Getting Research Data Sets from the USRDS

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USRDS Co-Project Officer
NIH, NIDDK, DKUHD
### Approved USRDS requests for standard analytic files and approved manuscripts: 2001 to 2006 (October)

<table>
<thead>
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<th>Year</th>
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Outline for research proposals using USRDS data

I Research topic and submission date
II Background information
III Study design
   Objectives
   Hypothesis(es)
   Analytical methods
IV Data being requested
   a. List of Standard Analytical Files needed
   b. Description of data security: responsible party, computer access, etc
   c. Timeframe for the project
   d. Statement that data will be returned to the USRDS or destroyed at the end of the project.
V Outline of estimated costs of requested data: source of funding
VI IRB clearance (or waiver)
VII Signed agreement for release of data (DUA)
VIII Investigator information for principal investigator and co-authors, supply:
   Name
   Affiliation
   Business address
   Business phone number
   Business fax number
   Email address

2006 ADR
Outline for research proposals using USRDS data-links with other data sets

I Research topic and submission date
II Background information
III Study design
   Objectives
   Hypothesis(es)
   Description of data linkage – variables to be used in linkage
   Analytical methods
IV Privacy Issues
   a. Statement describing that patient consent allows such a merge or a statement why patient consent could not be obtained.
   b. IRB clearance (REQUIRED)
V Data being requested
   a. List of Standard Analytical Files needed
   b. Description of data security: responsible party, computer access, etc
   c. Timeframe for the project
   d. Statement that data will be returned to the USRDS or destroyed at the end of the project.

2006 ADR
Outline for research proposals using USRDS data-links with other data sets (continued)

VI Outline of estimated costs of requested data: source of funding

VII Signed agreement for release of data (DUA)

VIII Investigator information for principal investigator and co-authors, supply:
   Name
   Affiliation
   Business address
   Business phone number
   Business fax number
   Email address
USRDS Available Data Sets

• Standard Analysis Files (SAF)
  ❑ Core CD – Patient, treatment history, payer sequence, transplant, wait list, DMMS, medical evidence, facility
  ❑ Transplant CD – follow-up data, immunosuppressives
  ❑ Hospital CD – dates, diagnoses and procedures
  ❑ Claims CDs – institutional and physician/supplier
• Clinical Performance Measures (CPM) merged data
USRDS Examples of linked data requests

- Cardiovascular Health Study (CHS)
- Choices for Healthy Outcomes in Caring for End-stage Renal Disease (CHOICE)
- MRFIT, ALLHAT, HEMO, MDRD
- Kaiser Permanente Northern California
- Bogalusa Heart Study
- Utah Population Database
- Cooperative Cardiovascular Project (CCP) from CMS
- Davita – Dialysis chain
- Minnesota Heart Study
- Baltimore HIV cohorts
- DCI
- Mayo Clinic – Heart patient cohort
- Joslin – diabetes cohorts
5 % Medicare sample CKD, diabetes, and CHF

- 1992 through 2004 defined cohorts
- Follow-up data including
  - Hospitalization
  - Mortality
  - ESRD
  - Medicare expenditures
  - All billing data
Size of 5% Medicare sample by diagnosis

- Diabetes
- CHF
- CKD

Years: 1992 to 2003

- 0
- 50,000
- 100,000
- 150,000
- 200,000
- 250,000
- 300,000

Number of patients:

- Diabetes
- CHF
- CKD
Distribution of Medicare patient counts & costs for CKD, HTN, diabetes, & ESRD

Figure p.1

Populations estimated from the 5 percent Medicare sample, & include patients surviving the entire cohort year (2002) with Medicare as primary payor, plus period prevalent ESRD patients for 2003. Diabetes & CKD are determined from claims in 2002 & 2003; hypertension is defined from Medicare claims in the 5 percent sample, but includes only hypertension as the primary cause of renal failure in ESRD patients.
NIDDK central repository components

• Biosample repository (Fisher):
  - archival storage of biological specimens

• Database repository (RTI):
  - maintain archival datasets,
  - respond to queries about data and stored samples

• Genetics repository (Rutgers Univ.):
  - create immortalized cell lines, DNA extraction
  - http://pubnts06.rti.org/niddk/home.do
Introduction

On July 1, 2003, The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) of the National Institutes of Health (NIH) established Central NIDDK Repositories for biosamples and data collected in clinical studies. The purpose of the Central Repositories is to expand the usefulness of these studies by providing access to the biosamples and data to a wider research community beyond the end of the study. There are three Central Repositories:

- **Biosample Repository** - Fisher BioServices, Inc
  (14665 Rothgeb Drive, Rockville, MD 20850)
  Receives biosamples collected in many different studies, store the samples under optimal conditions, and distribute them to qualified investigators. The Contractor for the Biosample Repository is Fisher BioServices Corporation of Rockville, MD. A complete statement of work for this contract can be found [here](#), (PDF, 120KB)

- **Genetics Repository** - Rutgers, The State University of New Jersey
  (604 Allison Road, Nelson Labs C112, Piscataway, NJ 08854)
  Receives blood samples collected in many different studies, and processes them to create immortalized cell lines, and DNA samples. In addition, the Genetics Repository also cryopreserves blood cells, extracts DNA from blood samples, stores samples of DNA under optimal conditions, and distributes DNA samples to qualified investigators. The Contractor for the Genetics Repository is Rutgers, The State University of New Jersey, New Brunswick, NJ. A complete statement of work for this contract can be found [here](#), (PDF, 121KB)

- **Data Repository** - RTI International
  (3054 Cornwallis Rd, Research Triangle Park, NC 27709)
  Receives, archives, maintains and distributes databases or parts of databases from studies. In addition, the Data Repository analyzes stored data in response to inquiries, assists ongoing studies in preparing data for eventual archiving, coordinates cross-referencing between the three Central Repositories, and maintains the Central Repositories website. The Contractor for the Data Repository is Research Triangle Institute, Research Triangle Park, NC. A complete statement of work for this contract can be found [here](#), (PDF, 111KB)
Current repository holdings

- IBD Genetics Consortium - >300 genetic samples
- Liver Transplantation Database (LTD) – Archival data set available
- National Analgesic Nephropathy Study (NANS) – Archival data set available
- DPT-1 (Diabetes Prevention Trial)
- Medical Therapy of Prostatic Symptoms (MTOPS)
- MDRD (Modification of Diet in Renal Disease)
- ICDB (The Interstitial Cystitis Data Base)
- CRISP (Consortium for Radiological Imaging Studies of PKD)
- HEMO (Hemodialysis)
- AASK (African American Study of Kidney Disease and Hypertension)
Future contributing studies

- CRIC (Chronic Renal Insufficiency)
- FAVORIT (Folic Acid for Vascular Outcome reduction in transplantation)
- FSGS Consortium (Focal & Segmental Glomerulosclerosis)
- HALT-PKD (PKD Trials Network)
- Dialysis Access Consortium (DAC)
- NASH (Non-alcoholic Steatohepatitis Study)
- TEDDY (The Environmental Determinants of Diabetes of the Young)
- TODAY (Type 2 Diabetes in Children and Adolescents)
- TrialNET (Type 1 Diabetes Clinical Trial Network)
- BARC (Biliary Atresia Research Consortium)
- Bariatric Surgery Study Consortium
- CAMUS (Complementary & Alternative Medicine for Urological Symptoms)
- Type 1 Diabetes Genetics Consortium
- Boston Area Community Health (BACH) study
- Viral Resistance to Antiviral Therapy of Chronic Hepatitis C (VIRAHEP-C)
Approved requests for research files from NIDDK Repository: 2005 and 2006

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ESRD trends and quality of care: USRDS 2006 Annual Data Report

Allan J. Collins, MD, FACP
Professor of Medicine
University of Minnesota
Director, USRDS Coordinating Center
Summary of the USRDS 2006 ADR

• Growth of the ESRD population
  • Incidence, prevalence counts and rates
  • Are we on track?
• Sources of the new dialysis population starting each year
• Mortality: 1st year vs others
• Aspects of care and provider’s patterns
  • Dialysis therapy
  • Anemia management
  • Overshooting of target Hb levels
Trends In ESRD Patient counts

First graph: incident patients & December 31 point prevalent patients. Second graph: data obtained from CMS’s annual End-Stage Renal Disease Facility Survey, CMS Independent Renal Facility Cost Reports, & the CMS “Dialysis Facility Compare” website.
Number of incident & point prevalent patients

figure 1.3, projected to 2010

2004 actual prevalent count: 472,099 (M-1: -0.5%)
2004 M-1 Projected 474,382*

2004 actual incident count: 104,364 (M-1: -21%, M-2: -0.9%)
2004 incident M-2 conservative Projection: 105,317*

*USRDS 2000 ADR &
*JASN 2001; Vol 12:2753-2758

2006 ADR
Original, projected and actual YTD incidence counts

Incidence counts

- Conservative projection
- Actual counts thru 2004
- Original counts

Cohort year

2006 ADR
**Patient counts & counts of new & returning dialysis patients**

Figure p.2

First graph: incident patients & December 31 point prevalent patients. Second graph: data obtained from CMS’s annual End-Stage Renal Disease Facility Survey, CMS Independent Renal Facility Cost Reports, & the CMS “Dialysis Facility Compare” website.
Year-to-year percent growth in the dialysis population

Figure 2.1 (continued)

Data obtained from CMS’s annual End-Stage Renal Disease Facility Survey, CMS Independent Renal Facility Cost Reports, & the CMS “Dialysis Facility Compare” website.
Incident patient counts, by first modality

Figure p.3

Incident ESRD patients; excludes those with unknown modality.
Prevalent patient counts, by modality

December 31 point prevalent ESRD patients; excludes those with unknown modality.
Total ESRD expenditures are from paid claims as well as estimated costs for HMO & organ acquisition. ESRD costs in 2004 are inflated by 2 percent to account for costs incurred but not reported. Total Medicare expenditures obtained from the CMS Office of Financial Management, Division of Budget. EGHP data derived from the Medstat claims database that includes ESRD patients younger than 65 & with no Medicare payments.
Medicare costs obtained from claims files, & include all Medicare primary payor claims as well as amounts paid by Medicare as secondary payor. Also included in the Medicare total are HMO costs, estimated as the number of HMO months times the Medicare AAPCC, & organ acquisition costs, estimated as $25,000 per transplant. Non-Medicare estimate includes all non-Medicare patients, estimated based on per year costs from Medstat ESRD patients. Primary payor estimates for Medicare as secondary payor patients obtained using difference between paid claims & AAPCC for these patients.
Current state of the ESRD population

• In 2004 the prevalent population had reached 472,000 with estimated total ESRD expenditures at $32 billion in 2004
• The actual growth is within 0.5-0.9% of the conservation estimates
• The ESRD program costs now accounts for 6.8% of the Medicare program
Trends in the ESRD population

• The actual growth in incident and prevalent populations appear to be on target with the conservative projections reported 7 years ago.

• The current counts for 2004 appear to be 0.5-0.9% below the projections which may reflect slowing beyond that anticipated in the original projections.

• What may account for the slowing of the incident population?
Adjusted ESRD incident rates

Figure hp.2

Incident ESRD patients; adjusted for age, gender, & race.

2006 ADR
Incident counts & adjusted rates, by primary diagnosis

Figure 2.11

Incident ESRD patients. Rates adjusted for age, gender, & race.

2006 ADR
Slowing of the ESRD rates

• The rates of ESRD by cause of kidney failure have actually peaked and in some cases declined.

• The trends, however, do not reflect ESRD rates in the true at-risk populations which may provide a better gauge of the impact of treatment to prevent kidney disease.

• DM ESRD rates in the DM population should be compared to the overall trends.
Comparing DM ESRD rates by traditional vs at-risk population methods

• Incident ESRD cases taken from the USRDS ME forms (numerator): DM

• Risk population for the denominator
  - General population age, gender and racial groups from the US Census Bureau
  - DM populations estimated from the CDC National Health Information Survey

• All rates are adjusted (direct adjustment) for age, gender and race to the base population year of 2003
Adjusted incident rates of reported ESRD with diabetes as primary diagnosis: Age

CDC method*

USRDS method†

*Burrows et al; CDC

†USRDS 2006 ADR
Adjusted incident rates of reported ESRD with diabetes as primary diagnosis: Gender

**CDC method**

- CDC diabetes population as denominator

**USRDS method**

- General population as denominator

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*Burrows et al; CDC

†USRDS 2006 ADR
Adjusted incident rates of reported ESRD with diabetes as primary diagnosis: Race

**CDC method**

- CDC diabetes population as denominator

**USRDS method**

- General population as denominator

*Burrows et al; CDC

†USRDS 2006 ADR
Adjusted incident rates of reported ESRD with diabetes as primary diagnosis: age 0-44

CDC method

USRDS method

2006 ADR

*Burrows et al; CDC

†USRDS 2006 ADR
Comparisons between Incidence rates in the General vs DM population

• Historical Incidence rate with the general population as the base have slowed and started to decline
• Incidence rates computed from the DM population show incidence rates have been declining for most groups since the mid-1990s
• Therefore, the more conservative population based incidence rates may be less representative of the potential progress that has been made in treating DM and reducing complications such as ESRD
Potential caveats to the ESRD rates computed within the DM vs General population

- The rising DM prevalence in the general population may dilute the denominator thereby reducing the computed ESRD rates.
- Earlier detection of DM may create lead time bias in that the newly diagnosed group may take longer to develop ESRD.
- The competing death risk in the DM population may lower the number of individuals reaching ESRD which cannot be viewed as a success.
- The overall ESRD rate computed from the general population base may under represent true improvements in kidney disease treatment since the denominator is less related to the true at-risk population.
- More observation time is required to determine if these trends are sustained before true success in the treatment of DM kidney disease can be determined.
Caveats related to DM ESRD rates in the DM population

**DM ESRD rates in the DM population: CDC**

- **Rate per million population**
- **Cohort year**
- **Male**
- **Female**

**Trends in age-standardized death rate: CDC**

- **Rate per 100,000 Population**
- **Year of Death**

**Prevalence of diabetes in the general pop.**

- **Percent of population**
- **Rise in DM population**

- **Competing death event**
- **Competing event vs growth of DM**

**Rise in DM population**
Death rates and survival: ESRD

• Incident base interval death rates
  ▪ Mortality in the first and subsequent years
  ▪ First year mortality rates in the HD population

• Prevalent based death rates
  ▪ Vintage mortality rates
Mortality rates, by modality

Figure 6.1

Incident ESRD patients, adjusted for age, gender, race, and primary diagnosis. Incident ESRD patients, 1996, used as reference cohort.
Adjusted mortality rates, by vintage: dialysis

Figure 6.14

- Adjusted mortality rates for prevalent dialysis patients, 2001, used as reference cohort.
- Adjusted for age, gender, race, and primary diagnosis.
Adjusted five-year survival, by first modality

Figure p.23

Incident dialysis patients & patients receiving a first transplant in the calendar year, 1990–1994 & 1995–1999 combined; adjusted for age, gender, race, & primary diagnosis. Incident ESRD patients, 1996, used as reference cohort. Dialysis patients are followed from day 90 after initiation; transplant patients are followed from the transplant date.
### Percent of patients meeting K/DOQI & preventive care guidelines

#### Figure 5.1

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### Notes

**Kt/V & vascular access data:** incident & prevalent dialysis patients; from 2004 CPM report—patient data from 2003. **URR:** prevalent hemodialysis patients, 2004; from Medicare claims. **Hemoglobin:** prevalent dialysis patients, 2004; from Medicare claims. **Albumin:** incident dialysis patients, 2004; from Medical Evidence form. **Diabetic care:** point prevalent patients initiating ESRD 90 days prior to January 1, 2003, age 18–75 on December 31, 2004, & alive through December 31, 2004, with diabetes as the primary cause of ESRD or a comorbidity on the Medical Evidence form, or with diabetes diagnosed during the first year. Testing/test strips tracked in 2004; HbA1c & lipid tests are at least 30 days apart.

2006 ADR
Vascular access use in prevalent dialysis patients

Figure p.10

Top left graph: December 31 point prevalent hemodialysis patients; CPM data. Access represents the current access as of the latest data collection for the year. Includes only patients for whom the access is known. Top right graph: period prevalent dialysis patients, from Medicare claims data; rates adjusted for age, gender, race, & primary diagnosis. ESRD patients, 2004, used as reference cohort.
Vascular access use in dialysis patients

Figure p.10 (continued)

period prevalent hemodialysis patients. Data from Part B claims. Some patients may have more than one access at a given point in time.

2006 ADR
Mean hemoglobin at initiation, by EPO treatment

Incident ESRD patients with a first service date between May 1995 & June 2005; data from Medical Evidence Form.
Patient distribution, by mean monthly hemoglobin (g/dl) at initiation

Figure 3.14

Incident ESRD patients with a first service date between May 1995 & June 2005; data from Medical Evidence Form.

66% <11 gm/dl
43% <10 gm/dl
23% <9 gm/dl
period prevalent dialysis patients with EPO claims; monthly hemoglobin includes all claims with a hematocrit value between 10 & 50; weekly EPO dose includes all claims for patients with an average number of administrations per month of ≤20. EPO doses prior to 2005 are adjusted for inpatient days.
Patient distribution, by mean monthly hemoglobin (g/dl)
Figure p.13

Period prevalent dialysis patients with EPO claims; monthly hemoglobin includes all claims with a hematocrit value between 10 & 50; weekly EPO dose includes all claims for patients with an average number of administrations per month of ≤20. EPO doses prior to 2005 are adjusted for inpatient days.
Patient distribution by hemoglobin & chain affiliation, 2004

Figure 10.21

Includes only EPO-treated patients; mean hemoglobin represents the average hemoglobin value for the year across all patients.
Treatment of anemia: achieving the minimum target and overshooting: 2004 data

• Likelihood of achieving the minimum CPM target Hb level of 11 gm/dl
• Likelihood of overshooting the FDA recommended Hb upper limit of 12 gm/dl
• Odds ratio of overshooting by provider ownership adjusted for age, gender, race, cause of ESRD, ME form comorbidity and initial Hb level
Incident patients: Probability of achieving a hemoglobin of 11 g/dl; from the first ME Hb level

Figure 5.42

dialysis patients incident between July 1, 2004, & July 1, 2005, with Medicare as primary payor; included patients received EPO during the first six months after incidence.
Incident patient that reach a Hb of 11 gm/dl: Probability of achieving a hemoglobin of 12+ g/dl

Figure 5.43

dialysis patients incident between July 1, 2004, & July 1, 2005, with Medicare as primary payor; included patients receive EPO during the first six months after incidence & achieve a hemoglobin of 11 g/dl during that time period.
Odds Ratio (95% CI) of Overshooting by Ownership

- Exceed 12 g/dl
- Exceed 12.5 g/dl
- Exceed 13 g/dl
- Exceed 13.5 g/dl
- Exceed 14 g/dl

Ownership:
- All Ownership
- DAVITA
- DCI
- FRESENIUS
- Gambro
- HOSPITAL
- INDEPENDENT
- RCG
- National NA

2006 ADR
Sustaining higher Hb levels

- Overshooting the CMS prior audit target Hb level of 12.5 gm/dl appears to be common
- Overshooting of the target Hb level also appears to vary among the different provider ownership groups
- There is limited data on sustained elevations in Hb levels
  - We studied Hb levels over a 3 month period tracking Hb levels
Variability of monthly hemoglobin

Figure 5.41

Where they go: Month 1 hemoglobin groups, with distribution by hemoglobin in Month 3

- Hemoglobin at Month 1:
  - 12.5+ g/dl: 29.5%
  - 11-<12.5 g/dl: 47.4%
  - <11 g/dl: 23.0%

Where they come from: Month 3 hemoglobin groups, with distribution by hemoglobin in Month 1

- 12.5+ g/dl: 31.1%
- 11-<12.5 g/dl: 48.4%
- <11 g/dl: 20.5%

Medicare EPO-treated dialysis patients point prevalent on January 1, 2004, & with Medicare as primary payor; included patients survive the first three months of 2004 & have EPO claims in each of the three months.
Aspects of care in the dialysis population

- Dialysis therapy appears to be consistently near the target for a KT/V of 1.2+
- Fistula utilization is approaching the initial KDOQI and CMS targets
- Hb levels are at an all-time high with 50% being greater than 12 gm/dl in any given month
- Over a year there is considerable variation among providers with DCI having the greatest percent of patients within the 11-12gm/dl range and 10-12 gm/dl range
- Overshooting of the target Hb range is common and associated with particular provider ownership groups
Summary

• Incidence rates are down except for the younger African American and Native American populations
• Incidence and prevalence based mortality are down except in the first year of hemodialysis treatment
• First years mortality rates on hemodialysis have not declined in 11 years.
• Care is improving across a broad range of measures increased utilization of fistulas
  • The prevalence of catheters has stabilized and insertion rates have declined
• The mean Hb at incidence of ESRD is 10.3 gm/dl and in the prevalent population it is 11.9 gm/dl
  • Hbs appear to commonly exceed the FDA package insert of 12 gm/dl, however there are difference across the provider groups
  • Overshooting of the Hb levels also appears to be different
• First year mortality rates need to addressed with more research and assessment of care
Muscle Wasting, Exercise and Nutrition in CKD

Robert N. Foley, MB
Background

• Sarcopenia, or reduced muscle mass, is common in older populations, and is associated both with functional disability as well as higher mortality rates in most (but not all) studies reported to date. Sarcopenia in non-end-stage CKD is poorly characterized.

• This is surprising when one considers that
  - CKD is a disease of older segments of the population.
  - Muscle wasting is a cardinal feature of untreated end-stage renal disease.
Questions

- Is there an association exists between level of kidney function and sarcopenia?
- Is this association monotonic or threshold-based?
- Can potentially modifiable associations for sarcopenia be identified in subjects with CKD in the community?
Methods

- The Third National Health and Nutrition Examination Survey (NHANES III, 1988 to 1994),
- Stratified, multistage, probability sampling methods used to assemble a nationwide probability sample of the non-institutionalized population of the US.
- All participants aged 20 years or older were eligible for bioimpedance analysis and for fasting determination of hematologic and biochemical profiles at the mobile examination center. For the current study, we considered adults age 20 or older in whom serum creatinine values were measured and who underwent bioimpedance (BIA) measurements.
Methods (continued)

- Valhalla 1990B Bio-Resistance Body Composition Analyzer (Valhalla Medical, San Diego, CA) with an operating frequency of 50 kHz at 800 µA was used to measure bioimpedance resistance, in ohms. Whole-body BIA measurements between the right wrist and ankle were performed, with the subject in a supine position.
Methods

• Skeletal muscle mass was calculated using the BIA equation of Janssen et al., which has been shown high degrees of accuracy when validated against estimates from magnetic resonance imaging:

  Muscle mass (kg) = [(height/BIA-resistance X 0.401) + (sex X 3.825) + (age X -0.071)] + 5.102

  where height is measured in cm, BIA-resistance in ohms and gender is coded as ‘1’ for men and ‘0’ for women.
Definition of Sarcopenia

- Muscle mass indexed to total body mass (skeletal muscle index, SMI).
- SMI values in NHANES III participants aged 18 to 39 corresponding to 1 and 2 standard deviations below mean levels were used: normal,
  - Class I sarcopenia: $31.0\% \leq \text{SMI} \leq 37\%$ in males, $22.0\% \leq \text{SMI} \leq 28.0\%$ in females
  - Class II sarcopenia: $\text{SMI} < 31.0\%$ in males, $\text{SMI} < 22.0\%$ in females.

Janssen et al
Methods

• Diabetes mellitus was defined as self-reported diabetes mellitus, use of medications for diabetes mellitus or fasting blood glucose ≥ 126 mg/dl.
• Dietary intake was based on 24-hour dietary recall.
• Recall methods, in the preceding month, were used to estimate the amount of exercise performed per subject and metabolic equivalents were used to rate exercise intensity relative to walking.
Methods

• A Homeostasis Model Assessment (HOMA) was used to evaluate insulin resistance. Assuming that normal subjects aged <35 yr with normal weight have an insulin resistance of 1, the values for a patient can be calculated from the fasting concentrations of insulin and glucose using the following formula: fasting serum insulin (µU/ml) x fasting plasma glucose (mmol/L)/22.5.

• National estimates of each parameter were adjusted for the sampling weights implicit in complex survey designs, using SUDAAN software.
Population characteristics (N=13,770)

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| Urinary albumin-to-creatinine ratio ≥ 30 mg/g | 10.5 |

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<th>Age (years)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>20-39</td>
<td>45.8</td>
</tr>
<tr>
<td>40-59</td>
<td>33.3</td>
</tr>
<tr>
<td>60-69</td>
<td>11.3</td>
</tr>
<tr>
<td>≥ 70</td>
<td>9.5</td>
</tr>
</tbody>
</table>

| Female sex | 50.7 |
| African American | 10.2 |
| Hispanic American | 5.0 |
| School education < 12 years | 23.8 |
| Income to poverty ratio < 1 | 17.0 |
| Body mass index ≥ 25 kg/m² | 55.5 |
| Self-reported conditions |   |
| Diabetes mellitus | 5.1 |
| Cardiovascular disease | 5.0 |
| Hypertension | 23.2 |
Sarcopenia and GFR

GFR ≥ 90  GFR 60-89  GFR < 60
Class I Sarcopenia  Class II Sarcopenia

P < 0.0001
Sarcopenia and ACR

P < 0.0001
Odds Ratio of Sarcopenia

P < 0.0001

GFR ≥ 90
GFR 60-89
GFR < 60

Unadjusted
Adjusted

GFR ≥ 90: 1
GFR 60-89: 1.75
GFR < 60: 4.15

GFR ≥ 90: 1
GFR 60-89: 0.85
GFR < 60: 0.93

P < 0.0001
NS
Odds Ratio of Sarcopenia

P < 0.0001

Unadjusted: 1.87
Adjusted: 0.98

ACR < 30
ACR ≥ 30

USRDS
Adjustment Variables

- Age, sex, ethnicity, schooling, income to poverty ratio, body mass index, diabetes mellitus, cardiovascular disease, hypertension
## Odds Ratios for Sarcopenia in the CKD Populations

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-39</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>40-59</td>
<td>5.21 (2.79, 9.74)</td>
<td>P &lt; 0.0001</td>
</tr>
<tr>
<td>60-69</td>
<td>7.52 (4.63, 12.22)</td>
<td></td>
</tr>
<tr>
<td>≥ 70</td>
<td>5.81 (3.50, 9.65)</td>
<td></td>
</tr>
<tr>
<td><strong>Female sex</strong></td>
<td>Not associated</td>
<td>0.0121</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>1.05 (0.80, 1.37)</td>
<td></td>
</tr>
<tr>
<td>Hispanic American</td>
<td>0.80 (0.59, 1.09)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.44 (0.25, 0.75)</td>
<td></td>
</tr>
<tr>
<td><strong>School education &lt; 12 years</strong></td>
<td>Not associated</td>
<td>0.0121</td>
</tr>
<tr>
<td><strong>Income to poverty ratio &lt; 1</strong></td>
<td>Not associated</td>
<td>0.0121</td>
</tr>
<tr>
<td><strong>Body mass index ≥ 25 kg/m²</strong></td>
<td>8.66 (6.29, 11.92)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td><strong>Diabetes mellitus</strong></td>
<td>1.56 (1.03, 2.36)</td>
<td>0.0366</td>
</tr>
<tr>
<td><strong>Cardiovascular disease</strong></td>
<td>1.81 (1.40, 2.34)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
<td>2.46 (1.97, 3.08)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td><strong>GFR (mL/min per 1.73 m²)</strong></td>
<td>0.76 (0.69, 0.85)</td>
<td>&lt; 0.0</td>
</tr>
</tbody>
</table>
## Odds Ratios for Sarcopenia in the CKD Populations

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Odds Ratio (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise (hrs/week)</td>
<td>0.85 (0.79, 0.92)</td>
<td>0.0002</td>
</tr>
<tr>
<td>C-reactive protein (mg/dl)</td>
<td>Not associated</td>
<td></td>
</tr>
<tr>
<td>Caloric intake (kcal/kg/day)</td>
<td>Not associated</td>
<td></td>
</tr>
<tr>
<td>Protein intake (g/kg/day)</td>
<td>0.75 (0.67, 0.84)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Fat intake (g/kg/day)</td>
<td>0.72 (0.65, 0.80)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Carbohydrate intake (g/kg/day)</td>
<td>0.86 (0.81, 0.90)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Hemoglobin (g/dl)</td>
<td>Not associated</td>
<td></td>
</tr>
<tr>
<td>Serum bicarbonate (mmol/l)</td>
<td>Not associated</td>
<td></td>
</tr>
<tr>
<td>Uric acid (mg/dl)</td>
<td>1.32 (1.21, 1.44)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Calcium (mg/dl)</td>
<td>1.20 (1.09, 1.32)</td>
<td>0.0002</td>
</tr>
<tr>
<td>Phosphorus (mg/dl)</td>
<td>Not associated</td>
<td></td>
</tr>
<tr>
<td>25-OH-Vitamin D3 (ng/ml)</td>
<td>0.94 (0.91, 0.96)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Albumin (g/dl)</td>
<td>0.88 (0.78, 0.99)</td>
<td>0.0292</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>1.37 (1.25, 1.52)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Triglycerides (mg/dl)</td>
<td>Not associated</td>
<td></td>
</tr>
<tr>
<td>HDL-cholesterol (mg/dl)</td>
<td>0.94 (0.90, 0.98)</td>
<td>0.0023</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>1.40 (1.24, 1.57)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>1.18 (1.08, 1.30)</td>
<td>0.0006</td>
</tr>
<tr>
<td>Among subjects without diabetes:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fasting blood glucose (mg/dl)</td>
<td>51.64 (7.85, 339.54)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Glycated hemoglobin (%)</td>
<td>1.69 (1.42, 2.01)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>HOMA insulin resistance</td>
<td>2.26 (1.75, 2.93)</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>
## Adjusted Odds Ratios for Sarcopenia in the CKD Populations

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>OR (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-39</td>
<td>1</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>40-59</td>
<td>3.76 (1.95, 7.26)</td>
<td>0.0448</td>
</tr>
<tr>
<td>60-69</td>
<td>6.10 (3.36, 11.08)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>≥ 70</td>
<td>5.99 (3.17, 11.31)</td>
<td>0.0048</td>
</tr>
<tr>
<td>Income to poverty ratio &lt; 1</td>
<td>1.51 (1.01, 2.24)</td>
<td>0.0448</td>
</tr>
<tr>
<td>Body mass index ≥ 25 kg/m²</td>
<td>9.67 (7.11, 13.16)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Exercise (hrs/weekc)</td>
<td>0.96 (0.94, 0.98)</td>
<td>0.0012</td>
</tr>
<tr>
<td>Protein intake (g/kg/day)</td>
<td>0.68 (0.48, 0.98)</td>
<td>0.0364</td>
</tr>
<tr>
<td>Fat intake (g/kg/day)</td>
<td>0.67 (0.50, 0.91)</td>
<td>0.0097</td>
</tr>
<tr>
<td>Carbohydrate intake (g/kg/day)</td>
<td>0.79 (0.69, 0.90)</td>
<td>0.0008</td>
</tr>
<tr>
<td>Calcium (mg/dl)</td>
<td>1.49 (1.07, 2.06)</td>
<td>0.0178</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>1.01 (1.00, 1.01)</td>
<td>0.0019</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>1.02 (1.00, 1.03)</td>
<td>0.0133</td>
</tr>
<tr>
<td>Glycated hemoglobin, non-DM</td>
<td>1.59 (1.14, 2.21)</td>
<td>0.0071</td>
</tr>
<tr>
<td>HOMA insulin resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>1.02 (1.01, 1.04)</td>
<td>0.0113</td>
</tr>
<tr>
<td>Without diabetes</td>
<td>1.23 (1.09, 1.39)</td>
<td>0.0012</td>
</tr>
<tr>
<td>With diabetes</td>
<td>1.01 (1.00, 1.02)</td>
<td>0.0373</td>
</tr>
</tbody>
</table>
Conclusions

• Sarcopenia is common in community dwelling adults with CKD. Although causality cannot be assumed, several associations may be susceptible to intervention.
Adherence to Medications in the CKD Population

Wendy L. St. Peter, Pharm.D., FCCP
Changchun Wang, MS
United States Renal Data System,
Minneapolis Medical Research
Foundation, University of Minnesota,
College of Pharmacy
Background (Cont)

- Medications are primary treatment modality for multiple acute and chronic conditions in patients on dialysis
- Successful management is dependent on patient adherence to medication
- Failure to take medications can result in suboptimal outcomes and increased healthcare expenditures
- **Very little** is known about medication adherence in dialysis patients
  - Small sample sizes, short study durations
  - Surveys reliant on patient self-report
Background (Cont)

- Curtin RB et al. evaluated phosphate binder and anti-hypertensive adherence in 135 HD patients
  - >65 years old (n=68), ≤65 years old (n=67)
  - 6 week study
  - Adherence measured by patient report, pill count and an electronic medication event monitoring system (MEMS)
  - Evaluated relationship between adherence and patient, treatment and disease characteristics
  - Repeated nonadherence was found in:
    - 65% of older, 80% of younger for phosphate binders
    - 43% of older, 48% of younger for antihypertensive meds
  - In general, African Americans had more adherence issues than Caucasians
How to Measure Adherence

• Patient self-report
• Pill count
• Electronic medication event monitoring system
• Pharmacy administrative claims data
Estimating Medication Adherence using Claims Data

- Prescription databases allow access to a vast amount of drug information
  - Drug name
  - Dose
  - Date dispensed
  - Days supply
  - Refill history
  - Costs (Rx cost, co-payment amounts, deductibles)
- Challenge is to provide meaningful surrogate measures of drug adherence
Medication Possession Ratio (MPR)

- Sclar and colleagues introduced method in 1991
- Widespread adoption of MPR as a measure of adherence:
  \[
  \frac{\text{Sum of drug days supply}}{\text{Number of days between first and last fill}}
  \]

- MPR <1: lapses in prescription refilling
- MPR >1: early refilling
- MPR >80%: characterizes relatively consistent drug use
Hypotheses

• Medication adherence will vary depending on drug
• Medication adherence in CKD patients (on or not yet on dialysis) is associated with various baseline patient characteristics
  - Age
  - Dialysis vs CKD (not on dialysis)
  - Dialysis vintage
  - Type of medical plan
  - Comorbidities
  - Hospitalization
  - Health care costs
Methods

• Prevalent CKD (not on dialysis) and dialysis patients
• Age: at least 18 years old
• CKD patients were defined by at least 1 inpatient or 2 outpatient claims with CKD-related ICD-9-CM codes in each calendar year
• Incident CKD patients (2000-2004) were selected if:
  ▪ they had CKD in current year, but did not have CKD in previous year
  ▪ their first CKD diagnosis date fell into a fee-for-service continuous enrollment period
Methods (Cont)

• Dialysis patients (2000-2004) were selected if:
  ▪ They had \( \geq 3 \) dialysis claims in three different months
  ▪ First dialysis service date fell in continuous insurance enrollment period
• Drug index date: first prescription (Rx) occurring after first record of dialysis service date or first date of CKD
• Both fixed follow-up periods and periods of \( \geq 12 \) months were evaluated
• Termination points: death, transplant, end of enrollment period
Methods (Cont)

• Patient baseline characteristics were evaluated
  • At date of first Rx
    • age, vintage, plan type
  • In the month before first Rx
    • Number of therapeutic drug classes
  • In 6 month period before first Rx
    • Comorbidities (14 evaluated)
    • Hospitalizations and hospital days
    • Costs (inpatient, outpatient and prescription costs)
Calculation of MPR as a function of a fixed length of time

<table>
<thead>
<tr>
<th>Patient 1</th>
<th>Refill 1</th>
<th>gap=60 days</th>
<th>Refill 2</th>
<th>gap=60 days</th>
<th>Refill 3</th>
<th>gap=60 days</th>
<th>Refill 4</th>
<th>gap=60 days</th>
<th>MPR=33%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 days</td>
<td></td>
<td>30 days</td>
<td></td>
<td>30 days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient 2</th>
<th>Refill 1</th>
<th>gap=30 days</th>
<th>Refill 2</th>
<th>gap=120 days</th>
<th>MPR=50%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>90 days</td>
<td></td>
<td>90 days</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient 3</th>
<th>Refill 1</th>
<th>Refill 2</th>
<th>Refill 3</th>
<th>MPR=100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 days</td>
<td>28 days</td>
<td>31 days</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
</table>
Adherence to drug therapy: ACE-Is/ARBs

Incident CKD patients, 2000–2004
Adherence to drug therapy: ACE-Is/ARBs, by different age groups

Incident CKD patients, 2000–2004
Adherence to drug therapy: ACE-Is/ARBs, by age

Incident dialysis patients, 2000-2004
Adherence to drug therapy: beta blockers

Incident CKD patients, 2000–2004
Adherence to drug therapy: beta blockers, by age

Incident dialysis patients, 2000-2004
Adherence to drug therapy: lipid lowering agents

Incident CKD patients, 2000–2004
Adherence to drug therapy: lipid lowering agents, by age

Incident dialysis patients, 2000-2004
Adherence to drug therapy in dialysis patients: phosphate binders

Sevelamer

Calcium acetate
Baseline characteristics of dialysis patients, receiving phosphate binders

Sevelamer

![Bar chart showing patients (% of MPR >= 80% and MPR < 80%) by age and gender.]

Calcium acetate

![Bar chart showing patients (% of MPR >= 80% and MPR < 80%) by age and gender.]
Association of baseline characteristics with adherence

Mean # hospital days during 6 mo. baseline period

- MPR ≥ 80%
- MPR < 80%

Sevelamer
Calcium acetate
Association of baseline characteristics with adherence-Vintage

Mean vintage (in days)

MPR >= 80%  MPR < 80%

Sevelamer  Calcium acetate
Association of baseline characteristics with adherence - Comorbidities

Sevelamer

- Number of comorbidities: 0-2, 3-5, 6+
- MPR >= 80%: 20%, 50%, 10%
- MPR < 80%: 10%, 30%, 60%

Calcium acetate

- Number of comorbidities: 0-2, 3-5, 6+
- MPR >= 80%: 10%, 30%, 60%
- MPR < 80%: 30%, 70%, 20%

2006 ADR
Association of baseline characteristics with adherence-Drug Classes

Mean # of therapeutic drug classes 1 month before drug index date

- MPR >= 80%
- MPR < 80%

Sevelamer
Calcium acetate
Association of baseline characteristics with adherence-Cost

Mean total cost ($ IP/OP/RX) during 6 mo. baseline period

- Sevelamer
- Calcium acetate

MPR >= 80%
MPR < 80%
Association of baseline characteristics with adherence-Plan Type

Sevelamer

<table>
<thead>
<tr>
<th>Plan Type</th>
<th>Percentage MPR &gt;= 80%</th>
<th>Percentage MPR &lt; 80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp.</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>EPO</td>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td>POS</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>PPO</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>

Calcium acetate

<table>
<thead>
<tr>
<th>Plan Type</th>
<th>Percentage MPR &gt;= 80%</th>
<th>Percentage MPR &lt; 80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp.</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>EPO</td>
<td>10</td>
<td>70</td>
</tr>
<tr>
<td>POS</td>
<td>20</td>
<td>50</td>
</tr>
<tr>
<td>PPO</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>
Summary

• Adherence to medications (by MPR) varies greatly between and even within drug class
• In general, older patients are more adherent to medications than younger patients
• Dialysis patients are less adherent to medications than CKD patients (not on dialysis)
Summary

• For phosphate binding agents, the following characteristics were found more commonly in patients with better adherence (MPR≥80%)
  - Older
  - Male
  - Lower dialysis vintage
  - About same no. of hospital days during baseline period
  - Larger number of therapeutic drug classes during baseline period
  - Lower health care costs during baseline period
  - Higher percentage of patients with 6+ comorbidities (calcium acetate only) during baseline period
  - Comprehensive health care plan
Conclusions

• Medication adherence declines over time and is particularly poor in dialysis patients
• Younger patients are generally less compliant than older patients
  - Age is highly influential on many of the factors studied and needs to be taken into account in future analyses
• Educational programs on adherence should focus on the younger CKD patient
• Further research into factors that affect medication adherence in CKD patients is needed
Limitations

- The MarketScan® Database is composed of a large convenience sample of patients within employer group health plans and is not a random sample. Data may thus not be reflective of the broader U.S. CKD population.
- MPR provides information on medication availability over defined periods of time, but does not shed light on the timeliness or consistency of prescription refilling.
Neurologic disease in the CKD and ESRD populations: Neuroepidemiology

Anne M. Murray M.D., M.Sc., Eric Weinhandl, M.S., Rui Zhang, M.S., and Allan Collins, M.D., FACP
Introduction

• Definition of Neuroepidemiology
• Neurologic Diseases we will discuss: Dementia, Stroke/TIA, Peripheral Neuropathy
• Prevalence, Incidence, and Outcomes in three populations:
  • ESRD
  • CKD
  • Non-CKD Medicare 5%
Neuroepidemiology

- Definition: the epidemiology of neurologic diseases
- Epidemiology:
  - Classic definition: The branch of medicine dealing with the incidence and prevalence of disease in large populations, and the detection of the source and cause of epidemics (Webster)
  - Modern version: the scientific study of factors affecting the health and illness of populations, and serves as the foundation and logic of interventions made in the interest of public health and preventive medicine. (Wikipedia)
Why study neuroepidemiology in renal patients?

Neurologic Disease:
• is extremely common in CKD/ESRD pts, due to:
  • aging of the populations
  • high burden of CV risk factors (HTN>80%, DM >60%)
• is associated with high risk of negative outcomes,
• is largely ignored in these populations
Median age of incident 2003 ESRD patients

- White (2003: 67.6)
- Black (59.5)
- Native American (59.1)
- Asian (64.4)
- Hispanic (60.7)
- All (64.8)
Fastest growing part of the ESRD population is the 75+ age group
Incident counts & adjusted rates, by age
DEMENTIA
OR
COGNITIVE IMPAIRMENT
(mild, moderate, severe; severe CI = dementia)
Prevalent dementia: diagnosed more often overall in CKD (7.6%) than ESRD (7%) pts. Prevalence underestimated by >50%.

Figure 6.43: point prevalent patients alive & with Medicare as primary payor during the two years preceding January 1, 2004.
Prevalent dementia by modality
More common in HD >> PD >> Tx

Figure 6.88. Prevalent ESRD, 2001.

2006 ADR
CKD and cognitive impairment: cross-sectional association

- UCSF- Clinic populations of 80 HD and 80 Stage III/IV CKD pts. Mean age 62.5 ± 14.3 yrs
- Three cognitive tests: 3MS, Calif VLT, Trails B
- Graded relation between cognitive function and severity of CKD (MDRD est GFR)
- ESRD cognitive function worse than CKD, CKD worse than published norms (p < .001)
- Percentage with impairment on 3MS and Trails B increased with declining kidney function (p < .01)

California Verbal Learning Test delayed recall

Trailmaking B in seconds (executive function: longer is worse)

CKD and cognitive decline: longitudinal association

- 3,034 elderly in Health, ABC study with baseline Cr, followed for 4 yrs with cog assessment q 2 yrs
- Cog function assessed using Modified Mini Mental State exam (3MS-100 points max)
- Lower baseline eGFR assoc with increased risk of cognitive decline on 3MS (5 pt drop or 3MS < 80), compared to eGFR> 59:
  - GFR 45-59: OR 1.32 (1.03-1.69) (32% increase)
  - GFR <45: OR 2.43 (1.38-4.29) (243%)

Kurella M, Chertow, Fried et al. JASN 2005
Prevalence of cognitive impairment in 338 HD patients by age: 37% severe CI (dementia)

Prevalence of Cognitive Impairment: AOR = 3.54 (1.28, 9.78; P < .02) for severe CI in HD pts vs. non-CKD pts
* Only 12.7% of HD pts normal

N= 101 for both HD and non-CKD control gps
Logistic regression models; factors associated with severe CI in hemodialysis patients

- In logistic regression models for severe CI, factors associated with severe CI (AOR; 95% CI):
  - Stroke 1.95; (1.08, 3.44) \( p < .03 \)
  - Equil Kt/V ≥ 1.2 1.67; (1.01, 2.75) \( p < .05 \)
  - Education (>12 yrs) 0.32; (0.14, 0.72) \( p < .001 \)
    (protective)
  - >24 months of dialysis, low hemoglobin (< 11.0 mg/dl) borderline, (\( p < .08 \)); other labs, depression NS

Murray AM, Knopman D, Pederson S, Collins A et al Neurology 2006
First yr follow-up:
Incidence of severe CI = 26.4% (19.2, 33.6)
AOR for sev CI in HD vs. non-CKD: 3.0 (1.1, 8.0)

N= 230 for HD, and 83 for non-CKD pts
Murray AM, Pederson S, Knopman D. ASN 2006
Incident dementia in prevalent patients in 1999 vs. 2004: 10% increase in 5 yrs and underestimated (4.5% USRDS vs 26.4%)

point prevalent patients, 1999 & 2004, alive & with Medicare as primary payor during the two years preceding January 1 of the labeled year, with no listed dementia diagnosis during the two years prior to January 1 of the labeled year.

Figure 6.47
Prevalent dementia by type of dementia: Vascular and ‘Other’ more commonly diagnosed in CKD/ESRD vs. non-CKD

Figure 6.44: point prevalent patients alive & with Medicare as primary payor during the two years preceding January 1, 2004.
Event-free probability of hospitalization in patients with or without dementia

Figure 6.45: point prevalent patients alive & with Medicare as primary payor during the two years preceding January 1, 2004.
Survival probability in patients with or without dementia

Figure 6.46: point prevalent patients alive & with Medicare as primary payor during the two years preceding January 1, 2004.
Dementia in the Dialysis Outcomes and Practice Patterns Study

- 16,694 DOPPS subjects
- Dementia defined by medical record dx
- Prevalence- 4% with recorded hx of dementia
- Risk factors for dementia (cross-sectional):
  - Age, black race, low education, CVA, DM, markers of malnutrition, anemia
- Dementia assoc with increased risk of:
  - death = 1.48, (1.32-1.66) and
  - dialysis withdrawal = 2.01, (1.57-2.57)

Survival curve for all-cause mortality for patients with and without dementia in DOPPS, adjusted to mean age of 60 years

<table>
<thead>
<tr>
<th></th>
<th>HD</th>
<th>CKD</th>
<th>Non- CKD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age 85+ (65-74)</strong></td>
<td>2.5</td>
<td>6.0</td>
<td>10.7</td>
</tr>
<tr>
<td></td>
<td>(2.3-2.8)</td>
<td>(5.1-7.0)</td>
<td>(10.2-11.1)</td>
</tr>
<tr>
<td><strong>Black race (W)</strong></td>
<td>1.49</td>
<td>1.22</td>
<td>1.23</td>
</tr>
<tr>
<td><strong>Other race</strong></td>
<td>0.78</td>
<td>1.00</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(.83-1.01)</td>
</tr>
<tr>
<td><strong>Anemia</strong></td>
<td>1.12</td>
<td>1.29</td>
<td>1.40</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td>1.07</td>
<td>1.10</td>
<td>1.15</td>
</tr>
<tr>
<td></td>
<td>(1.0-1.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HTN</strong></td>
<td>1.26</td>
<td>1.07</td>
<td>1.06</td>
</tr>
<tr>
<td><strong>Stroke</strong></td>
<td>2.04</td>
<td>2.38</td>
<td>2.28</td>
</tr>
</tbody>
</table>
Stroke & TIA
Prevalent CVA by age, 2004: 17% HD, 10% CKD, 4% non-CKD

Figure 6.29: point prevalent hemodialysis, CKD, & non-CKD patients, 2004.
Rate of prevalent TIA, 2004, by age

Figure 6.30: point prevalent hemodialysis, CKD, & non-CKD patients, 2004.
Incident CVA and TIA in incident HD, CKD, and non-CKD patients by age

Combined CVA/TIA incidence:
21% HD
14% CKD
4% non-CKD

Figure 6.24: incident hemodialysis, CKD, & non-CKD patients, 2001.
CKD and incident stroke/TIA: the Bezafibrate Trial

- 6,685 pts w CAD; half enrolled in CV bezafibrate trial in Israel: IDDM excluded
- Followed for 4.8-8.1 yrs
- Ages 45-74; mean 60 ± 7 yrs, 88.5% men
- Mean GFR 69 ± 11 (MDRD) at baseline
- 20% with GFR < 60

CKD & Incident Stroke/TIA (cont’d)

- GFR < 60 assoc w HR 1.53 (1.16-2.10) for stroke/TIA (adj)
- Association graded; each SD of lower GFR assoc w 23% increased HR of Stroke/TIA
- Cr >1.70 : HR 3.18 (1.37-7.35) vs Cr < 0.9
- Potential Mechanisms: high rates of inflammation, procoagulants, homocysteine, anemia, oxidative stress, CaPhos homeostasis
Time to hospitalization following incident CVA

Hazard Ratios (CI) for CVA vs. no CVA

HD: 2.44 (2.32, 2.56)
CKD: 2.68 (2.54, 2.82)
Non-CKD: 3.23 (3.17, 3.28)

Figure 6.25: incident hemodialysis, CKD, & non-CKD patients, 2001, & without CVA/TIA claims in the previous two years. Incident hemodialysis patients age 67 & older, 2001, used as reference cohort.
Two-year survival rates following incident CVA

Hazard Ratios (CI) for CVA vs. no CVA

HD: 2.47 (2.34, 2.60)
CKD: 3.02 (2.84, 3.21)
Non-CKD: 3.98 (3.89, 4.08)

Figure 6.26: incident hemodialysis, CKD, & non-CKD patients, 2001, & without CVA/TIA claims in the previous two years. Incident hemodialysis patients age 67 & older, 2001, used as reference cohort.
Peripheral Neuropathy (undertreatment of pain)
Prevalence of peripheral neuropathy: 19.3% HD, 10.7% CKD, 2.5% non-CKD

Figure 6.40: point prevalent patients, 2002.
Incidence of peripheral neuropathy: declines with age in incident patients: approx 5x more common in diabetics

Figure 6.39: incident hemodialysis, CKD, & non-CKD patients, 2001, without peripheral neuropathy claims in the previous two years

2006 ADR
Time to hospitalization with or without a peripheral neuropathy diagnosis

Figure 6.41: point prevalent patients, 2002.
Survival with or without a peripheral neuropathy diagnosis

Figure 6.42: point prevalent patients, 2002.
Conclusion: Neuroepidemiology in Renal Disease

- Dementia, Stroke, and Peripheral Neuropathy occur 3-10x more commonly in CKD and ESRD pts than non-CKD Medicare population.

- Neurologic disease is often undiagnosed and undertreated.

- Risk of many adverse outcomes of neurologic disease is elevated in the CKD/ESRD populations (pain, hospitalization, death).
Conclusion: Neuroepidemiology

Potential interventions:

• improved stroke prevention via more aggressive HTN, diabetes, and anemia treatment

• longer dialysis times: consider lower K/V

• improved detection and treatment of cognitive impairment, stroke, and pain via required annual neurologic assessment