United States Renal Data System: 2002 ASN Symposium

Chronic Kidney Disease in the Medicare Population:

Progression to ESRD vs Death, Morbidity, Quality of Care, and Cost
Structure of the USRDS

Larry Agodoa, MD
Co-Project Officer
United States Renal Data System
NIH, NIDDK, DKUHD
Administrative Oversight of the USRDS

Department of Health & Human Services (DHHS)

Centers for Medicare and Medicaid Services (CMS)
  - Office of Clinical Standards & Quality (OCSQ)
  - ESRD Networks
  - Office of Strategic Planning (OSP)
    - CMS USRDS Project Coordinator

National Institutes of Health (NIH)

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)
  - Division of Kidney, Urologic, and Hematologic Diseases (DKUHD)

NIH Project Officers

USRDS CC
Cardiovascular SSC
Economic SSC
Quality of Life SSC
Nutrition SSC
United States Renal Data System

- USRDS Investigative Centers
  - Coordinating Center: Director Allan Collins MD, Deputy Director Bertram Kasiske MD
  - Cardiovascular SSC: Director Charles Herzog MD, Deputy Director Blanche Chavers MD
  - Economic SSC: Director Lawrence Hunsicker MD, Deputy Director John Brooks PhD
  - Rehabilitation/Quality of Life SSC: Director Nancy Kutner PhD, Deputy Director Donna Brogan PhD
  - Nutrition/Malnutrition SSC: Director Glen Chertow MD, Deputy Director George Kaysen MD MPH

- 2002 Annual Data Report: online at wwwUSRDS.ORG
  - ADR with enclosed CD shipped October 31, 2002
Chronic Kidney Disease in the Medicare Population

- USRDS data: Paul Eggers, PhD
- Trends in Diabetes in the General Population, CKD, likelihood of death vs ESRD and progression of comorbid conditions
  - Allan Collins MD FACP: Coordinating Center
- Morbidity and preventive care in the general Medicare, CKD and dialysis populations
  - Lawrence Hunsicker MD: Economic SSC
- Comparing Cost of Medicare non-CKD, CKD and dialysis populations
  - John Brooks PhD: Economic SSC
Getting Research Data Sets from the USRDS

Paul Eggers, PhD
Co-Project Officer
United States Renal Data System
NIH, NIDDK, DKUHD
Approved USRDS requests for standard analytic files: November 2001 to October 2002

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Approved USRDS manuscripts using SAF files: November 2001 to October 2002

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Outline for USRDS study proposals: USRDS ADR

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USRDS team contributing to this presentation

- Medical:
  - A. Collins MD, L. Hunsicker MD, M. McBean MD MPH, A. Murray MD MPH

- Biostatistics and epidemiology:
  - D. Gilbertson PhD, SL. Li MS, C. Solid MS, J. Ma PhD, J. Xue DVM PhD, T. Roberts MS, T. Louis PhD

- Economics:
  - W. Manning PhD, S. Li MS, J. Liu PhD, J. Ebben BS, J. Brooks PhD

- Data systems:
  - S. Chen MS, C Arko MS, F Dalleska, MS, E. Frazer BS

- Editorial & Graphics:
  - S. Everson PhD, D. Berrini BS, E. Constantini MA
Trends in Diabetes in the General Population, CKD, likelihood of death vs ESRD and progression of comorbid conditions

Allan J. Collins, MD FACP

Director, USRDS Coordinating Center
Chronic Kidney Disease is a Major Comorbid Condition Within the Medicare Population

- The Medicare program in the US currently consumes 2.3% of the gross domestic product and it is projected to more than double to 5.4% by 2030 (CBO* 9-18-2002).
- Chronic diseases in the Medicare population are a major public health concern and cost to the US.
- Approximately 20-26 million Americans have some degree of kidney damage (NKF K/DOQI Guidelines Feb 2002), which contributes to the ever increasing number of individuals advancing to ESRD.

*Congressional Budget Office
Perspectives on chronic disease: Medicare Beneficiaries and their Cost of Care*
5% Medicare sample, 1997 cohort (CBO 9-18-02)

*CBO Testimony: Dan L. Crippen, Director
Percent of Medicare Beneficiaries and spending by the number of Chronic Conditions*:
5% Medicare sample, 1997 (CBO 9-18-2002)

- 3+ conditions: 47%
- 2 conditions: 15%
- 1 condition: 16%
- none: 22%

*CBO Testimony: Dan L. Crippen, Director
Prevalence of DM in the General Population: CDC Annual Survey*; all age groups

Ali H. Mokdad, PhD, et al  The continuing Epidemics of Obesity and Diabetes in the United States
Data taken from CDC’s Behavioral Risk Factor Surveillance System (BRFSS) in 2000
Costs of the ESRD & Medicare programs

Figure 12.2, dollars in 2000 are inflated by 2% to account for costs incurred not reported.
ESRD as a Chronic Disease: Trends in Patient Counts 1978-2000

- Incident ESRD
- Prevalent dialysis
- Prevalent ESRD

Patient counts 1978-2000:
- 1978: 50,000
- 1980: 100,000
- 1982: 150,000
- 1984: 200,000
- 1986: 250,000
- 1988: 300,000
- 1990: 350,000
- 1992: 400,000
- 1994: 450,000
- 1996: 500,000
- 1998: 550,000
- 2000: 600,000

Yearly counts:
- 1978: 96,192
- 1980: 275,053
- 1998: 378,862
- 2000: 470,587

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How does the burden of Chronic Kidney Disease compare to the other major diseases such as Diabetes Mellitus or Congestive Heart Failure?
Distribution of DM, CHF and CKD in the Senior US Population: NHANES vs Medicare Dx Codes

- Identify the DM and CHF in NHANES III from patient history questions (Bench Mark)
- Identify DM, CHF and CKD from diagnosis codes within the Medicare Part A & B claims (clinically apparent disease)
  - DM identified by established methods used by CMS, NCQA and health plans*
  - CHF and CKD identified by the same method used for DM*
- Compare NHANES and Medicare claims methods to validate the approach and then identify the trends in CVD complications associated with CKD

* Hebert et al, American Journal of Medical Quality 1999, 14:270-277
Participated Medicare Current Beneficiary Survey (MCBS) Access to Care 1992-1993
Defining DM in the Medicare population: time trends & growth

* Hebert et al, American Journal of Medical Quality 1999, 14:270-277
Participated Medicare Current Beneficiary Survey (MCBS) Access to Care 1992-1993

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Identified diseases, by data source

figure p.24, patients age 65 & older, comparison regressed to 1990

- Diabetes
- Congestive heart failure
- Chronic kidney dis.

Percent of patients

NHANES III 1988-1994
General Medicare: 1996-1999 data regressed to 1990

*Stage IV & V (1.1%), eGFR <30 ml/min, NHANES III

Imputed eGFR, 34 ml/min: General Medicare population with clinically apparent disease from Dx codes (1.8%), 1990

Imputed eGFR for the most current Medicare 1997-1998 cohort
40.1 ml/min (3.5% of Medicare as CKD)
figure p.25, patients age 65 & older

5.9 million seniors have stage III-V CKD

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Incidence of ESRD during one year follow-up by DM and CKD in general Medicare Patients
5% Medicare sample (100% estimate), 1997-1998 cohort

Entry period
General Medicare

ESRD during one year follow-up

% Patients

- 100
- 80
- 60
- 40
- 20
- 0

N=1,265,831 (25,316,620)

N=1,711 (34,220)

19.7%
15.27
2.72
1.7
19.23
12.86
41.73
26.18

80.31

80.8%

DM, CKD
DM, no CKD
No DM, CKD
No DM, no CKD

General Medicare est. by group

406,800
4,007,980
688,680
19,940,320
Percent of patients advancing to ESRD or died during two year follow-up by DM, CKD vs dialysis
5% Medicare sample, 1996-1997 cohort (RR: Death vs ESRD)

Follow-up: 12-31-1999

<table>
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<th>Status in the entry period</th>
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<th>Event free</th>
<th>ESRD</th>
<th>Death</th>
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<td>DM, no CKD</td>
<td>85.0</td>
<td>0.31</td>
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<td>No DM, CKD</td>
<td>73.2</td>
<td>2.25</td>
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<td>dialysis (Prev. 1997)</td>
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RR: Relative Risk
Prevalence and Incidence of Cardiovascular Disease in the Medicare non-CKD and CKD populations: 5% Medicare data 1996-1997 entry, followed thru 1999

Study design

1996-1997 Medicare Age 67+
(all pts survive the entire period)

12-31-97
Period of Advancing comorbidity

12-31-98
Final outcome period

12-31-99
All patients alive

Define CKD and CVD from Medicare Dx codes*
in the entry
Follow-up patients w/o CVD (remove ESRD, HMO pts)

Determine Probability of a new Dx of CVD for all outcome groups

Track patients To ESRD, new Dx of CKD, death or thru 12-99

* Hebert et al, American Journal of Medical Quality 1999, 14:270-277
Participated Medicare Current Beneficiary Survey (MCBS) Access to Care 1992-1993
Prevalence of CVD in general Medicare during 1996-97: age 67+; CKD during entry

All patients: % with CVD Dx

- CKD (N=27,974)
- Non-CKD (N=983,281)
- All patients (N=1,011,255)
Unadjusted incidence by type of CVD per 100 patient-years at risk during 1998

All patients: new CVD Dx

- **All CVD**: 28
  - CKD: 28
  - Non-CKD: 17
- **ASHD**: 13
  - CKD: 7
  - Non-CKD: 6
- **CHF**: 11
  - CKD: 5
  - Non-CKD: 6
- **CVA/TIA**: 9
  - CKD: 5
  - Non-CKD: 4
- **PVD**: 12
  - CKD: 5
  - Non-CKD: 7
- **Other CVD**: 19
  - CKD: 11
  - Non-CKD: 8

Rate per 100 pt-yrs
Life table estimates for probability of incident CVD during 1998 by CKD and patient groups

Non-CVD patients 1996-'97 and did not die or develop ESRD/CKD in 1998

**Non-CKD patients***
- CKD/ESRD (N=8,167)
- Died (N=17,017)
- All (N=554,024)
- No events (N=528,840)

**RR: 1.61 for new CVD in CKD**

*All Log-rank tests for differences among patient groups: p<.0001

**CKD patients***
- ESRD (N=124)
- Died (N=422)
- All (N=5,712)
- No events (N=5,166)
Life table estimates for probability of incident CHF during 1998 by CKD status and patient groups
Non-CHF patients 1996-'97, alive thru 1998, by outcome in 1999

RR: 2.25 for new CHF in CKD

*All Log-rank tests for differences among patient groups: p<.0001

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Conclusions

- CKD is common in the Medicare population
- Medicare Claims Dx of CKD represents only those patients with more advanced disease (late stage III+ disease: mean eGFR 34 ml/min)
- The Medicare population is 5 to 134 times more likely to die than to ever reach ESRD
- CVD is twice as common and advances at 1.7-2.5 times the rate in the CKD vs the non-CKD population
- CVD advances at a similar rate in those individuals that are destined to CKD, ESRD or death

Premature Death is the major issue for the CKD population!
Morbidity and preventive care in the general Medicare, CKD and dialysis populations

Lawrence Hunsicker, MD

Director, Economic Special Study Center
Issues to be Addressed

- Mortality and hospitalization rates among the Medicare CKD patients, though lower than among the ESRD population, are much higher than among non-CKD patients.

- Preventive care is lagging in the Medicare CKD population, as it is among patients with ESRD.

- Preventive care (in particular, influenza vaccination) has the potential to reduce both deaths and illness in both the CKD and ESRD populations.
All-cause mortality in the general Medicare & dialysis populations, patients age 65+, all patients

Figure 9.9, period prevalent patients, 1999, unadjusted
All-cause mortality in the general Medicare & dialysis populations, patients age 65+, by diabetic status

Figure 9.6, period prevalent patients, 1999, unadjusted
All-cause mortality in the general Medicare & dialysis populations, patients age 65+, by gender
figure 9.7, period prevalent patients, 1999, unadjusted
All-cause mortality in the general Medicare & dialysis populations, by patient age
figure 9.8, period prevalent patients, 1999, unadjusted
Expected remaining lifetime in patients with increasing morbidity, by age

Figure 9.25, chronic kidney disease & diabetes, prevalent dialysis patients, 2000
Hospital admissions, by diagnosis, patient population, & diabetic status
figure 6.12, prevalent patients age 65 & older, 1999
Cardiovascular admissions, by diagnosis, age, & patient population
figure 6.10, prevalent patients age 65 & older, 1999

Admissions/1000 Pt yrs at risk
Mortality and hospitalization rates among the Medicare CKD patients, though lower than among the ESRD population, are much higher than among non-CKD patients.

Preventive care is lagging in the Medicare CKD population, as it is among patients with ESRD.

Preventive care (in particular, influenza vaccination) has the potential to reduce both deaths and illness in both the CKD and ESRD populations.
Pre- & post-ESRD patients diabetic care: receiving lipid testing

figure 5.8, patients 67+, by race/ethnicity
Pre- & post-ESRD patients diabetic care: receiving glycosylated hemoglobin testing

Figure 5.9, patients 67+, by race/ethnicity
Lipid monitoring in diabetic patients: general Medicare and ESRD patients
figure 5.12, patients age 65–75, by HSA, unadjusted

Percent of patients
- 65.1+ (68.9)
- 60.4 to <65.1
- 56.4 to <60.4
- 42.9 to <56.4
- below 42.9 (NA)

Percent of patients
- 65.1+ (72.0)
- 60.4 to <65.1
- 56.4 to <60.4
- 42.9 to <56.4
- below 42.9 (35.9)
Glycosylated hemoglobin (HbA1c) testing in diabetic patients: Medicare vs ESRD pts
figure 5.14, patients age 65–75, by HSA, unadjusted
Issues to be Addressed

- Mortality and hospitalization rates among the Medicare CKD patients, though lower than among the ESRD population, are much higher than among non-CKD patients.

- Preventive care is lagging in the Medicare CKD population, as it is among patients with ESRD.

- Preventive care (in particular, influenza vaccination) has the potential to reduce both deaths and illness in both the CKD and ESRD populations.
Influenza Vaccine Delivery and Effectiveness in End-Stage Renal Disease*

- Prevalent dialysis patients.
- Billing data for influenza immunization sought in period from 1 September – 31 December.
- Data for hospitalization and mortality sought in subsequent period from 1 January – 28 February, the CDC defined influenza seasons for ‘98 and ‘99.
- All analyses corrected for baseline comorbidities existing prior to immunization period.

Influenza vaccination rate*: 97-98 & 98-99, By modality compared to HP 2000/2010

Influenza vaccination rate*: 98-99, By modality, age and race

Odds Ratios for Hospitalization and Mortality: Vaccinated vs. Not Vaccinated

^Gilbertson, et al, KI (in press), 2002  *Upper limit for Bacteremia/Viremia/Septicemia, PD = 2.01
Pre- & post-ESRD patients (age 67+) care for influenza vaccinations

Figure 5.4, by age, & race/ethnicity, fall of pre-ESRD to fall of post-ESRD
Percent of patients receiving influenza vaccinations

figure 5.1, hemodialysis patients, by HSA, 1999 unadjusted
Issues to be Addressed

- Mortality and hospitalization rates among the Medicare CKD patients, though lower than among the ESRD population, are much higher than among non-CKD patients.

- Preventive care is lagging in the Medicare CKD population, as it is among patients with ESRD.

- Preventive care (in particular, influenza vaccination) has the potential to reduce both deaths and illness in both the CKD and ESRD populations.
Comparing Medicare Costs for non-CKD, CKD and dialysis Patients

John M. Brooks, PhD

Deputy Director, Economic Special Study Center
Non-Dialysis Sample Definitions

- From Medicare 5% sample, excluding patients:
  → in HMO or with ESRD during 1997-1998
  → not continuously enrolled in Medicare Part A and Part B during 1997-1998
  → less than 67 in 1999

- CKD: At least 1 inpatient or 2 outpatient CKD claims during 1997-1998 (*methodology)

  non-CKD sample size: 1,066,608
  CKD sample size: 38,781

Dialysis Sample Definition

- From USRDS database, excluding patients
  - not continuously on dialysis from 7/1/1998 through 12/31/1998 after 90 days on initiation of ESRD
  - less then 67 in 1999

- Dialysis Sample: 61,679
Medicare Costing Methodology

- Inpatient, outpatient, Part B, SNF, Hospice
- CKD and non-CKD patients:
  → All costs from 1/1/99 to either death, end of entitlement, ESRD initiation or 12/31/99.
- Dialysis patients:
  → All costs from 1/1/99 to either death, transplant, lost-to-follow-up, or 12/31/99.
Medicare Costing Methodology con’t

- Estimated average per member per month (PMPM) total cost.

- Divided PMPM non-dialysis cost into:
  - Reactive Costs: costs in response to a medical condition
  - Proactive Costs: not reactive
## Patient Characteristics by Patient Group

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<th>Non-CKD Patients</th>
<th>CKD Patients</th>
<th>Dialysis Patients</th>
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<td>61,697</td>
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<td><strong>Age group (years) %</strong></td>
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Distribution of Medicare Expenditures & Population by Diagnosis Group: Age 67+

Medicare Expenditures: 1999
- 88% non-CKD
- 9% CKD
- 3% Dialysis

Medicare population: 97-98
- 97%
- 3.5%
- 0.28%
Unadjusted Average Total PMPM Costs in 1999 by Patient Group

- Non-CKD Patients: $505
- CKD Patients: $1,373
- Dialysis Patients: $5,223
### PMPM Total Cost by Group and Demographics in 1999

<table>
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<th>CKD Patients</th>
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<td>0.005</td>
</tr>
<tr>
<td>Age 67-74: Reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 75-84</td>
<td>+80.3%</td>
<td>0.589</td>
<td>0.006</td>
</tr>
<tr>
<td>Age 85 +</td>
<td>+160%</td>
<td>0.957</td>
<td>0.008</td>
</tr>
<tr>
<td>Female: Reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>-19.3%</td>
<td>-0.214</td>
<td>0.005</td>
</tr>
<tr>
<td>White: Reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>-38.1%</td>
<td>-0.479</td>
<td>0.010</td>
</tr>
<tr>
<td>Other race</td>
<td>-35.9%</td>
<td>-0.445</td>
<td>0.014</td>
</tr>
<tr>
<td>Non-CKD: Reference</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CKD</td>
<td>+467%</td>
<td>1.74</td>
<td>0.014</td>
</tr>
</tbody>
</table>
Adjusted Comparison of CKD and non-CKD costs

<table>
<thead>
<tr>
<th></th>
<th>Relative cost (CKD/non-CKD)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White</td>
<td>Black</td>
</tr>
<tr>
<td>67-74</td>
<td>3.6</td>
<td>4.8</td>
</tr>
<tr>
<td>75-84</td>
<td>3.2</td>
<td>4.6</td>
</tr>
<tr>
<td>85+</td>
<td>2.2</td>
<td>5.9</td>
</tr>
</tbody>
</table>

67-74 Male: 3.6, 3.2, 2.2
75-84 Male: 4.8, 4.6, 5.9
85+ Male: 3.2, 3.8

67-74 Female: 3.2, 3.8, 2.2
75-84 Female: 2.2, 2.5
Non-Dialysis Reactive and Proactive Medicare PMPM Costs by Group in 1999

- **Non-CKD Patients**
  - Reactive: $504
  - Proactive: $504

- **CKD Patients**
  - Reactive: $1,333
  - Proactive: $1,333

- **Dialysis Patients**
  - Reactive: $2,781
  - Proactive: $2,781

Percentage differences:
- Non-CKD: 71% (29% decrease; $145 savings)
- CKD: 81% (19% decrease; $253 savings)
- Dialysis: 15% (85% increase; $2,352 increase)
Effect of pro-active treatment on costs: Influenza vaccination in dialysis pts, age 67+

Average monthly Hospitalization costs in the first 4 months of 1999

Vaccinated in the fall 1998

- Vaccinated (n=33,164) Mean IP PMPM 1-1 to 4-30-99: $1,530
- Not vaccinated (n=28,533) Mean IP PMPM: $1,766

Difference: $236 PMPM
Flu Vaccination Medicare Cost Implications

- Assuming $50 vaccination, savings per patient:
  \[(236 \times 4) - 50 = 894\]

- Total potential cost savings during influenza season:
  \[28,533 \times 894 = 25,508,502\]
Summary of the economic impact of CKD

- ESRD patients age 67+ represent 0.3% of the Medicare population and consume 10 times their proportion of expenditures.
- CKD patients age 67+ represent 3.5% of the Medicare population and consume 9% of the Medicare budget.
- CKD patients are 4.5-6 times more expensive than the non-CKD general Medicare population.
- Influenza vaccination appears to be a cost effective preventive health care measure and should be recommended for ALL ESRD patients!
Major issues in CKD

- Given the burden of disease and high rates of heart failure and death, how frequently do nephrologists see this vulnerable population to guide care?
Life table estimates for probability of first outpatient nephrologist visit during 1998
CKD patients 1996-'97, alive thru 1998, by outcome in 1999

Follow-up time (month)

Probability of visit

ESRD (N=617)
All (N=27,974)
Alive (N=23,006)
Died (N=4,351)
Overall Summary

- There are 12.6 times as many patients with CKD as patients with ESRD in the Medicare system.
- CKD patients are less sick than the patients with ESRD, but they are much sicker than the non-CKD patients, and their care is disproportionately expensive.
- CKD patients are about 5–10 times more likely to die than to reach ESRD. Nephrologists see them late if at all.
- They receive less preventive care than is recommended.
Overall Conclusions

- There appears to be a self-fulfilling pessimism about the care of patients with CKD (as for patients with ESRD), who receive less than recommended proactive preventive care.
- We need to determine which aspects of traditional preventive care are effective in this population and do more to apply the aspects that are effective.
- The nephrology community needs to educate and to work with the larger medical community to address the unmet needs of the very large population with CKD short of ESRD.
Adjusted relative risks for incident CVD and CHF during 1998 between CKD and non-CKD patients

Non-CVD or non-CHF patients 1996-'97, alive thru 1998

Reference: Non-CKD patients
Adjusted for age, gender, and race

Relative risk

CVD

CHF

Study population: N=559,736
N=895,771

2.25
1.61
Effect of Proactive Treatment on Costs: Flu Vaccinations for Dialysis Patients

- Inpatient PMPM Costs in first 4 months of 1999

- Dialysis patients with/without flu vaccination in fall of 1998

<table>
<thead>
<tr>
<th></th>
<th>Number</th>
<th>PMPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>With Vaccination</td>
<td>33,164</td>
<td>$1,530</td>
</tr>
<tr>
<td>Without Vaccination</td>
<td>28,533</td>
<td>$1,766</td>
</tr>
</tbody>
</table>

- Vaccinated patients had $236 lower Medicare inpatient costs *per month*. 
All-cause mortality in the general Medicare & dialysis populations, patients age 65+, 1999, unadjusted

Figure 9.4, period prevalent general Medicare & period prevalent dialysis pts

Patients by cardiovascular disease

- Cardiovascular disease
- No cardiovascular disease

Deaths per 1,000 patient years at risk

No chronic kidney disease
Chronic kidney disease
Dialysis
Expected remaining lifetime in patients with increasing morbidity, by age

Figure 9.26, diabetes, chronic kidney disease, & chronic heart disease.
Number of patients with a pre-ESRD outpatient nephrologist visit

OP Nephrology visits within two years of ESRD

1995-1998

No visit 50.4%  N = 55,087

Nephrology visit 49.6%  N = 54,234
Cumulative percent of patients with a 1st outpatient nephrologist visit pre-ESRD: age 67+

Pts with OP nephrology visits = 54,234

First service month
Life table estimates for probability of first outpatient nephrologist visit during 1998
CKD patients 1996-'97, alive thru 1998, by outcome in 1999

<table>
<thead>
<tr>
<th>Follow-up time (month)</th>
<th>Probability of visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>1</td>
<td>0.10</td>
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<tr>
<td>2</td>
<td>0.20</td>
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<tr>
<td>3</td>
<td>0.30</td>
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<tr>
<td>4</td>
<td>0.40</td>
</tr>
<tr>
<td>5</td>
<td>0.50</td>
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<td>6</td>
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<td>7</td>
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<td>11</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

- ESRD (N=617)
- All (N=27,974)
- Alive (N=23,006)
- Died (N=4,351)
Cumulative Comorbidity Dx in Medicare Patients Advancing to ESRD:
Pts age 67+, two years before ESRD incidence

Pre-ESRD period

ESRD period

ESRD 1\textsuperscript{st} service month

-24 -21 -18 -15 -12 -9 -6 -3 0 3

ASHD
CHF
PVD
CVATIA
CARDO

Cumulative % patients

0 10 20 30 40 50 60 70 80

Time in Months

USRDS ASN 2002
Map: Pneumoncoccal vaccination
Life table estimates for probability of incident CVD during 1998 by CKD and patient groups

Non-CVD patients 1996-'97 and did not die or develop ESRD/CKD in 1998

CKD patients*

RR: 1.61 for new CVD in CKD

Non-CKD patients*

*All Log-ranks test for differences among patient groups: p<.0001
Adjusted relative risks for incident CVD and CHF during 1998 between CKD and non-CKD patients
Non-CVD or non-CHF patients 1996-'97, alive thru 1998

Relative risk

Reference: Non-CKD patients
Adjusted for age, gender, and race

Study population: N=559,736

N=895,771

USRDS ASN 2002
ESRD patients, by diagnosis & origins in the general Medicare population

figure p.18, 1997-1998 general Medicare patients

4.4% All patients

Gen. Med. pts during entry period

ESRD pts in followup period

Percent of patients

67%

DM/CKD/CHF
DM/CKD
CHF/CKD
CKD only
DM/CHF
CHF only
DM only
None