Preventive Health Care Measures Before and After Start of Renal Replacement Therapy

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OBJECTIVE: **To describe utilization of preventive health care measures in patients with chronic kidney disease (CKD), both in the year prior to onset of renal replacement therapy (RRT), and in the first year of RRT.**

METHODS: **We identified a large cohort of patients with CKD in the New Jersey Medicaid and Medicare programs with fixed enrollment into the cohort at 1 year prior to RRT. We applied commonly used quality assurance instruments (Health Plan Employer Data and Information Set measures) and defined levels and correlates of use of preventive care measures before and after RRT. These included mammography, Pap smear testing, prostate cancer screening, diabetic eye exams, and glycosylated hemoglobin testing (HbA1c). We employed logistic regression models with adjustment for age, race, gender, comorbidity, timing of first nephrologist contact, socioeconomic status, and calendar year of first RRT.**

RESULTS: **Overall, screening rates were low with the exception of diabetic eye exams. Prostate cancer screening, diabetic eye exams, and HbA1c testing were performed less often after onset of RRT compared to the year before ($P < .05$). Although screening rates before RRT improved considerably over the period of observation for these measures ($P < .05$), this was not the case once patients were on RRT.**

CONCLUSIONS: **Preventive health care interventions remain underutilized among RRT patients. Greater attention to such preventive measures could lead to significant improvements in the health status of such vulnerable patients. Thus, quality improvement of the general health care for patients on RRT should become a priority in renal health policy.**

KEY WORDS: **end-stage renal disease; quality management; preventive care; diabetes mellitus; mammography; hemoglobin A1C.**

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The 2000 Annual Data Report from the United States Renal Data System (USRDS) contained a novel section on the use of preventive health care measures in the incident and prevalent Medicare end-stage renal disease (ESRD) population.[1] The 9 interventions that were evaluated were those relevant to the non-ESRD population (screening for breast, cervical, and prostate cancer, as well as diabetic eye exams, glycosylated hemoglobin testing, and influenza vaccination), as well as such measures that were indicators of good quality of preventive care specifically in the ESRD population (hepatitis B vaccination for dialysis staff or patients, hepatitis C diagnosis rates). Where applicable, algorithms derived from the National Committee for Quality Assurance in its Health Plan Employer Data and Information Set (HEDIS) 2000 program were evaluated.[2] This program has been an important and independent source of information on performance of key indicators of the quality of care (QoC) provided by managed care organizations for purchasers of health care.[3] However, these procedures have also been used to evaluate the QoC in non–managed care populations.[4–6]

The present study expands on these preliminary descriptive statistics by describing the patterns of 5 important preventive health care measures (screening for breast, cervical, and prostate cancer, as well as diabetic eye exams and glycosylated hemoglobin testing among diabetics) in a large and typical population of incident ESRD patients in New Jersey. All measures were evaluated the year before onset of renal replacement therapy (RRT) and the first year of RRT. We sought to determine whether utilization of health maintenance screening tests differs between the year prior to RRT compared to the first year of RRT, as well as by other important patient characteristics.

METHODS

Patients

Details of the population selection algorithm have been presented previously.[7] Briefly, we identified all patients who began RRT during the period 1990 through mid-1996 who had been active participants in either the Medicare or Medicaid programs of the state of New Jersey for at least 12 months prior to the initiation of dialysis. These patients were identified using the International Classification of Diseases, Ninth Revision, and the Physicians' Current Procedural Terminology codes for hemodialysis, peritoneal dialysis, other dialysis, or renal transplantation. The first record of RRT during this period was referred to as the index claim. To ensure eligibility in the Medicare, Pharmaceutical Assistance to the Aged and Disabled (PAAD), or Medicaid programs, patients were required to have had at least 1 health service encounter of any kind in each of the 2 years prior to their first maintenance dialysis procedure. We also required that the first diagnosis of renal insufficiency have occurred more than 1 year prior to the initiation of dialysis,

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in order to exclude patients with new onset renal disease, particularly those with irreversible acute renal failure who may not have had the opportunity for many encounters with a nephrologist prior to dialysis. To be sure that RRT was chronic in nature, we excluded patients if they had only 1 episode of RRT and survived >1 month, and patients were required to have regular use of dialysis without gaps of more than 2 months in their billing, unless renal transplantation occurred. We also excluded a smaller number of patients whose health care providers could not be identified. All patient identifiers were transformed into anonymized untraceable study numbers to protect confidentiality.

Covariates

For each patient, we characterized the following demographic variables in the 12 months prior to initiation of dialysis: age, gender, race, socioeconomic status (as reflected in whether the patient had been enrolled in Medicaid or the PAAD program during this period), and the frequency and timing of visits with a nephrologist. Physician specialty was identified by Medicare and Medicaid specialty codes as well as by Unique Physician Identification Numbers assigned to all practicing physicians. For each physician encounter, provider numbers were searched for the specialty code for nephrologists.

We also extracted information on all hospitalizations, physician visits, procedures, and nursing home care received by these patients during this period. This made it possible to identify all diagnoses assigned to these patients by all clinicians who cared for them, including specific renal diagnoses, as well as comorbid conditions such as hypertension, diabetes mellitus, congestive heart failure, ischemic heart disease, and other relevant conditions. This way we were able to calculate a comorbidity index for all patients as described by Charlson.[8,9] Patients were defined as having late referral if their first encounter with a nephrologist was ≤90 days prior to onset of RRT.[7] We also created a dichotomous covariate indicating whether patients received their first RRT before 1994, or later.

Quality of Care Indicators and Populations at Risk

The 5 preventive screening strategies we sought to evaluate as QoC indicators were screening for breast cancer (mammography), cervical cancer (PAP smear), and prostate cancer (PSA level), as well as diabetic eye exams and glycosylated hemoglobin (HbA1c) concentration. Separate cohorts of patients were defined for the year prior to RRT and for the first year of RRT for those who survived the first year. We next sought to compare the populations studied in the year before RRT versus the first year on RRT. Therefore, we compared the full population that survived to onset of RRT (n = 3,014) with the subpopulation of these patients who survived the first year of RRT. Screening rates were not different in the year prior to RRT in those 2 subgroups: fitting all models in both cohorts did not lead to changes in the findings reported. We therefore used the larger cohort (n = 3,014) as study base for our analyses in the year prior to RRT.

We then created subpopulations that contained only those patients to whom the respective preventive health care measure was clinically relevant in accordance with the HEDIS criteria (see Table 1).[10] For each subpopulation, we identified rates of screening using the algorithm from the HEDIS protocol.[10] For prostate cancer screening, we used the algorithm published in the 2000 USRDS Annual Data Report (ADR).[2] We made the assumption that the rate of screening for each test was independent of time, and thus standardized for the recommended frequency of testing by multiplying 1-year screening rates by the recommended screening interval (3 years for cervical and prostate cancer screening, 2 years for mammography).

Statistical Analyses

We tested for association between the presence of each screening measure and demographic covariates, the Charlson comorbidity score, timing of first nephrologist encounter, and year of onset of RRT, using univariate or multivariate logistic regression. Age and the Charlson comorbidity score were studied as continuous covariates; race was defined categorically. The unadjusted rates of screening between the year before and the first year of RRT were compared using a 2-sample test of proportions in StataQuest 4.0 (The Stata Corporation, Inc., College Station, Tex). All other statistical analyses used the SAS system for Unix, version 6.11 (SAS Institute, Inc., Cary, NC). Test statistics were considered significant at the $P < .05$ level.

RESULTS

Population and Patient Characteristics

We identified 17,884 patients who underwent RRT at some point during the years 1991 to mid-1996. Of these patients, 12,557 had adequate baseline data for a full year prior to dialysis in Medicaid and/or Medicare to permit further study. In this population, 5,242 patients had their first renal diagnosis at least 1 year prior to the initiation of dialysis. Six hundred twenty-six patients in this group received less than 30 days of renal replacement therapy (RRT), indicating that they had acute renal failure, and were excluded. Five hundred ninety-nine patients had more than 2 months without claims for RRT and survived

Table 1. Subpopulation Definitions

Intervention	Population
Breast cancer screening	Women, age 52 to 69 y
Cervical cancer screening	Women, age 21 to 64 y
Prostate cancer screening	Men, age 50 or older
Diabetic eye exams	Diabetics (any type), age 18 to 75
Glycosylated hemoglobin testing	Diabetics (any type), age 18 to 75

without additional dialysis care; they were excluded by not having ESRD. Last, 1,003 patients lacked adequate data describing their health care providers. This left a study population of 3,014 patients (see Table 2), which is the source population from which the respective subpopulations of our analyses were drawn. By definition of our selection algorithm, these 3,014 individuals also constitute the pre-ESRD cohort; of these, 1,184 patients completed the first year of RRT in our database and thus constitute the incident ESRD cohort of our investigation.

Breast Cancer Screening

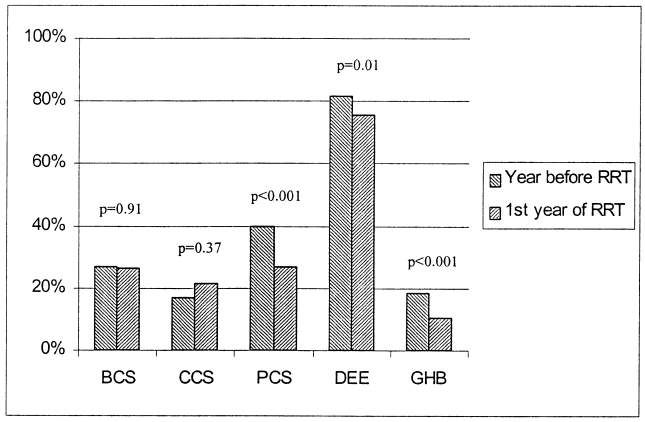
There were 344 women aged 52 to 69 years in the pre-ESRD cohort and 160 in the ESRD cohort representing the age range described in Table 1. The standardized mammography rate before RRT was 26.74%, and 26.25% in the first year of RRT ($P = .907$; see Fig. 1). Both rates are lower than those presented in the USRDS-ADR for the overall U.S. ESRD population in this age range from 1995 to 1998 (~35%).[1] In the multivariate models, only higher comorbidity was positively associated with mammography rates in the year prior to RRT. A 1-point increase in the Charlson comorbidity score was associated with an 18% higher likelihood of being screened for breast cancer (odds ratio [OR], 1.18; 95% confidence interval [95% CI], 1.02 to 1.36; $P = .018$). This association was found only in the year prior to RRT, but not thereafter.

Cervical Cancer Screening

We identified 195 women aged 21 to 64 years in the pre-ESRD cohort, and 99 in the ESRD cohort. The standardized screening rate in the year before RRT was 16.92%, and 21.21% in the first year of RRT ($P = .369$; see Fig. 1). Both findings are comparable with the data presented in the USRDS-ADR.[1] In the univariate analyses, age was a statistically significant predictor of cervical cancer screening rates in both time intervals, the likelihood of being screened decreasing by 8% per year of age (see Table 3). This effect remained significant in the fully adjusted model for the year prior to RRT (OR, 0.90; 95% CI, 0.84 to 0.96; $P = .003$; see Table 4). The analysis of the year after onset of RRT contained small numbers and failed to show any significant effects, but pointed toward a similar trend. A decrease in Pap smear rates with increasing age was also shown in the USRDS-ADR.[1]

Table 2. Characteristics of Overall Study Population ($N = 3,014$)

Variable	n	%
Age, y		
<45	83	2.8
45 to 54	137	4.6
55 to 64	261	8.7
65 to 74	1,288	42.7
75 to 84	1,063	35.3
≥85	182	6.0
Gender		
Female	1,320	43.8
Male	1,694	56.2
Race		
White	2,240	74.3
Black	586	19.4
Other	188	6.2
Entitlement program/SES		
Non-PAAD, non-Medicaid	2,010	66.7
PAAD or Medicaid	1,004	33.3
Timing of first nephrologist visit		
≤90 Days before dialysis	1,039	34.5
>90 Days before dialysis	1,975	65.5



BCS: breast cancer screening;
CCS: cervical cancer screening;
PCS: prostate cancer screening;
DEE: diabetic eye exams;
GHB: glycosylated hemoglobin testing;
RRT: renal replacement therapy.

FIGURE 1. Prevalence of screening measures.

Prostate Cancer Screening

There were 1,613 men older than 50 years in the pre-ESRD cohort and 670 in the ESRD cohort. The standardized screening rate before RRT was 39.99%, and 26.69% in the first year of RRT ($P < .001$; see Fig. 1), the latter figure being comparable to the USRDS-ADR.[1] Older age, higher comorbidity status, and more recent onset of RRT were significantly associated with a higher likelihood of being screened for prostate cancer in the year prior to RRT, in both the univariate and the fully adjusted analyses. The likelihood of PSA testing increased by 5% for each year of age (OR, 1.05; 95% CI, 1.03 to 1.07; $P < .001$), and by 7% for each 1-point increase in comorbidity score (OR, 1.07; 95% CI, 1.01 to 1.13; $P = .026$). The effect of age was also present in the analysis of national data.[1] Patients who started RRT in 1994 or later were 4 times more likely to receive PSA testing (OR, 4.04; 95% CI, 2.89 to 5.65; $P < .001$).

Table 3. Univariate Relationship Between Preventive Care Measures and Individual Covariates*

	Breast Cancer Screening		Cervical Cancer Screening		Prostate Cancer Screening		Diabetic Eye Exams		Glycosylated Hemoglobin	
	Pre-ESRD (*n* = 344)	Post-ESRD (*n* = 160)	Pre-ESRD (*n* = 195)	Post-ESRD (*n* = 99)	Pre-ESRD (*n* = 1,613)	Post-ESRD (*n* = 607)	Pre-ESRD (*n* = 1,084)	Post-ESRD (*n* = 440)	Pre-ESRD (*n* = 1,084)	Post-ESRD (*n* = 440)
Age	0.98 (0.92 to 1.04) *P* = .470	0.95 (0.87 to 1.03) *P* = .208	0.92 (0.87 to 0.97) *P* = .005	0.92 (0.86 to 1.00) *P* = .039	1.05 (1.03 to 1.07) *P* < .001	0.99 (0.96 to 1.28) *P* = .677	1.03 (1.01 to 1.04) *P* = .009	1.00 (0.97 to 1.02) *P* = .89	1.02 (1.00 to 1.04) *P* = .109	1.00 (0.96 to 1.03) *P* = .925
Charlson score	1.18 (1.03 to 1.35) *P* = .018	0.78 (0.59 to 1.39) *P* = .090	0.97 (0.71 to 1.34) *P* = .866	0.71 (0.43 to 1.19) *P* = .190	1.10 (1.04 to 1.16) *P* = .001	1.04 (0.90 to 1.19) *P* = .609	1.18 (1.08 to 1.29) *P* < .001	1.13 (0.99 to 1.29) *P* = .069	0.99 (0.92 to 1.07) *P* = .833	0.95 (0.79 to 1.13) *P* = .528
Male gender†	NA	NA	NA	NA	NA	NA	1.13 (0.84 to 1.54) *P* = .420	0.91 (0.59 to 1.41) *P* = .685	0.98 (0.72 to 1.34) *P* = .919	0.78 (0.42 to 1.42) *P* = .409
Black race‡	1.21 (0.61 to 2.40) *P* = .590	1.84 (0.73 to 4.64) *P* = .198	0.43 (0.09 to 2.12) *P* = .301	0.39 (0.04 to 3.67) *P* = .410	1.00 (0.68 to 1.47) *P* = .993	0.44 (0.18 to 1.05) *P* = .063	0.60 (0.43 to 0.85) *P* = .004	1.05 (0.64 to 1.71) *P* = .850	0.70 (0.48 to 1.02) *P* = .064	0.57 (0.28 to 1.20) *P* = .139
Other race‡	1.08 (0.39 to 3.03) *P* = .881	NE	0.27 (0.03 to 2.21) *P* = .221	0.91 (0.16 to 5.37) *P* = .920	0.47 (0.19 to 1.17) *P* = .105	0.49 (0.06 to 3.75) *P* = .49	0.58 (0.32 to 1.05) *P* = .072	0.71 (0.31 to 1.62) *P* = .413	0.48 (0.22 to 1.07) *P* = .074	0.24 (0.03 to 1.85) *P* = .172
Late referral§	0.54 (0.25 to 1.16) *P* = .108	1.15 (0.43 to 3.07) *P* = .773	0.47 (0.10 to 2.25) *P* = .335	0.71 (0.13 to 3.89) *P* = .420	0.87 (0.64 to 1.18) *P* = .370	1.03 (0.56 to 1.89) *P* = .937	0.71 (0.51 to 0.98) *P* = .037	0.91 (0.55 to 1.49) *P* = .701	1.31 (0.95 to 1.81) *P* = .105	1.85 (0.98 to 3.51) *P* = .056
Medicaid/PAAD‖	0.60 (0.30 to 1.19) *P* = .141	0.88 (0.35 to 2.22) *P* = .785	1.87 (0.55 to 6.34) *P* = .311	0.44 (0.08 to 2.37) *P* = .325	1.34 (0.98 to 1.83) *P* = .070	1.09 (0.60 to 1.99) *P* = .780	0.68 (0.50 to 0.93) *P* = .016	0.67 (0.43 to 1.03) *P* = .070	0.75 (0.54 to 1.04) *P* = .080	0.58 (0.31 to 1.10) *P* = .090
First RRT ≥1994¶	1.33 (0.71 to 2.47) *P* = .37	0.52 (0.18 to 1.51) *P* = .225	1.99 (0.56 to 7.05) *P* = .287	0.36 (0.04 to 3.15) *P* = .339	3.95 (2.84 to 5.51) *P* <.001	1.60 (0.91 to 2.82) *P* = .099	1.63 (1.19 to 2.22) *P* = .002	1.30 (0.82 to 2.06) *P* = .262	1.67 (1.22 to 2.28) *P* = .001	1.16 (0.63 to 2.15) *P* = .636

* *Odds ratio, 95% confidence interval, P value.*
† *Female gender = reference group.*
‡ *White race = reference group.*
§ *Early referral = reference group.*
‖ *Medicare/no-PAAD = reference group.*
¶ *First renal replacement therapy (RRT) <1994 = reference group.*
NA, not applicable; NE, not estimated.

Table 4. Multivariate Relationship Between Preventive Care Measures and All Covariates (Full Logistic Models)*

	Breast Cancer Screening		Cervical Cancer Screening		Prostate Cancer Screening		Diabetic Eye Exams		Glycosylated Hemoglobin	
	Pre-ESRD (*n* = 344)	Post-ESRD (*n* = 160)	Pre-ESRD (*n* = 195)	Post-ESRD (*n* = 99)	Pre-ESRD (*n* = 1,613)	Post-ESRD (*n* = 607)	Pre-ESRD (*n* = 1,084)	Post-ESRD (*n* = 440)	Pre-ESRD (*n* = 1,084)	Post-ESRD (*n* = 440)
Age	0.97 (0.90 to 1.04) *P* = .320	0.96 (0.87 to 1.05) *P* = .337	0.90 (0.84 to 0.96) *P* = .003	0.93 (0.84 to 1.02) *P* = .133	1.05 (1.03 to 1.07) *P* < .001	0.99 (0.95 to 1.02) *P* = .441	1.01 (0.99 to 1.03) *P* = .162	0.99 (0.96 to 1.02) *P* = .088	1.01 (0.99 to 1.04) *P* = .254	0.99 (0.96 to 1.03) *P* = .713
Charlson score	1.18 (1.02 to 1.36) *P* = .024	0.79 (0.59 to 1.06) *P* = .115	1.02 (0.71 to 1.48) *P* = .897	0.77 (0.44 to 1.36) *P* = .372	1.07 (1.01 to 1.13) *P* = .026	1.04 (0.90 to 1.19) *P* = .629	1.15 (1.05 to 1.25) *P* = .002	1.12 (0.98 to 1.28) *P* = .098	0.97 (0.90 to 1.05) *P* = .506	0.93 (0.78 to 1.12) *P* = .457
Male gender†	NA	NA	NA	NA	NA	NA	1.08 (0.79 to 1.49) *P* = .678	0.82 (0.52 to 1.28) *P* = .378	0.93 (0.68 to 1.27) *P* = .637	0.63 (0.34 to 1.19) *P* = .152
Black race‡	1.22 (0.60 to 2.52) *P* = .583	2.00 (0.74 to 5.45) *P* = .525	0.63 (0.11 to 3.51) *P* = .594	1.33 (0.09 to 19.1) *P* = .833	1.15 (0.77 to 1.73) *P* = .493	0.42 (0.17 to 1.01) *P* = .053	0.66 (0.47 to 0.94) *P* = .022	1.14 (0.69 to 1.89) *P* = .615	0.73 (0.50 to 1.08) *P* = .116	0.63 (0.30 to 1.33) *P* = .222
Other race‡	1.01 (0.34 to 3.00) *P* = .984	NE	0.31 (0.03 to 2.80) *P* = .296	1.24 (0.16 to 9.55) *P* = .836	0.54 (0.21 to 1.38) *P* = .195	0.50 (0.06 to 3.87) *P* = .506	0.61 (0.33 to 1.14) *P* = .122	0.71 (0.30 to 1.67) *P* = .431	0.48 (0.21 to 1.08) *P* = .075	0.25 (0.03 to 1.91) *P* = .180
Late referral§	0.61 (0.28 to 1.34) *P* = .221	0.86 (0.30 to 2.49) *P* = .779	0.41 (0.08 to 2.23) *P* = .301	0.30 (0.04 to 2.54) *P* = .271	0.90 (0.65 to 1.23) *P* = .498	1.10 (0.59 to 2.05) *P* = .763	0.73 (0.53 to 1.02) *P* = .065	0.92 (0.56 to 1.53) *P* = .750	1.32 (0.95 to 1.83) *P* = .104	1.88 (0.98 to 3.62) *P* = .057
Medicaid/PAAD‖	0.59 (0.29 to 1.18) *P* = .136	0.80 (0.29 to 2.17) *P* = .658	1.89 (0.49 to 7.19) *P* = .353	0.44 (0.07 to 2.64) *P* = .368	1.31 (0.94 to 1.82) *P* = .116	1.11 (0.60 to 2.04) *P* = .749	0.76 (0.55 to 1.05) *P* = .099	0.63 (0.40 to 1.00) *P* = .051	0.79 (0.56 to 1.10) *P* = .161	0.55 (0.28 to 1.08) *P* = .082
First RRT ≥1994¶	1.21 (0.64 to 2.29) *P* = .562	0.46 (0.15 to 1.42) *P* = .179	3.11 (0.76 to 12.7) *P* = .115	0.50 (0.04 to 6.00) *P* = .573	4.04 (2.89 to 5.65) *P* < .001	1.54 (0.86 to 2.74) *P* = .146	1.56 (1.13 to 2.14) *P* = .006	1.32 (0.82 to 2.12) *P* = .248	1.69 (1.24 to 2.31) *P* = .001	1.29 (0.68 to 2.44) *P* = .436

* *Odds ratio, 95% confidence interval, P value.*
† *Female gender = reference group.*
‡ *White race = reference group.*
§ *Early referral = reference group.*
‖ *Medicare/no-PAAD = reference group.*
¶ *First renal replacement therapy (RRT) <1994 = reference group.*
NA, not applicable; NE, not estimated.

Diabetic Eye Exams

The last 2 analyses are drawn from the same population of diabetics (any type) between ages 18 and 75 in accordance with the HEDIS algorithms, 1,084 in the year prior to RRT, and 440 in the first year of RRT. The proportion of diabetic patients who had an evaluation by an ophthalmologist in the earlier cohort was 81.37%, and 75.68% in the latter group of patients (P = .012; see Fig. 1). Although age, comorbidity, black race, late nephrologist referral, socioeconomic status, and year of first RRT were significantly associated in univariate analyses with having such examinations, only comorbidity, black race and year of onset of RRT remained significant in the multivariate model. A 1-point increase in the Charlson comorbidity score was associated with a 15% higher likelihood of having an eye exam (OR, 1.15; 95% CI, 1.05 to 1.25; P = .002). Black race was associated with a 34% reduced likelihood of receiving an eye exam compared to white race (OR, 0.66; 95% CI, 0.47 to 0.94; P = .022). Starting RRT in 1994 or later increased the likelihood of having an eye exam by 56% (OR, 1.56; 95% CI, 1.13 to 2.14; P = .006).

Glycosylated Hemoglobin Testing Among Diabetics

Among the diabetic patients awaiting RRT, 18.54% had their glycosylated hemoglobin tested, whereas only 10.68% received testing in the year after onset of RRT ($P < .001$; see Fig. 1). The latter number is considerably lower than the ~20% for the overall U.S. ESRD population in 1995 shown in the USRDS-ADR.[1] The only parameter significantly associated with glycosylated hemoglobin testing in both the univariate and multivariate analyses was year of onset of RRT in the pre-ESRD cohort. Diabetic patients starting RRT in or after 1994 were 69% more likely to be tested for HbA1c level than patients who started RRT before 1994 (OR, 1.69; 95% CI, 1.24 to 2.31; $P < .001$).

DISCUSSION

On the basis of provocative data from the USRDS 2000 Annual Report[1] and reports of suboptimal screening for disease in the healthy population,[11] we sought to measure the adequacy of specific preventive measures in the ESRD population before and after the start of RRT. With the exception of diabetic eye exams, ≤40% of patients had recommended screening studies for breast, cervical cancer, or prostate cancer and hemoglobin A1c values. For example, despite an increased risk of cancer in the ESRD population,[12] screening rates for breast or cervical cancer were only 27% and 17%, respectively. These rates are dramatically lower than reported rates for managed care plans in the same geographic region (average rates of 61%, and 64%, respectively).[13] The already low screening rates did not improve when individuals started RRT, which mandates regular and frequent contact with health care professionals. Even worse, we found that the rates for PSA screening, diabetic eye exams, and glycosylated hemoglobin testing decrease significantly once RRT is initiated. Possible causes for such neglect of accepted screening practices include physician inattentiveness, physician fatalism about patient outcomes, poor patient adherence to testing procedures, and inadequate financial coverage for these tests. Patient adherence seems not to be a principal explanation for low testing rates, since the lowest screening rate was for the blood-based study, i.e glycosylated hemoglobin. On the other hand, the highest rate was for the most time-consuming patient study, diabetic eye examinations. Physician inattentiveness and/or fatalism about patient outcomes seems a likely possibility that cannot be confirmed or refuted from this data set. Inadequate financial coverage for tests seems an unlikely cause, since most patients obtained full Medicare coverage with the development of ESRD, yet there was a reduction in testing when RRT started.

It is noteworthy that diabetic eye exams among diabetics were performed with high frequency in the year prior to and in the first year of RRT. Both percentages are considerably higher than those shown in the USRDS-ADR[1] as well as the average performance shown for the managed care plans operating in the state of New Jersey (34%).[13] Considering the population under investigation, bias by indication may be playing a role. In other words, as retinorenal disease progresses, and patients develop increased visual symptoms, they are more likely to be referred for opthalmologic evaluation and treatment. The positive assocation between the frequency of diabetic eye exams and the extent of comorbid conditions supports this hypothesis. Other screening measures, such as testing for breast and prostate cancer, were also positively associated with the severity of comorbid conditions. This suggests that providers may be more cognizant of preventive health care measures in sicker patients. Alternatively, these relationships might be confounded by the degree of health care access: those with more frequent health care provider contacts may have been both more likely to be diagnosed with comorbid conditions and more likely to receive preventive screening (ascertainment bias). Further research is needed to elucidate the role of generalists and physicians from specific specialties regarding such screening procedures.

There are several limitations to this study. First, this is a single state experience, and the findings observed may not be uniform in other geographies and with a different patient and provider case mix. Second, it suffers the limitation of most retrospective observational cohort analyses, which is that the results describing predictors of inadequate screening define associations only, and causality cannot be determined. Third, as noted above,

several forms of bias, such as ascertainment bias, may impact the relationships. Although these data provide a relatively complete window on the chronic kidney disease population >65 years old, it is less clear whether they are generalizable to the advanced chronic kidney disease or end-stage renal disease populations under age 65.

At a national level, quality improvement efforts in the ESRD program at the level of the patient have focused on adequacy of dialysis, anemia management, vascular access choice, and monitoring for malnutrition.[14] Other dimensions of quality of care, such as health maintenance screening, have not received similar attention. Some of the absence of scrutiny may be diagnostic nihilism driven by the assumption that patients with ESRD have such limited survival that they will not gain benefit from the detection and treatment of conditions like cancer.[15] However, the utility of mass screening programs increases with the prevalence of the disease to be detected in the respective population. This is the case with cancer in patients with chronic kidney disease.[16] As survival improves for ESRD patients,[17] it seems inappropriate to ignore preventive health care measures that could result in meaningful benefits in populations with chronic disease. Physicians may be skeptical about the efficacy of preventive health care measures in such populations. While there is no specific evidence of the efficacy of preventive health care measures in chronic kidney disease patients in particular, it is unlikely that this would not be the case for Pap smear testing, mammography, measurement of HbA1c, or in diabetic eye testing. Only the issue of PSA testing in dialysis patients has been formally evaluated, and it was found that total PSA testing can safely and reliably be used to screen patients on dialysis for prostate cancer.[18] Although we recognize that the use of this test remains controversial in all populations, it may be beneficial to launch educational efforts toward health care professionals as well as patients that emphasize the importance of screening programs for patients on RRT. While it is difficult to specifically identify and target physicians caring for the pre-ESRD population, it is easier to implement formal reporting procedures, incentive systems, and feedback mechanisms tailored to improve preventive health care. In ESRD patients, for whom the nephrologist often functions as the primary care provider,[19–23] the monitoring of preventive health care measures as reported in the 2000 USRDS-ADR may be a critical initial step in converting this to a clinical performance measure.

From the perspective of the generalist, it is noteworthy that as patients approach and undergo renal replacement therapy, the health care they receive revolves predominantly around preparation for and delivery of renal replacement therapy, and preventive health care may fall through the cracks. Therefore, the relationship between the nephrologist (or the dialysis facility) and the primary care provider needs to be clearly defined and highly functional. Otherwise, the respective roles can remain ambiguous and lead to decreased quality of care in this highly vulnerable population.

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