney function decline among Korean adults	Setting: Korea Sample Size 20,147 men and 39,857 women	Evidence indicates the benefits of fiber, potassium, and bicarbonate in fruits and vegetables in preventing the risk of kidney function decline Korea prudent dietary pattern were green and yellow vegetables, light-colored vegetables, mushrooms, fish and shellfish, seaweed, kimchi, soybean paste, potatoes, beans, tofu, soymilk, and fruits similar to the DASH diet Dietary patterns characterized by vegetables, fruits, fish, and soy foods such as DASH diet, have reported reducing the risk of kidney function decline The DASH diet appeared to lower the risk of kidney function decline by > 40% due to its high proportion of fruits and vegetables A study with 6.1 years of follow-up, reported that a lacto-vegetarian dietary pattern was associated with a 43% decrease in incident CKD Whole grains have been shown to have a beneficial effect on renal function and CKD, while a negative correlation has been shown between refined grains and eGFR The prudent dietary pattern was associated with a lower risk of kidney function decline in Korean men, and the flour-based food and meat dietary pattern was associated with an increased risk of CKD and kidney function decline in all participants	
19	Hou et al., 2022 Title:	Design: Cross-sectional study Aim:	Population: CKD patients with hyperuricemia	Studies have shown that hyperuricemia can cause or accelerate the progression of CKD	III

	Vegetarian diet is associated with a lower risk of chronic kidney disease in diabetic patients	Assess the association of vegetarian dietary habits with CKD in patients with gout or hyperuricemia	Setting: Taipei Sample Size: 3618, 225 vegans, 509 lacto-ovo vegetarians, and 2884 omnivores	Studies have reported that a vegetarian diet is associated with a lower risk of gout and hyperuricemia Vegan diet is associated with a 31% lower risk of CKD in patients with hyperuricemia. A vegan diet may be beneficial in reducing the occurrence of CKD in patients with hyperuricemia Compared with the omnivore group, the vegan group was older; had a lower proportion of smoking, alcohol drinking, obesity, gout, and very high uric acid levels (>9 mg/dL); and had lower diastolic blood pressure and uric acid, low-density lipoprotein, and creatinine levels Vegan, but not a lacto-ovo vegetarian, diet was independently associated with a lower odds ratio for CKD in patients with hyperuricemia. Plant-based diets do not necessarily eliminate animal products but focus on eating mostly plants, such as fruits, vegetables, nuts, seeds, and whole grains. Plant-based diets also highlight eating whole foods without much processing that are as close to their natural state as possible CKD patients consuming plant-based proteins had a lower rate of disease progression or mortality Most vegetables are also rich in dietary fiber. An increase in the consumption of dietary fiber is proposed to prevent the development or to slow the progression of CKD for decades	
20	Hu et al., 2021	Design:	Population: CKD patients	Healthy Eating Index-2015, Alternative Healthy Eating Index-	III

	Title: Adherence to healthy dietary patterns and risk of CKD progression and all-cause mortality: Findings from the CRIC (Chronic Renal Insufficiency Cohort) Study	Prospective cohort study Aim: Define the associations of 4 healthy dietary patterns with risk for CKD progression and all-cause mortality among people with CKD	Setting: US clinical centers Sample Size: 2,403 aged 21-74 years	2010, aMed, and DASH diet dietary scores were inversely associated with all-cause mortality Following a healthy dietary pattern was associated with lower risk for CKD progression and death. These results may inform clinicians to recommend patients with CKD to follow overall healthy dietary patterns that are rich in fruits, vegetables, nuts, legumes, and whole grains and low in red/processed meats, added sugars, and sodium A MA of 7 cohort studies, a healthy dietary pattern (rich in vegetables, fruits, legumes, whole grains, and fiber and low in red meat, sodium, and refined sugars) was associated with lower risk for mortality Results indicate an association between healthy dietary patterns and lower risk for CKD aMed score and CKD progression was the strongest with 25% reduced risk for CKD progression compared with 17% for Alternative Healthy Eating Index-2010, 17% for DASH diet, and 9% for Healthy Eating Index-2015	
21	Ikizler et al., 2020 Title: KDOQI clinical practice guideline for nutrition in CKD: 2020 update.	Design: Expert opinion by way of MA/SR Aim: MNT clinical practice guidelines for patients with CKD	Population: CKD patients Setting: N/A Sample Size N/A	107-page article covering various nutritional management aspects Updated guideline statements focus on 6 primary areas: nutritional assessment, MNT, dietary protein and energy intake, nutritional supplementation, micronutrients, and electrolytes. The primary emphasis in the updated guideline is to provide information on dietary management rather than	IV, I

				covering all possible nutritional intervention strategies This update reportedly should be more focused and could be followed by additional guidelines for other components of nutritional care of patients with CKD There are no guideline statements provided on certain nutritional management aspects of patients with CKD, including but not limited to obesity, exercise, and anabolic pharmacotherapy Guideline 1: Nutritional Assessment 1.0 Statements on Usual Care lists routine nutrition screening at least biannually to identify those at risk of PEW, and routine nutrition assessment by a RD, annually, or when indicated by nutrition screening or provider referral Recommends a low protein intake (0.55-0.60 g/kg/d without diabetes, 0.6-0.8 g/kg/d with diabetes) for patients with CKD to retard the progression to kidney failure and prevent uremic symptoms	
22	Joshi et al, 2022 Title: Chapter 29 - Nutritional approaches and plant-dominant diets for conservative and preservative management of chronic kidney disease	Design: Expert opinion Aim: Evaluate nutritional approaches and plant-dominant diets for limiting CKD progression	Population: CKD patients Setting: N/A Sample Size: N/A	It is possible, though not yet unequivocally proven, nutritional interventions may also slow the rate of CKD progression, independent of uremia management It is unclear whether quantity or quality of ingested protein is a risk factor for incident kidney disease Evidence suggests that daily dietary protein intake exceeding 1.5 g/kg of ideal body weight (g/kg/d) may cause glomerular hyperfiltration	IV

				High-protein diet exacerbates proteinuria in persons with diabetes or hypertension, but as a popular weight reduction strategy its net effect on kidney health is unclear Most controlled trials have confirmed beneficial effects of restricted protein intake as did several MA United States National Academy of Medicine has maintained that dietary protein intake should be 0.8 g/kg of the ideal body weight per day (g/kg/d) Americans on average consume much higher amounts of protein, that is, 1.2-1.4 g/kg/d, mostly from animal sources, according to NHANES. In recent practice, higher dietary protein intake has been recommended to combat obesity and diabetes Ketogenic (keto)-diets, which are high in protein and animal fats, are gaining popularity across different health-care systems throughout the world as a recommended dietary intervention for adults with diabetes Despite its immediate appeal for the use of type 2 diabetes, the keto-diet has not been as effective for glycemic control or weight loss in RCT as often touted and may carry additional risks to long-term health American diet contains 15%-20% protein ≤ one-third of protein sources from plants	
23	Joshi et al, 2023 Title: Risks and benefits of different dietary patterns in CKD	Design: Expert opinion Aim: Review the risks and benefits of major	Population: CKD patients & CKD providers Setting: N/A	Plant-based diets, especially those that are lower in protein, may slow CKD progression, mitigate uremia, and delay dialysis initiation. The most healthful dietary patterns favor the inclusion of whole,	IV

		popular diets to help guide health care professionals in treating patients with CKD	Sample Size N/A	unprocessed foods, preferably from plant-based sources Mediterranean diets have an established record of cardioprotective benefits but also may be beneficial for the kidney. High consumption of meat and animal protein has been associated with the risk of incident CKD and kidney failure, as is typical with ketogenetic diets Western diet is rich in animal-based foods and processed/ultra-processed foods, this diet has been linked to metabolic disorders, including obesity, hypertension, diabetes, CVD, cognitive impairment, and emotional disorder Low-carbohydrate/high-protein diets may conflict with KDOQI guideline recommendation because excess protein intake can promote kidney injury An essential part of supporting patients through any dietary change is referral to a (renal) dietitian who has an understanding of the risks and benefits of different dietary patterns	
24	Kalantar-Zadeh et al. 2023 Title: Caring for patients with advanced chronic kidney disease: Dietary options and conservative care instead of maintenance dialysis	Design: Expert opinion Aim: Discussion of prevention and treatment of CKD with focus on dietary options	Population: CKD providers Setting: Virtual advisory board Sample Size International group of nephrologists, RD, psychologist	High dietary protein intake ≥1.5 g/kg/day) can cause glomerular hyperfiltration and inflammatory gene expression, which are risk factors for CKD Evidence shows that VLP diets 0.3-0.4g/kg/day are beneficial for CKD CKD is largely preventable and treatable Lifestyle modifications are associated with numerous hurdles	V

				A multidisciplinary approach with, patient empowerment/involvement and the use of technology are key approaches to improve CKD	
25	Kalantar-Zadeh et al. 2020 Title: Plant-dominant low-protein diet for conservative management of chronic kidney disease	Design: Expert opinion Aim: Highlight past and contemporary data on the dietary management of CKD	Population: CKD patients Setting: N/A Sample Size N/A	Recent MA and SR concluded that daily red meat consumption over years may increase CKD risk, conversely fruit and vegetable proteins may be renal protective Diet palatability and adherence to LPD or meatless diets are often cited as dietary management challenges. A plant-dominant, fiber-rich LPD may slow CKD progression, along with reducing cardiovascular risk in CKD patients Successful implementation of plant-based LPD is dependent on the engagement of dietitians who are trained in the field of CKD Overwhelming majority of CKD patients never meet with a CKD-specialized dietitian prior to dialysis initiation, and most patients remain uninformed about the role of diet in CKD progression and management. Among CKD providers and patients, lack of awareness about the benefits of plant-dominant LPD are barriers	IV
26	Kelly et al., 2020 Title: A Coaching Program to Improve Dietary Intake of Patients with CKD: ENTICE-CKD	Design: RCT Aim: Improve diet quality in CKD patients with dietitian-led telehealth coaching intervention	Population: Australian English speaking, CKD, >18 years, with mobile phone access Setting: Telehealth Sample Size	The majority of dietary interventions for CKD patients are delivered in one-off dietary education sessions, without ongoing follow-up Telephone coaching is a basic form of telehealth shown to be effective at promoting adherence to complex dietary recommendations in CKD There has been no telehealth intervention demonstrated to effectively support diet quality	I

			80, control group n = 39: age 61±13, 64% male, 82% European, 3% white, 15% other intervention group n = 41: age 6 3± 12, 63% male, 5% Asian, 85% white, 5% European, 2.5% indigenous, 2.5% other	improvements in CKD, recent patient engagement studies suggest that people with CKD are open to using telephone Compared with controls change in dietary intake was not detectable on diet quality at 3 or 6 months as assessed by alternative health eating index mean difference, yet individual measures of diet quality were significantly changed after the telehealth intervention	
27	Kelly et al, 2023 Title: Are digital health technologies and models of nutrition care the future of chronic kidney disease management?	Design: Expert opinion Aim: Review the current evidence base concerning the past and present mobile and digital health programs to improve nutrition in CKD and highlights the novel future trends in this field	Population: CKD patients Setting: N/A Sample Size N/A	CKD patients own mobile devices similar to the rates reported in the general population Mobile phone ownership surpasses 84%, this is skewed toward younger patients and those with higher levels of education One-third of people with CKD ≥ 61 years regularly use the internet to search for online health and dietary support Nutrition and dietetic care can be effectively delivered using digital and virtual technologies: consultations, assessments, establishment of diagnoses, formulation of plans, and monitoring/reviewing clinical progress Mobile and digital supported nutrition care should be available to CKD patients CKD patients are found to be disadvantaged by low socioeconomic status, limited health/technology literacy, unreliable phone/internet access, intellectual impairment, and/or are from non-English speaking background	IV

28	Kelly et al., 2017 Title: Healthy dietary patterns and risk of mortality and ESRD in CKD: A meta-analysis of cohort studies	Design: MA of cohort studies Aim: Evaluate the association between dietary patterns and mortality or ESRD among adults with CKD	Population: CKD patients Setting: N/A Sample Size 7 studies with 15, 285 participants	Healthy dietary patterns are associated with lower mortality for CKD. Interventions to support adherence to increased fruit and vegetable, fish, legume, whole grain, and fiber intake, and reduced red meat, sodium, and refined sugar intake could be effective tools to lower mortality in CKD patients Key elements of greater fruit and vegetable intake were present in all studies	I
29	Khor et al., 2023 Title: Nutrition education models for patients with chronic kidney disease	Design: Expert opinion Aim: Summarizes the evidence supporting the application of theoretical models as strategies to enhance nutrition education for patients with CKD	Population: N/A Setting: N/A Sample Size N/A	SCT is one of the most widely used theories to design nutritional education and behavioral change intervention TTM in combination with nutrition interventions promoted positive dietary behaviors: increased fruit and vegetable consumption, reduced fat intake, and increased exercise duration and frequency CKD patients using digital technology in nutrition interventions has shown positive effects Training CKD providers, RD, nurses, and other health care professionals who are involved in the clinical care of patients with CKD is essential Digital technology is a promising tool to facilitate CKD patient education and empowerment, self-management, and monitoring	IV
30	Kim et al, 2019 Title: Plant-based diets and incident CKD and kidney function	Design: Cohort study Aim: Evaluate the association between plant-based diets, incident CKD, and	Population: CKD patients Setting: 24-year follow-up Sample Size	Higher adherence to healthy plant-based diets and a vegetarian diet was associated with favorable kidney disease outcomes Follow-up of 24 years, 4343 incident CKD events occurred those in the highest quintile of healthy plant-based diet had a 14% lower risk of CKD	III

		kidney function decline in population-based study over 20 years	14,686 middle-aged adults	In contrast, those in the highest quintile of less healthy plant-based diet had an 11% higher risk of CKD Higher consumption of healthy plant foods (fruits, vegetables, whole grains, nuts, legumes, coffee, tea) was associated with a lower risk and slower eGFR decline Plant-based diet, healthy plant-based diet, and pro-vegetarian diet showed similar results, but a stronger risk reduction was observed for the healthy plant-based diet (14%) compared with overall plant-based diet (6%) and pro-vegetarian diet (10%)	
31	Kirk et al., 2020 Title: The grid course facilitates nutritional education and medical nutrition therapy for patients with chronic kidney disease	Design: Expert opinion Aim: Provide knowledge of training for CKD providers regarding gap of qualified professional to provide CKD nutritional advice	Population: CKD patients & CKD providers Setting: N/A Sample Size N/A	RD trained in CKD nutrition is barrier to treat growing CKD prevalence GRID course was developed to have CKD educated renal nutrition experts GRID provides training of macro and micronutrient needs of CKD patients, the role of gut microbiome, use of pre-/probiotics and role of appetite in CKD	V
32	Ko & Kalantar-Zadeh, 2021 Title: How important is dietary management in chronic kidney disease progression? A role for low protein diets	Design: Expert opinion Aim: Role of LPD in CKD patients presenting a summary of current clinical practice guidelines and supporting evidence for nutritional management regarding the amount	Population: CKD patients Setting: N/A Sample Size N/A	LPD is beneficial for CKD patients by reducing nitrogen waste products and decreasing kidney workload High protein diet causes glomerular hyperfiltration resulting in glomerular structural damage and increased pressure on the remaining glomeruli MDRD secondary analysis with a longer observation period showed each 0.2 g/kg/day reduction in protein was associated with a slower decline of GFR by 1.15 mL/min/1.73 m2 per year, and halved the risk of kidney failure or death	V

		of protein intake in patients with CKD		LPD to lessen glomerular hyperfiltration and mitigate accumulation of protein waste products are beneficial for CKD	
33	Lambert, 2023 Title: Designing dietary education materials for people with chronic kidney disease: recommendations for improving the quality of resources	Design: Expert opinion Aim: Quantify the dietary education resources in the Journal of Renal Nutrition	Population: N/A Setting: Journal of Renal Nutrition Sample Size 42 resources published from 2011-2021	Medicare beneficiary in USA reads at a 5th grade level, 92% of material was readable at a grade level of 5 (IQR 5-7), median understandability score 71% (IQR 60-81), 52% of material met 70% PEMAT score benchmark, median actionability score 37% (IQR 20-83) 29% met benchmark, median CDC CCI score 65% with 10% meeting benchmark Promoting diet readability through: wide margins, font 12-14 and sans serif, labels with captions, use of color with insight to color blind, readability calculator, simple word choice, Portion size, define vague, complex and dietic words, Short sentences <25 words Understandability through: outline material, limit key message to 3, active voice, logical order, limit bullet points to < 7, explain numbers Actionability through: clearly state action, why behavior is needed, outline steps, cultural sensitivity, Other recommendations: test group, positive messaging, cooking assessment, clinician contact information, dichotomous thinking	IV
34	Lambert et al., 2018 Title: How do patients and carers make sense of renal dietary advice?	Design: Qualitative Aim: Describe experience of patients with CKD in processing and	Population: CKD patients ≥18 years of age who had a renal RD or dialysis educator Setting:	6 themes from interviews: renal diet was frustrating, overwhelming, and emotional to learn, diet complex and challenging, RD input was highly valued, carer support is important, developing problem solving strategies,	IV

	A qualitative exploration	interpreting renal dietary advice Explore strategies they used to understand and apply renal diet information Develop recommendations for improved clinical practice	In person or via telephone Sample Size 26, median age 66, age range 30-86 (IQR 62.75-76), 58% male, 21 married 3 divorced, 2 single	desire for additional resources and/or support,	
35	Lambert et al., 2019 Title: Qualitative exploration of the experiences of renal dietitians and how they help patients with end stage kidney disease to understand the renal diet	Design: Qualitative Aim: Describe experience of RDs providing renal dietary advice to CKD	Population: Renal RDs Setting: Australia and New Zealand, metropolitan, regional and rural face-to-face or telephone calls Sample Size 27	Development of 5 themes from interviews of renal RDs working with CKD: frustration, limited or inadequate resources, establishing trust and demonstrating empathy, clarifying ambiguities, and conflicting information Primary function to be educated for calcification of ambiguities and simplify confusing and complex diet information A trusting relationship was required to proffer education Conflicted state of being able to provide education in health-care environments with limited resources	IV
36	Lambert et al., 2017 Title: Evaluation of the quality and health literacy demand of online renal diet information	Design: Expert opinion Aim: Comprehensive analysis of 254 websites and YouTube for accuracy of renal diet information	Population: N/A Setting: Internet Sample Size 254 websites and YouTube	Websites had 73% of renal diet information correct yet of poor quality written in high health literacy demand and hard to execute YouTube had easy to understand information that was actionable yet on 18% was accurate with the vast majority being poor quality Best information for CKD was government bodies, RDs, academic institutions, and medical organizations Further work required for actionability of CKD diet and quality of information	IV

37	Lu et al., 2017 Title: Dietary fiber intake is associated with chronic kidney disease (CKD) progression and cardiovascular risk, but not protein nutritional status, in adults with CKD	Design: Longitudinal cohort study Aim: Assess if fiber intake correlates to CKD and CVD progressing or regression	Population: CKD patients Setting: Zhujiang hospital of Southern Medical University Guangzhou, China Sample Size 157 CKD patients ≥18 years, 47.5 ± 13.02 years, 47.1%male	Higher fiber intake ≥ 10g/day was associated with higher eGFR Fiber intake was not associated with the eGRF in regression analysis that higher fiber intake retarded the decrease in the eGFR over the 18-month follow-up period Inconsistent results related to no healthy people included, but study confirmed protective benefit of fiber for CKD This was through lower levels of pro-inflammatory markers CRP, IL-6, and indoxyl sulfate	III
38	McFarlane et al., 2019 Title: Prebiotic, probiotic, and synbiotic supplementation in chronic kidney disease: A systematic review and meta-analysis	Design: SR & MA Aim: SR of prebiotic, probiotic, and synbiotic supplementation as therapeutic intervention for CKD population	Population: CKD patients Setting: N/A Sample Size 16 studies investigating 645 adults, 5 prebiotic, 6 probiotic, & 5 synbiotic	Literature review indicated very low to moderate quality Evidence suggests that prebiotic, probiotic, and synbiotic supplementation may be safe, well-tolerated, and acceptable within the CKD population yet limited evidence supports the use in CKD management Microbiota composition in studies was promising considering GI complications with CKD population but formulation and dosage of product was different	I
39	Mirmiran et al., 2018 Title: Dietary fibre intake in relation to the risk of incident chronic kidney disease	Design: Cross-sectional study Aim: Evaluate the association of fiber intake with risk of incident CKD	Population: NON-CKD patients at onset Setting: District No. 13 of Tehran, Iran Sample Size 1630 patients ≥ 27 years	Noticed an inverse relationship between total fiber intake, from legumes and vegetables, and diagnosis of CKD 50% lower risk of CKD with ≥26.0g/day fiber intake Fiber from legumes and vegetables, not fruits or cereals, was significant for incident CKD reduction of 17% after 23-year follow-up People with higher scores of the diet rich in vegetables and legumes such as	III

				the Mediterranean diet had 51% less rick of CKD	
40	Moloudpour et al., 2023 Title: Association between plant-based diet and kidney function in adults	Design: Cross-sectional study of cohort study Aim: Determine association between plant-based diet and CKD	Population: CKD patients Setting: XXX Province, XXX city in Iran Sample Size 9,746 CKD patients aged 35-65, mean age 47.34 ± 8.26 years, 4697 male	Plant-based diet study showed decreased odds of CKD Substantial evidence between vegetarian diet and prevalent renal dysfunction Study review of 432,732 European adults with high intake of vegetables was associated with a higher eGFR Findings showed whole grains, legumes, nuts, vegetables, fruits, fruit juice, potatoes, fiber, tea and coffee, polyunsaturated fatty acids, and vitamins A, C, E, K, potassium, lutein-zeaxanthin, lycopene, bcarotene, omega 6 and folate help improve kidney function and prevent premature death In contrast, refined grains, animal fat, meat, eggs, and sodium intake were associated with a decreased eGFR and impaired kidney function	III
41	Mocanu et al., 2021 Title: Plant-based versus animal-based low protein diets in the management of chronic kidney disease	Design: Expert opinion by way of SR Aim: Describe recent evidence of CKD low-protein diet and which is beneficial for reduction in rate of decline in kidney function	Population: CKD patients Setting: MDRD study group, KDOQI clinical practice Guidelines for Nutrition in CKD patients, ARIC study group, Adventist Health Study 2 Sample Size MDRD 1,585 CKD patients, aged 18-70,	CKD patients eating typical Western diet of processed red meat had an acceleration of CKD 3 times higher than normal ARIC study had 25% reduction in kidney function with primary consumption of processed red meat DASH diet found to 14% lower risk of developing CKD Mediterranean diet was associated with better survival then Western diet Adventist Health Study 2 largest study to assess plant-based diets of 5 types: non-vegetarian, semi-vegetarian pesco-vegetarian, lacto-ovo-vegetarian, and vegan found	IV, I

			ARIC 14,882, Adventist Health Study 2 96,335	vegetarian diets were associated with a lower mortality compared with non-vegetarian	
42	Naraska et al., 2023 Title: Vegetarian nutrition in chronic kidney disease	Design: MA Aim: Assess potential roles of and existing data on efficacy/effectiveness and safety of various vegetarian and plant-based diets in CKD	Population: CKD patients Setting: N/A Sample Size N/A	Plant-based diets have greater healthy foods; such as, whole grains, cereals, nuts, fruits, and vegetables, and better nutrient profiles with dietary fiber, unsaturated fatty acids, folate, magnesium, vitamin C, vitamin E, carotenoids, phyto-chemicals, and lower bioavailability of phosphorus and potassium CKD and HTN are closely interrelated, such that HTN is the second cause of kidney failure and can lead to incident CKD RCTs have shown that plant-based diets are beneficial for improved blood pressure Type 2 diabetes is lower statistically regarding a vegetarian diet from a MA of 307,099 people	I
43	Oliveria et al., 2024 Title: Dietary intake and nutritional status in diabetic and nondiabetic patients with chronic kidney disease stage 4-5 (NutriDiab Study)	Design: Observational and cross-sectional study Aim: Assess the dietary intake and nutritional status of diabetic and non-diabetic CKD patients	Population: CKD patients Setting: French population Sample Size 75 CKD patients, 36 with diabetes, aged 60-80, 48% women	Reported and known that regular monitoring of diet and nutritional status for CKD patients is essential to assess compliance with guidelines Few CKD patients have dietary follow-up for assessment of dietary intake and nutritional status, especially with diabetics Diabetic kidney disease is known cause of kidney failure and limited assessment/management of nutrition will worsen CKD Diabetics had more fat mass and less lean tissue Diabetics ate less calcium and fiber but both groups had poor fiber intake < 25g/day	III

				Non-diabetics had a higher dietary protein intake vs. diabetics which was inline with recommendations for LPD for preservation of kidney function	
44	Pereira et al., 2021 Title: Strategies designed to increase the motivation for and adherence to dietary recommendations in patients with chronic kidney disease	Design: Expert opinion by way of SR Aim: Explore hidden factors involved regarding eating behavior of CKD patients to describe and suggest strategies for a nutritional approach	Population: CKD patients & CKD providers Setting: N/A Sample Size N/A	Nutritional counseling approach for dietary management of CKD patients is best for it stimulates patients to make their own choices Collaborative communication is best to guide patients toward better food choices Nonprescriptive style of nutritional counseling is founded upon professional guidance under the specific dietary adjustments required for CKD CBT techniques and tools: self-monitoring, goal-setting, and contingency management, should be adapted for dietary management for they uphold nutritional counseling Motivational interviewing should be learned and utilized for it reinforces the patient's self-efficacy	IV, I
45	Pérez-Torres et al., 2021 Title: Mediterranean diet and chronic kidney disease (CKD): A practical approach	Design: Case report by way of MA &SR Aim: Offer practical approach to Mediterranean diet adaptation as nutritional treatment in CKD patients	Population: CKD patients Setting: N/A Sample Size N/A	Numerous studies show Mediterranean diet is beneficial for CKD patients and can reduce co-morbid conditions: asthma, RA, QOL, DM, CAD, CVD, obesity, stroke, and cancer Mediterranean diet with high consumption of fruits, vegetables, nuts, legumes and whole grains had lower risk of CKD progression and all-cause mortality Further study showed low salt, sugary drinks, and meat correlated with lower incidence of CKD Mediterranean diet has been suggested related to benefits of lipid profile, BP, inflammation, and endothelial function	III, I

				Mediterranean diet should follow this traditional dietary pattern: plant-based foods (cereals, legumes, nuts, fruits, vegetables and herbs), low in red meat, moderate intake of fish, seafood, eggs, white meat and dairy products (yogurt and cheese), moderate intake (≤ 1 glass/day women, ≤2 glasses/day men) of alcohol (wine), olive oil is the main source of added fat KDOQI guidelines recommend LPD 0.55-0.6 g/kg/day with the best option being vegetable protein (legumes)	
46	Pérez-Torres et al., 2021 Title: The effect of nutritional interventions on long-term patient survival in advanced CKD	Design: Longitudinal study Aim: Evaluate the long-term effects of a NEP among patients with CKD	Population: CKD patients ≥18 years of age, no cognitive impairment Setting: Kidney disease care program at the nephrology department of the University Hospital La Pax, Madrid Spain Sample Size 186, initial with 169 at completion 2 years later mean age 66.1 ± 15.9, 52.7% male	Nutritional intervention has benefits from non-CKD into CKD Nutritional therapy should be individualized for age, sex, and population Nutritional advise is the first step for limiting mortality of CKD patients Hospitalization rate was significantly lower for NEP (13.7%) compared with control (26.7%) Men improved nutritional status significantly 4 (6.5%) out of 18(29.5%) remained in PEW state in contrast to women 10 (14.9%) of 17 (25.4%). No difference between groups for cause of death. Patients who died were more likely to be older (77.5 ± 8.2 vs. 64.5 ± 16.1 years Assessment of albumin alone as marker for malnutrition is good reflection of mortality Consideration of sex is important for nutritional interventions fare worse for women.	III

47	Rashid et al., 2023 Title: Rates and determinants of fast chronic kidney disease progression distinguished by nutritional status, and the impact of malnutrition on mortality - Evidence from a clinical population	Design: Prospective cohort study Aim: Recognize the rates and predictors of fast CKD progression by nutritional status, and determine impact of malnutrition on mortality in CKD patients	Population: CKD patients Setting: Renal clinic of a tertiary care public teaching hospital Sample Size 360 aged 53.7 ± 13.9 years, 53.8% male, 48% had diabetic CKD	244 patients experienced fast decline in kidney function related to: malnutrition (43.9%), rural region (37.5%), DM (33.1%), inflammation (21.1%), and adult group ≤ 60 years (41.1%) Only inflammation and malnutrition were statistically significant Fast CKD progression also received higher prescriptions of ACE inhibitor (21.4%), CCB (68.6%), and diuretics (32.2%) Hyperphosphatemia had 1.32 times increased rate of progression Malnutrition and hyperphosphatemia had 2.42 times progression Severely malnourished had higher incidence of death (7.2%) Systolic BP noted to be predictor with hyperphosphatemia for fast decline in kidney function regardless of nutritional status Early nutritional evaluation and timely dietary interventions to prevent CKD progression and death	III
48	Rhee et al., 2018 Title: Low-protein diet for conservative management of chronic kidney disease: A systematic review and meta-analysis of controlled trials	Design: SR and MA Aim: Conduct SR and MA to of LPD in management of uraemia and complications with CKD patients	Population: CKD patients Setting: N/A Sample Size 16 controlled trials with criteria of having ≥ 30 participants	LPD has been found to be beneficial for management of conserving CKD patients kidney function Found MA study of LPD versus VLPD and VLPD <0.4g/kg/day was associated with greater preservation of kidney function Results found CKD patients prefer not using nutritional strategies for conservative management of CKD Risk of progression to ESRD was significantly lower in LPD versus higher-protein diet None of the studies listed PEW or cachexia with LPD noting that it had	I

				benefits for favorable metabolic surrogates: azotemia, bone and mineral disorders, and acidosis	
49	Rhee et al., 2023 Title: Nutritional and dietary management of chronic kidney disease under conservative and preservative kidney care without dialysis	Design: Expert opinion by way of SR Aim: Discuss conservative and preservative dietary interventions for CKD patients	Population: CKD patients Setting: SR Sample Size N/A	ISRNM posted suggestions for protein intake for CKD patients following rigorous high-quality data from KDOQI and a LPD 0.55-0.60g/kg/day or a VLPD 0.28-0.43g/kg/day with keto acid analogs is best practice to conserve kidney function Research noted high intake of protein among adults across all levels of CKD function 8 plant -based diets were assessed: PLADO, PLAFOND, DASH, Mediterranean, Flexitarian, Vegetarian, Whole-food plant-based, and Vegan and all found more beneficial than typical Western diet and were associated with lower kidney decline MA of 16 RCTs showed that LPD significantly reduced eGFR decline Safety of LPD has been corroborated with review of 7 RCTs MA of 17 trails showed LPD and VLPD with keto acid analogs significantly preserved kidney function LPD should be initiated with specialty -trained kidney RD Animal protein sources versus plant and dairy were associated with eGFR decline over time	IV, I
50	Rysz et al., 2021 Title: The influence of dietary interventions on chronic kidney disease–Mineral and	Design: Expert opinion by way of SR Aim: Present the issue of CKD and bone mineral disorder and	Population: CKD patients Setting: N/A Sample Size	Patients who received monthly education showed positive changes Education can be beneficial for serum phosphate and reduction in mortality and morbidity Progressive protein restriction is beneficial	VI, I

	bone disorder (CKD-MBD)	the impact of various diets on its course for the best choice of nutritional intervention	23 studies, MA of 17 RCTs, and 1 study with SR/MA	Monitoring sodium, phosphorus, energy intake, and protein (animal or plant) was suggested in addition to protein assessment Supplementation of Vit. D, phosphate binders, antiresorptive agents, can be considered but studies show differentially beneficial VLPD not better than LPD regarding protein energy status, phosphorus, renal function, and bone disease VLPD with KAs seemed to be more effective in preventing eGFR reduction Mediterranean and VLPD were found to be best for BP, urea, sodium, PTH, hemoglobin, and bicarbonate VLPD is safe for the long term but must monitor bone mass Higher protein intake correlated with improved bone density Vegetarian diet was better than meat for phosphorus control and CHF patients	
51	Sakaguchi et al., 2023 Title: Plant-dominant low protein diet: A potential alternative dietary practice for patients with chronic kidney disease	Design: SR Aim: Review studies for recommend protein amount, type, and effect of diet on CKD	Population: CKD patients Setting: N/A Sample Size N/A	PLADO has been researched to be best for CKD and eGFR stabilization PLADO additionally has benefits for metabolic acidosis, hyperphosphatemia, reduction of uremic toxins, glomerular hyperfiltration, and electrolytes Hyperkalemia has not been a risk under PLADO diet Magnesium was better with PLADO and hypomagnesemia is known to be associated with higher risk of mortality if low PLADO is associated with improved potassium for plant bioavailability of	I

				potassium is 50-60% versus animal 80% Recommendation of protein intake 0.58g/kg/day was found to be poor typical intake 0.73-1.11g/kg/day	
52	Sing et al., 2020 Title: Features of patient-education websites for patients with chronic kidney disease: an analysis of recommended websites	Design: Expert opinion Aim: Evaluate 11 websites to identify those with the most useful information in 6 domains relevant to CKD self-management: diet, physical activity, financial information, emotional support, general CKD information, and medication adherence	Population: N/A Setting: Internet Sample Size 11 websites: DaVita, NKF, FKC, Kidney Foundation of Canda, Kidney Care of UK, Manitoba Renal Program, National Institute of Diabetes and Digestive and Kidney Diseases, Renal Support Network, The Renal Association, Life Options, NHS Inform	All websites had a ++ score for having CKD information, yet physical activity, emotional support, and medication adherence were not 8 of 11 websites scored ++ for having dietary information, no website received 0 3 websites addressed physical activity with ++, no 0 was received Emotional and financial support was covered by all except Manitoba Renal Program with a 0 in both categories Finance was least addressed	IV
53	Tao et al., 2019 Title: Effects of probiotic supplements on the progression of chronic kidney disease: A meta-analysis	Design: MA Aim: MA to assess the effects of probiotic supplementation on CKD progression	Population: CKD patients Setting: 10 RCTs in 8 countries Sample Size 339 CKD patients	Probiotics were beneficial for effect on urea levels in CKD patients Uric acid, CRP, creatinine, and eGFR was not significant	I

54	Teng et al., 2021 Title: Tailoring health-promoting programs for patients with chronic kidney disease: Randomized controlled trial	Design: RCT Aim: Compare the effectiveness of tailored TTM-based interventions on: biomarkers of kidney function, physical indicators, adoption of health-promoting lifestyle behaviors, kidney disease knowledge, perceived self-efficacy, perceived benefits and barriers to physical activity changes, and QOL among CKD patients over 30 months to provide knowledge to delay the progression of CKD	Population: Taiwanese CKD patients ≥ 20 years of age, Mandarin primary language, could be assessed every 6 months follow-up Setting: 2 medical centers in Southern Taiwan Sample Size 60 per group, as determined by power analysis of 80% power, and medium effect size of 0.25 for repeated measure analysis, 72% male	Current strategies to slow CKD function: monitoring kidney function, physical indicators, and adherence to health-promotion behaviors Health promotion lifestyle measured by 52 item Health-Promoting Lifestyle-II (HPLP-II) questionnaire Primary outcomes BMI (kg/m^2), waist/hip circumference, WHR, and eGFR (eGFR was estimated using the MDRD formula (eGFR (ml/min/1.73 m2) = 186 × (SCr)−1.154 × (Age)−0.203 × (0.742 if female) GEE analysis of HPLP-II shows only significant difference between physical activity score at 6 months and 12 months GEE analysis between nutrition and stress management were significant at 30 months GEE analysis of interpersonal relations at 24 months and 30 months and total HPLP-II score were higher than control indicating intervention was time dependent 30-month follow-up indicated intervention group experienced significantly slower decline in eGFR Physical activity, self-efficacy, perceived physical activity benefit, physical activity barriers, and RPK score did not significantly differ QOL score in physical, psychological, social, or environmental domains was not significant Individuals with CKD should be encouraged to be actively involved with their own care for TTM-focused	I

				intervention effected eGFR and waist circumference	
55	Torabikha et al., 2023 Title: Comparing the effects of mHealth app use and face-to-face training on the clinical and laboratory parameters of dietary and fluid intake adherence in hemodialysis patients: A randomized clinical trial	Design: RCT Aim: Compare the effects of a mobile health app and face-to-face training on dietary and fluid intake adherence	Population: HD patients Setting: HD center in Isfahan, Iran Sample Size 70 ≥ 18 years, able to read and write, access smartphone with Android operating system, using no other health apps, no mental illnesses or physical disability effecting training, aged 20-60 mean 46 ± 8.84 years, 49% male, in 2 stage-2-group RCT	Decrease in potassium and phosphorus levels with face-to-face but not significant Both app and face-to-face improved clinical and laboratory parameters Training in app was more effective and app had greater mean reduction than face-to-face. App presented complications regarding function, access, patient refusal to allow downloads onto device versus face-to-face meeting	I
56	Tseng et al., Title: Association of frailty with nutritional status in patients with chronic kidney disease	Design: Cross-sectional cohort study Aim: Examine association between frailty and nutritional status in CKD patients	Population: CKD patients Setting: Tzu Chi Hospital in Taipei, Taiwan Sample Size 157 CKD patients ≥ 20 years, 57-71 years, mean age 64 ± 12.0 years, 93 men, 64 women,	Higher BMI and FTI were associated with frailty Higher albumin, high handgrip strength, lower MIS, and high dietary protein intake were less likely to have frailty CKD progression ≥ 3 correlates with 6-fold greater risk of frailty Frailty more likely with older age, female, and diabetes Elevated BMI ≥ 30kg/m^2 was associated with increased frailty 2.34-fold increased likeliness to poor physical functioning Chronic inflammation can arise from excess adipose tissue and fatty	III

				infiltration of muscles decreasing function Inflammation can stimulate muscle wasting, suppress appetite, increase insulin resistance and growth hormone, enhance energy expenditure, resulting in malnutrition and decreased functionality Frail patients had higher PEW defined by MIS > 7 Association of low protein intake and frailty has been assessed related to tendency to eat less protein when frail	
57	Torreggiani et al., 2022 Title: Plant-based diets for CKD patients: fascinating, trendy, but feasible? A green nephrology perspective	Design: Expert opinion by way of SR Aim: Review available evidence for benefits of plant-based diet in CKD, emerging issues with use	Population: CKD patients Setting: SR Sample Size N/A	Plant-based diets are listed as being Mediterranean, Okinawan, and DASH diets Plant-based diets consist of fruit, vegetables, grains, legumes, nuts, seeds, and herbs, excluding animal products (meat, fish, seafood, poultry, eggs, and dairy products) Regimens have been adapted: vegetarian, ovolactovegetarian, lactovegetarian, ovovegetarian, pesco-vegetarian, vegan, semivegetarian/flexitarian, macrobiotic, and PLADO No guideline found to recommend one specific protein type over another Elderly CKD patients have been found to have excessive protein intake not typical of this population in general careful assessment of diet available to elderly is advised According to research best diet is VLPD, vegan, and supplemented yet is hard to maintain compliance so individual analysis of patients habits to reduce protein and animal protein is advised	IV, I

58	Torreggiani et al., 2023 Title: Personalized low-protein diet prescription in CKD population: Merging evidence from randomized trials with observational data	Design: Expert opinion by way of SR Aim: Discussion of feasible strategies to integrate a low-protein diet for CKD population by SR and observational studies	Population: CKD patients Setting: SR Sample Size N/A	Article notes that QOL is not generally assessed in RCTs for benefits of low-protein diet in CKD patients related to inverse in evidence pyramid quality Observation studies are low on quality of evidence pyramid for efficacy versus RCT yet are at the top on evidence pyramid for QOL Compliance for LPD is essential and individualization of goals and diet menu is best for adherence Studies found that for patients with DM and CKD LPD was significantly beneficial for limiting kidney progression Found that elderly ≥ 60 years had higher than required protein intake but were limited in clinical trials despite being the largest portion of CKD patients Once study found limitations in recommending VLPD, despite benefits, related to lack of compliance Elderly patients have been stated to be established in dietary ways but observational studies show improved compliance with personal approaches	IV, I
59	van Westing et al., 2020 Title: Diet and kidney function: A literature review	Design: SR of prospective cohort studies Aim: Review of current evidence on food, beverages, and dietary quality related to risk of incident CKD	Population: CKD patients Setting: SR of cohort studies Sample Size 21 studies, with 3-24 years of follow-up	Convincing evidence that healthy diet patterns, assessed by Healthy Eating Index-2015, DASH, or Mediterranean diet may lower CKD risk and progression Meat and sugar-sweetened beverages will decrease kidney function and an unhealthy diet is noted to have higher animal protein, phosphorus, fat, salt, sugar, and acid load (12.2-100.7 mEq per day) Two studies found that healthy diet patterns may prevent incident CKD	I

				After 23 years study follow-up of vegetable protein versus animal protein was significantly associated with lower risk of CKD Lower risk of incident CKD for PLADO maybe contributed to fiber Whole grains consumption has been attributed to lower kidney function decline CKD and fish intake was not correlated to be beneficial or problematic Coffee (black) and tea likewise were not found to be better or worse for incident CKD Low-fat dairy did have a benefit for kidney function but limited to 1 study	
60	Wu et al., 2023 Title: Vegan diet is associated with a lower risk of chronic kidney disease in patients with hyperuricemia	Design: Cross-sectional study Aim: Assessment of vegetarian diet for effects on hyperuricemia in CKD patients	Population: CKD patients Setting: Taipei Tzu Chi Hospital Sample Size 3618 CKD patients with hyperuricemia	Studies show that hyperuricemia, serum uric acid level ≥ 7, can accelerate the progression of CKD A markedly elevated uric acid ≥ 9 has a triple risk for incident CKD It is noted that crystallization of the uric acid in the urine was the crux for CKD progression Vegan diet associated with 31% lower risk of CKD with hyperuricemia Lacto-ovo vegetarian diet was not associated with better odds ratio for CKD progression CKD patients who consume plant-based diets had lower disease progression and mortality Study found factors to worsen CKD progression older age, DM, HTN, obesity, smoking, and very high uric acid level Pt education toward modifiable risk factors, HTN, DM, and obesity is beneficial to limit CKD progression	III

				ACE/ARB for HTN control and strict blood glucose control will prevent CKD progression Urate-lowering treatments did not slow progression of CKD	
61	Zarantonello & Brunori 2023 Title: The role of plant-based diets in preventing and mitigating chronic kidney disease: More light than shadows	Design: SR Aim: SR to provide recommendation of plant-based diet and LPD in CKD patients with review of concerns	Population: CKD patients Setting: SR Sample Size N/A	All plant foods contain all 20 amino acids, inclusive of the 9 essential amino acids, and is a quality protein source Plant-protein rich foods: legumes, nuts, and seeds are significant to provide full protein adequacy in a vegetarian diet PLADO has been researched and shown to be beneficial for modifiable risk factors and progression of CKD Lists plant-based diets as vegetarian/vegan (excludes all foods of animal origin), lacto-ovo-vegetarian (includes eggs and dairy), WFPD, flexitarian all kinds of meats are accepted but sporadically, semi-vegetarian certain types of meat are excluded, pescatarian (includes only fish), pollovegetarian (only poultry), Mediterranean, DASH, Blue Zones diet or diet of people living in areas where people live ≥ 100 years Unhealthy plant-based foods are refined grains, fruit juices, desserts, and potatoes Worldwide CKD increase ≥ 10% of the general population is related to modifiable risk factors DM, HTN and obesity Plant-based diet has secondary benefits to prevent dyslipidemia, ischemic cardiac disease, and metabolic syndrome	I

				DASH and Mediterranean diet are similar in preventing CKD progression Study finds that all animal protein had lower kidney function Ketogentic diet despite being beneficial for PKD through reduction of cysts is not generally recommend for any CKD patient Whole grains should be primary rather than refined	

Note. ACE = angiotensin converting enzyme; aMed = alternate Mediterranean diet; ARB = angiotensin II receptor blocker; ARIC = Atherosclerosis Risk in Communities; BMI = body mass index; BP = blood pressure; CBT = cognitive behavioral therapy; CCB = calcium channel blocker; CCD CCI = Centers for Disease Control and Prevention Clear Communication Index; CKD = chronic kidney disease; CKD-SFFQ = Chronic Kidney Disease Short Food Frequency Questionnaire; CKD-SM = CKD Self-Management Tool; CRP = c-reactive protein; CVD = cardiovascular disease; DASH = dietary approaches to stop hypertension; DM = diabetes mellitus; DNT = dietetic-nutritional therapy; eGFR = estimated glomerular filtration rate; FKC = Fresenius Kidney Care; FTI = fat tissue index; GEE = generalized estimating equation modeling; GI = gastrointestinal; GRID = Global Renal Internet Course for Dietitians; HD = hemodialysis; HPLP-II = Health Promoting Life-Style II; IL-6 = interleukin-6; HTN = hypertension; IQR = interquartile range; ISRNM = Internal Society of Renal Nutrition and Metabolism; KA = ketoacid analogs; KDOQI = Kidney Disease Outcomes Quality Initiative; KiKS = Kidney Disease Knowledge Survey; LPD = low protein diet; MA = meta-analysis; MDRD = Modification of Diet in Renal Disease; mEq = milliequivalent; MeSH = medical subject heading; MIS = malnutrition inflammatory score; MNT = medical nutrition therapy; N/A= not available/applicable; NAM = National Academy of Medicine; NEP = nutritional education program; NHANES = National Health and Nutrition Examination Survey; NKF = National Kidney Foundation; PEW = protein-energy wasting; PD = peritoneal dialysis; PEMAT = Patient Education Materials Assessment Tool; PEW = protein-energy wasting; PKD = polycystic kidney disease; PLADO = plant dominant low protein diet; PLAFOND = plant-focused low-protein diet for CKD in diabetes; PRAL = potential renal acid load; QOL = quality of life; RA = rheumatoid arthritis; RCT = randomized controlled trial; RD = registered dietitian; RPK = The Disease-Specific Knowledge of Renal Protection Checklist; RN = registered nurse; SEMCD = Self-Efficacy for Managing Chronic Disease; SCT = Social Cognitive Theory; Self-efficacy for Managing Chronic Disease Tool; SPSS = Statistical Package for the Social Sciences; SR = systematic review; TTM = Trans-Theoretical model; QOL = quality of life; VLPD = very low protein diet; WFPB = whole food plant-based diet; WHO-QOL-BREF= World Health Organization Quality of Life Brief Version; WHR = waist-hip ratio

Appendix F

Recommendations for Nutritional Management of CKD

Recommendations	**Grade** A = SR, RCT, MA B = Correlational/Comparative Studies C = Descriptive and Expert Opinion	**Recommended for practice based upon graded evidence literature and by stakeholders.** Yes/No
CKD patient education by RD with CKD education, experience, and knowledge; such as, training in GRID and 3 years of CKD nutritional management	A	
Plant-based diet for CKD patients for prevention of incident CKD and progression of CKD	A	
Low-protein diet for CKD patients for prevention of incident CKD and progression of CKD	A	
Elevated follow-up, more than bi-annually, by RD with worsening of CKD or provider with CKD nutrition education or training	A	
Multidisciplinary approach to improve adherence, patient empowerment,	A	

individualization, and use of technology to improve CKD progression		

Note: CKD = chronic kidney disease; GRID = Global Renal Internet Course for Dietitians; MA = meta-analysis; RCT = randomized control trial; RD = registered dietitian; SR = systematic review.

Stakeholders will be anonymous by way of random number generator for de-identification.

Appendix G

Stakeholders Rating Recommendations for Nutritional Management of CKD

Rating: 1 = Poor recommendation based upon evidence 2 = Fair or Weak recommendation based upon evidence 3 = Good or Moderate recommendation based upon evidence 4 = Excellent or high recommendation based upon evidence	Recommendation One: CKD patient education by RD with CKD education and experience and knowledge; such as, training in GRID and 3 years of CKD nutritional management	Recommendation Two: Plant-based diet for CKD patients for prevention of incident CKD and progression of CKD	Recommendation Three: Low-protein diet for CKD patients for prevention of incident CKD and progression of CKD	Recommendation Four: Elevated follow-up, more than bi-annually, by RD with worsening of CKD or provider with CKD nutrition education or training	Recommendation Five: Multidisciplinary approach to improve adherence, patient empowerment, individualization, and use of technology to improve CKD progression
Stakeholder One					
Stakeholder Two					
Stakeholder Three					
Stakeholder Four					
Stakeholder Five					
Stakeholder Six					

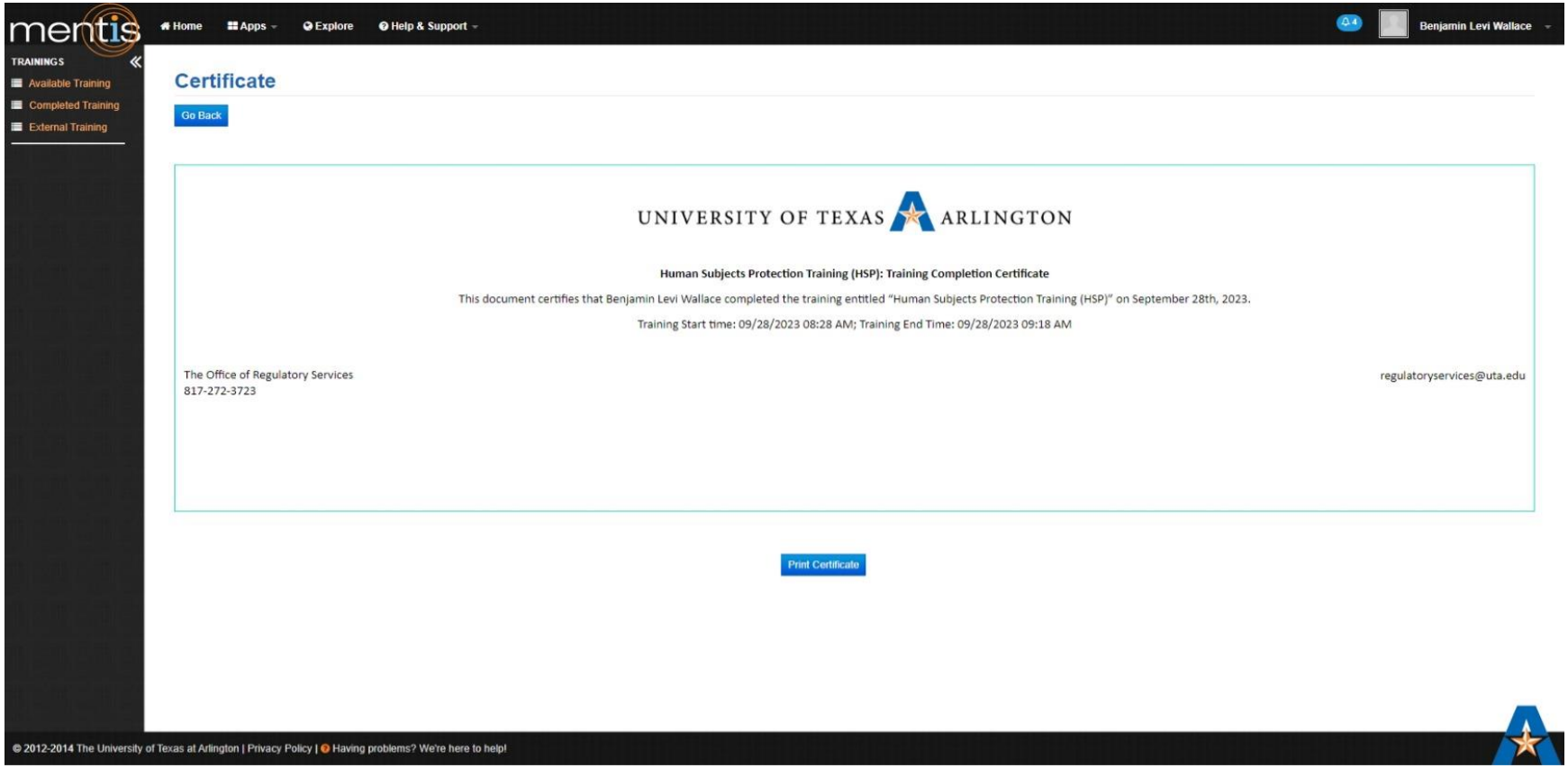
Note: CKD = chronic kidney disease; RD = registered dietitian.

Stakeholders will be anonymous by way of random number generator for de-identification.

Additional suggestions:

Appendix H

Certificate of Completion Human Subject Protection Training



Appendix I

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Recommendation1	**5**	**3**	**4**	**3.80**	**.447**
Recommendation2	**5**	**1**	**4**	**2.80**	**1.304**
Recommendation3	**5**	**1**	**4**	**2.60**	**1.140**
Recommendation4	**5**	**4**	**4**	**4.00**	**.000**
Recommendation5	**5**	**3**	**4**	**3.80**	**.447**
Valid N (listwise)	**5**				

Note. **N = number of stakeholders rating the recommendations**

Appendix J

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]
1	The distributions of Recommendation_1, Recommendation_2, Recommendation_3, Recommendation_4 and Recommendation_5 are the same.	Related-Samples Friedman's Two-Way Analysis of Variance by Ranks	.024

Hypothesis Test Summary

	Decision
1	Reject the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

Related-Samples Friedman's Two-Way Analysis of Variance by Ranks

Recommendation_1, Recommendation_2, Recommendation_3, Recommendation_4, Recommendation_5