Chronic Kidney Disease Burdens Patients, Health Care Systems, and Employers

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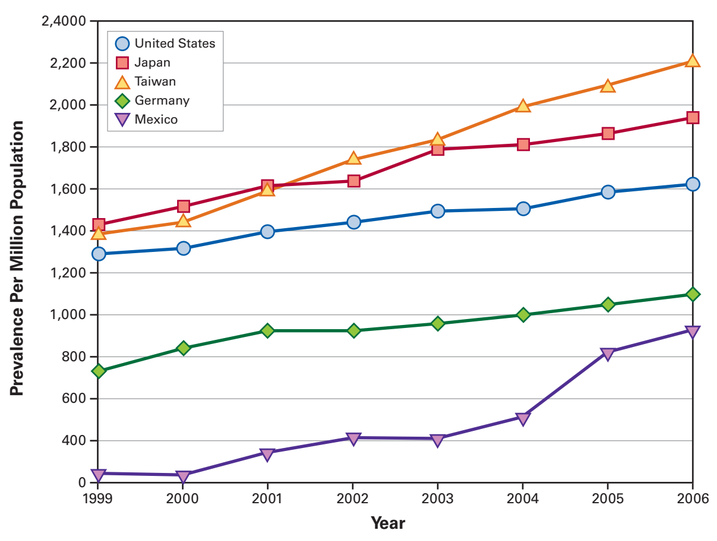
BACKGROUND

- Chronic kidney disease (CKD) is a major public health problem worldwide.[1]
- A 2008 systematic review of 26 studies conducted worldwide reported increased prevalence, with estimates from 1.5% to 43.3%; median estimates were 7.2% in persons aged 30 years and older and 23.4% to 35.8% in persons 64 years and older.[1]
- The trend of increased prevalence across countries highlights persistent growth of CKD worldwide (Figure 1).[2]
- As CKD becomes more complex due to comorbid illness and complications, severity of disease also increases, placing significant burden on patients and health care systems.[3-8]

Figure 1. Prevalence of CKD (1999-2006)



Source: Adapted from Collins, 2008.[2]

- Clearly defined stages of CKD and differences between early and late stages are critical for interpretation of data associated with CKD burden.
- The five stages of CKD are characterized by gradual and sustained decline in glomerular filtration rate (GFR) function over time (Table 1).[9]
- During early stage CKD, screening, risk reduction, and treatment of comorbidities are recommended to delay progression and avoid further complications of disease.[9]
- To date, the scientific literature does not present the progressive burden associated with predialysis CKD for patients and health care systems.

Table 1. Stages of CKD

Stage	Description	GFR (mL/min/1.73 m²)
Early		
1	Kidney damage with normal or increased GFR	≥ 90
2	Kidney damage with mildly decreased GFR	60-89
3[a]	Moderately decreased GFR	30-59
Late		
4	Severely decreased GFR	15-29
5	Kidney failure	<15 (or dialysis)

[a]Subclassification of Stage 3 (3A [lower risk group, eGFR 45-59] and 3B [higher risk group, eGFR 30-44]) is recommended by the United Kingdom consensus conference on early chronic kidney disease.[10]

Source: Adapted from National Kidney Foundation, 2006.[9]

OBJECTIVE

- To elucidate the patient and economic burden associated with CKD worldwide.

METHODS

- Targeted literature search of PubMed via the National Library of Medicine Gateway
- Desktop research
- Search categories:
  - CKD (excluding end-stage renal disease [ESRD] and renal failure)
  - Clinical description (disease staging)
  - Patient-reported outcomes (PROs)
  - Economics
- Limits:
  - Years 2000 to present
  - English language
  - Humans
  - Adults
- Articles were selected if they reported any of the following:
  - CKD staging from early to advanced disease
  - Change in PROs (e.g., health-related quality of life [HRQOL]) in one or more countries
  - Change in economics (e.g., resource utilization and cost) in one or more countries
- North American, European, and Asian studies were identified; most reports were from the United States (US).
- Thirty-six articles were selected for inclusion in this review; of those, 27 were from the US.

RESULTS

- As CKD progresses from one stage to the next, outcomes are adversely affected.[11-17]
- With deterioration of patient health status, resource utilization and costs escalate irrespective of country.[4-6,8,18-31]

Patient Burden of CKD

- Patients with CKD report cognitive impairment, dementia, sleep disturbance, and emotional and physical dysfunction, with physical dysfunction being most pervasive.[11-17]
- Compared with general populations, HRQOL and other PROs decline in patients with CKD.[13,14,16]
- Age, female sex, less education, lower income, unemployment, limited exercise, and comorbid illness are predictors of reduced HRQOL.[11,13,15]
- Progression of CKD adversely affects HRQOL. Across studies, the magnitude of physical health reduction (change from early to later stage CKD) was prominent (Figure 2).[13,15,17]

Figure 2. HRQOL Scores and Progression of CKD in the US and Canada, 2009[a]

[a]Statistical significance was observed for trend within each domain $P < 0.001$.
Source: Adapted from Mujais et al., 2009.[15]

Table 2. Economic Burden Across Countries: Costs Associated With CKD

Study/ Country	Data Description and Population	Outcomes/Costs
United States		
Taylor et al., 2011[33]	MarketScan employer data CKD	Total medical payments No CKD: $8,540 Stage 3: $9,727 Stage 4: $19,419 Stage 5: $30,366 (dialysis)
Kubacki et al., 2009[19]	Managed care claims CKD only CKD/diabetes CKD/hypertension	Annual medical costs CKD only: $10,170 CKD/diabetes: $22,444 CKD/hypertension: $19,667 Costs increased significantly from predialysis period to peridialysis (30 days pre- and postdialysis) period ($4,265 to $35,292)
Laliberte et al., 2009[5]	Managed care claims CKD with diabetes, hypertension, and combined cohorts	Annualized per-patient cost differences for those who developed CKD (2% of entire cohort) Diabetes/CKD: $11,814 ($18,444 vs. $6,631) Hypertension/CKD: $8,412 ($14,638 vs. $6,226) Diabetes/hypertension/CKD: $10,625 ($21,452 vs. $10,827) All $P < 0.001$
Schumock et al., 2009[18]	Managed care claims CKD with diabetes predialysis	Annualized total costs $30,398
USRDS, 2010[34]	USRDS, 5% Medicare random sample MarketScan (employer data)	PMPY costs (2008) Medicare: $19,752 Employer: $16,738 PMPM costs (1-month predialysis)(2007) Medicare: $8,000 Employer: $8,000 PMPM costs (dialysis initiation) (2007) Medicare: $15,000 Employer: $31,904
Sullivan et al., 2007[35]	Employer claims CKD	PMPY costs Stage 1 to Stage 2: $5,000 to $12,000 Stage 3 to Stage 4: $15,000 to 28,000 Stage 5: Exceeds $70,000 (dialysis)
Smith et al. 2004[26]	Managed care claims CKD cases vs. controls	Annualized total medical costs Stage 2: $7,050 vs. $3,473 Stage 3: $6,026 vs. $3,448 Stage 4: $7,623 vs. $2,947
Amedia, 2003[36]	Managed care claims 14 months before ESRD	PMPM costs increased from $1,183 (14 months prior to dialysis) to $9,370 (dialysis)
London et al., 2003[28]	Managed care claims 12 months before ESRD	Annualized total medical cost $37,330 per patient (Medications: 4% of total costs) 62.6% of patients hospitalized, with 1.3 hospitalizations per patient
Robbins et al., 2003[29]	Managed care claims Predialysis (6 months before initiation of dialysis) Peridialysis (2 months before and initiation)	PMPM costs Predialysis: $4,265 Peridialysis: $35,292
Canada		
Vekeman et al., 2010[4]	Managed care claims CKD Nephrology vs. other care setting	Annual total health care costs Nephrology setting vs. other care setting Stage 3: $10,132 vs. $14,000 Stage 4: $12,386 vs. $16,545 Stage 5: $23,445 vs. $18,522 (dialysis)
Germany		
Baumeister et al., 2010[6]	Population-based cohort with CKD Self-report survey to collect baseline health resource utilization Health resource utilization and costs modeled to 10 years	Annual health care costs compared with non-CKD Baseline: €3,581 vs. €1,272 Modeled costs represented a 65% increase in costs compared with those without CKD at 10 years. Primary cost driver: hospitalization
Meyer et al., 2008[24]	Hospital claims for coronary artery disease and CKD	In-hospital costs Stage 1: €2,926 Stage 2: €3,466 Stage 3: €4,208 Stage 4-5: €9,687 (Stage 5 includes dialysis) CKD was a significant, independent predictor of hospital costs; with each loss of 1mL/min in eGFR, the expenses for hospitalization increased by €18

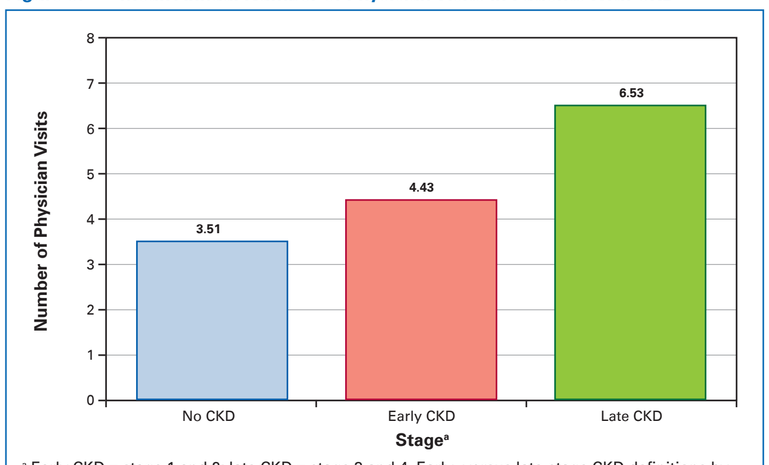
PMPM = per member per month; PMPY = per member per year; USRDS = United States Renal Data System.

Economic Burden of CKD

Resource Utilization and Costs of CKD

- Resource utilization and costs to health care systems and employers increase with CKD severity.
  - Twelve to 24 months before dialysis initiation, costs increase substantially due to hospitalization.[4,6,8,19,20,26-30]
  - In a 2005 inpatient Medicare claims cohort with CKD, the highest mean annual number of days hospitalized (9.51 days) was in patients with CKD. The mean annual number of physician visits in patients with CKD was second only to cancer, with 10.28 visits.[32]
  - Mean number of physician visits increase by CKD stage (Figure 3).[20]
  - Annual US total cost per patient with CKD (across stages) ranged from $1,183 to $35,292.[5,18,22,26,28,29,33-36]
  - Annual total cost per non-US patient with CKD (across stages) (only available in Canada and Germany) ranged from €2,926 to €23,455.[4,6,24]
- The cost burden of CKD is rising.
  - The Medicare costs attributable to patients with CKD increased nearly four-fold from 1993 to 2008 (CKD was 3.8% of 1993 Medicare costs, and 14.2% of Medicare costs).[34]

Figure 3. Mean Annual Number of Physician Visits in Patients With CKD



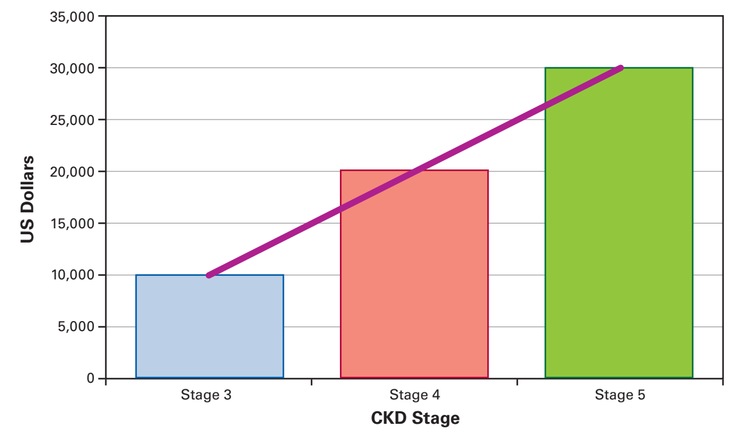
[a]Early CKD = stage 1 and 2; late CKD = stage 3 and 4. Early- versus late-stage CKD definitions by Alexander et al., 2009[20] are different than those presented by the NKF (Table 1).
Source: Adapted from Alexander et al., 2009.[20]

- Economic burden for CKD is high.
- While costs are measured differently across countries, the trend for increased resource utilization and cost burden is apparent.
- Costs increase with CKD disease progression, and hospitalizations consistently drive cost.
- As evidenced by the high cost burden, early screening, and predialysis, management of disease progression and comborbid illness are critical; whereas, disease progression may be delayed and future cost burden reduced.

Burden to Employers

- High health care costs and reduced productivity due to CKD burdens employers.[21,23,35]
- For employees with CKD (US), health care costs range from $1,187 (€971) (Stage 3) to $21,826 (€17,846) (Stage 5) (Figure 4), and work hours missed per week often exceeds 10.[33]

Figure 4. Mean Annual US Employer Medical Payments by CKD Stage



Medical payments = inpatient, outpatient, and prescription drugs.
Source: Adapted from Taylor et al., 2011.[33]

- Of note, a significant comorbid condition, anemia, impacts direct and indirect costs from an employer perspective.
  - For a major employer, predialysis treatment of anemia led to improved work productivity (presenteeism) by 91.5%, reduced absenteeism by 52.3 days per year, and reduced health care costs by approximately $4,417 per member per month (time frame: 15 months).[2]

CONCLUSIONS

- Published economic and patient-reported CKD data are sparse, with the fewest publications identified in the European Union.
- CKD prevalence is increasing worldwide, thereby, placing burden on patients and health care systems.
- With disease progression (reduced kidney function), comorbid illness, and complications, unfavorable outcomes arise.
- Patient burden is increased with progression of CKD.
- Resource utilization increases with CKD progression, resulting in increased total per-patient health care expenditures across countries.
- As evidenced by the high patient and economic burden of CKD, a large unmet need exists for new therapies and employee CKD-management programs.

REFERENCES

Please see handout for a complete reference list.

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