

# Medical Nutrition Therapy for Chronic Kidney Disease Improves Biomarkers and Slows Time to Dialysis

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**Objective:** To investigate whether medical nutrition therapy (MNT) provided by a registered dietitian experienced in chronic kidney disease (CKD) slows the progression of disease and improves nutrition-related biomarkers.

**Design:** Retrospective cohort study.

**Subjects:** The cohort included 265 participants from a regional nephrology center in a rural state; 147 of who received MNT were compared to a group that did not receive MNT and had started dialysis over a 10-year period.

**Intervention:** MNT by a registered dietitian with expertise in CKD.

**Main Outcome Measure:** Average time to dialysis, based on stage of CKD at baseline, was compared between groups. In addition, the effect of MNT on the change in biochemical measures for estimated glomerular filtration rate, blood urea nitrogen, albumin, CKD Mineral and Bone Disorder (MBD) markers (phosphorous, calcium, and intact parathyroid hormone) at baseline and at follow-up (dialysis initiation or most recent laboratories if dialysis was not started) was assessed.

**Results:** MNT group had less of a decline in estimated glomerular filtration rate than the non-MNT group (0.3 vs. 9.9 mL/minute/1.73 m<sup>2</sup>, respectively) a mean difference of 9.6 ( $P < 0.001$ ). When adjusted for stage using linear regression, the mean difference was greater (11.4,  $P < .001$ ). Using survival analysis and Cox proportional hazards regression, the non-MNT group was 3.15 more likely to initiate dialysis. Stratified by Stages 3 and 4 that hazard ratio increased (3.47 and 3.45, respectively). Albumin and markers of CKD-MBD were more likely to be within normal limits in the MNT group. The results indicate that better outcomes occur when MNT is given at CKD Stage 3 or 4 rather than CKD Stage 5.

**Conclusions:** Results suggest that people with CKD who received MNT were less likely to start dialysis and had improved nutritional biomarkers than participants who did not receive MNT.

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## Introduction

MEDICAL NUTRITION THERAPY (MNT) provided by a registered dietitian (RD) for patients with chronic kidney disease (CKD) for estimated glomerular filtration rate (eGFRs) between 15 and 50 mL/minute/1.73 m<sup>2</sup> has been supported by Medicare since 2002<sup>1</sup> and many health insurance companies. To improve outcomes in people with CKD, 2 reports, the Kidney Disease Outcomes Quality Initiative<sup>2-4</sup> and Kidney Disease Improving Global Outcomes,<sup>4,5</sup> recommend expert

dietary advice for management of progression and complications of CKD. In a retrospective cohort analysis, patients had lower mortality during the first year on dialysis therapy if they had seen a dietitian more than 12 months before dialysis initiation.<sup>6</sup> The Academy of Nutrition and Dietetics (The Academy) Evidence Analysis Library found good evidence in their 2010 Evidence Summary to support the statement that MNT provided by an RD for adult patients with CKD is effective.<sup>7</sup>

According to 2014 Centers for Medicare and Medicaid Services report, there were over 511,900 enrollees for end-stage renal disease (ESRD) during the calendar year 2013.<sup>8</sup> The United States Renal Data System, which collects and analyzes information about CKD and ESRD, demonstrated in their 2014 Annual Data Report a steady rise in ESRD Medicare expenditures since 1991.<sup>9</sup> The annual mean expenditure for treating a patient with renal replacement therapies (dialysis and transplant) in 2009 was approximately \$70,000 per patient.<sup>10</sup> Estimated lifetime incidences of CKD are expected to continue to grow based on current treatment patterns and risk factors.<sup>11</sup> It is, therefore, prudent to recommend services that delay the progression of CKD to ESRD.

The Academy and the National Kidney Foundation Council on Renal Nutrition developed Standards of

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Practice and Standards of Professional Performance for Registered Dietitians in Nephrology<sup>12,13</sup> to ensure core standards and minimum competencies for optimal nephrology care. These standards are updated to incorporate any changes in practice at regular intervals. MNT for patients with CKD addresses nutrition issues such as, but not limited to, protein energy wasting, electrolyte imbalances, mineral and bone disorders (CKD-MBD), fluid imbalance, and vitamin deficiencies. Caring for patients with CKD requires specialized knowledge to meet the nutritional challenges patients with this disease present.

Improved management of CKD can delay time to dialysis, which may result in increased quality of life (QoL) and reduced health-care costs. In this study, the researchers hypothesized that those patients with CKD who received MNT from an RD with renal expertise will have improved nutritional laboratory biomarkers at follow-up and will have a longer time period to dialysis compared with those patients with CKD who did not receive MNT before dialysis start.

## Methods

### Study Population

This study was a retrospective cohort analysis of data of patients seen for MNT at a University of Vermont Medical Center (UVMMC) Nephrology Department Outpatient Clinic, and new dialysis starts at UVMMC dialysis units throughout Vermont between April 2003 and April 2013. Patients were divided into 2 groups, those that received MNT from an RD and those that did not. This study was reviewed and approved by the University of Vermont Institutional Review Board.

### Data Collection

Baseline and follow-up data were obtained from medical records. Two patient lists were cross referenced (all new dialysis starts and all patients seen for CKD MNT) between April 2003 and April 2013. Exclusion criteria for screening patients included patients less than 18 years old, those with acute kidney injury, a kidney transplant, and those lacking sufficient laboratory data or lost to follow-up. Pre-dialysis RD care, demographic data, and laboratory data were collected using electronic medical records. The same renal RD from the nephrology clinic saw all patients who received MNT.

For both study groups, baseline was considered the date of CKD diagnosis as diagnosed by a nephrologist and documented in the electronic medical records. At baseline, gender, age, race, and whether the person had diabetes were assessed. Available laboratory values of blood urea nitrogen (BUN), eGFR, albumin, calcium, phosphorous, and intact parathyroid hormone (iPTH) were collected at baseline and follow-up. Follow-up was considered as the date of dialysis initiation or the date of most recent labora-

tories if dialysis was not initiated. Laboratory values of normal were based on the UVMMC laboratory normal values.

### Statistical Analysis

A comparison of the 2 groups at baseline and follow-up was completed using Fisher's exact tests for categorical variables and 2-sample *t* tests for continuous variables. The percentage of participants within normal ranges for BUN, calcium, phosphorous, iPTH, and albumin was compared. Analyses were also conducted stratified by stage of CKD at baseline and adjusted for stage using logistic regression for categorical variables and linear regression for eGFR. Time to dialysis was assessed using Kaplan-Meier survival estimates. Participants who did not start dialysis during the duration of the study were censored at the date of the most recent laboratory data. Cox proportional regression was used for adjusted analysis of time to dialysis. In addition to comparisons of all patients, analyses were conducted and restricted to patients with Stage 3 to 5 CKD who started dialysis more than 1 year after date of MNT or date of diagnosis. Statistical significance was defined as a 2-sided *P* value < .05. No adjustments were made for multiple comparisons, as recommended when a global null hypothesis is not of interest.<sup>14</sup> Analyses were conducted using SAS v9.4 (SAS Institute Inc., Cary, North Carolina).

## Results

Of the 568 patients screened who started dialysis during this time period or received MNT from an RD, 303 patients were excluded (Table 1) per exclusion criteria and not used in the analysis. Most of the exclusions (63%) were those lacking laboratory data. Of the remaining 265 patients, 147 received MNT from a renal RD and 118 did not. The 2 comparison groups, those that received MNT and those that did not, were overall very similar. There were no significant differences between those who received MNT and those who did not in terms of gender, age, race, eGFR, and presence of diabetes (Table 2). To address changes in care patterns that may have occurred over time, we divided each group that came into the study by 2.5-year quarters of entry. There was a statistical significance between the groups, with higher percentage of MNT patients from the first quarter relative to the non-MNT patients (23% of MNT patients were from the first quarter, whereas only 4% of the non-MNT patients were from the first quarter). Relatively more non-MNT patients were from the third quarter (38% compared with 22% of the MNT patients). The mean eGFR (Table 3) in the MNT group was higher than the non-MNT group, but with patients in Stages 3 and 4 CKD only, the difference between the groups diminishes at baseline.

The change in eGFR<sup>15</sup> from baseline to follow-up (Table 3) showed that the MNT group had decline in eGFR of 0.3 mL/minute/1.73 m<sup>2</sup> as compared to the

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