The Healthy People 2020 Objectives for Kidney Disease: How Far Have We Come, and Where Do We Need to Go?

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Abstract

The Healthy People 2020 initiative established goals for patients with CKD and ESRD. We assessed United States progress toward some of these key goals. Using data from the Centers for Medicare and Medicaid Services ESRD database, we created yearly cohorts of patients on incident and prevalent dialysis from 2000 to 2013. Change in event rate or proportion change over the study years was modeled using Poisson regression with adjustment for age, race, sex, and primary cause of ESRD. For all-cause mortality in prevalent patients, Healthy People 2020 sought approximately 0.8% relative annual improvement; actual improvement was 2.7%. Improvement was greatest for patients ages 18–44 years old (3.8%; *P*<0.01 versus 2.8% for ages 65–74 years old) and 2.3% even for patients ages ≥75 years old. For mortality in incident patients, the relative annual decrease was 2.1% overall, a twofold improvement over the goal; mortality decreased nearly twice as much in black as in white patients (3.2% versus 1.8%; *P*<0.001). Geographic variation was substantial; the relative annual decrease was 0.6% in the Midwest and more than fourfold greater (2.7%) in the South. Cardiovascular mortality in prevalent patients decreased dramatically at 5.0% per year, far exceeding the annual goal of approximately 0.8%; the decrease was greatest in patients ages ≥75 years old (5.5%; *P*<0.001 versus ages 65–74 years old; 5.1%). The relative annual increase in percentages of patients with a fistula at dialysis initiation was 2.4%, roughly three times the goal; the increase was greater for black than white patients (3.2% versus 2.3%; *P*<0.01). Adjusted regional differences varied greater than twofold: 2.0% for the South versus 4.1% for the Midwest. Thus, although gains have been substantial, not all groups have benefitted equally. Goal development for Healthy People 2030 should consider changes in goal paradigms, such as tailoring by geographic region and incorporating patient-centered goals.

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Introduction

The past decade has witnessed substantial improvement in the health of patients receiving maintenance dialysis. The rate of growth in incident patients with ESRD is substantially lower than it was at the turn of the millennium (1), and the mean survival of patients receiving dialysis may have increased by approximately 1 year over that period (2). Although these achievements are welcome, they must be considered within the context of the public health objectives established for the dialysis population and scrutinized to determine whether all areas of the country have benefitted equally. The main United States public health initiative by which progress is measured is the Healthy People (HP) project (3), which originated with the landmark Surgeon General's HP report of 1979 (4) and enshrined the concept that the health of the United States population should be a societal priority. Although the HP 2010 initiative was the first to enumerate kidney disease–specific goals, the HP 2020 initiative advanced this effort by explicitly listing a series of CKD public health targets. Few reports have specifically examined recent progress in meeting these objectives.

Using data generated as part of the Peer Kidney Care Initiative (5), we presently examine how the kidney care community has fared with regard to achieving the HP 2020 CKD goals, which set targets for all-cause and cardiovascular-related mortality in patients receiving dialysis, new patients with diabetes-related ESRD, and pre-ESRD care in the form of nephrology visits and placement of native vascular accesses. Within the broad public health framework of the HP 2020 initiative, we sought to determine how demographic characteristics, including geographic location, have been associated with the gains of the previous decade and consider how these findings might inform future goal development efforts.

Methods

Data Sources and Study Population

Data were ascertained from the Centers for Medicare and Medicaid Services (CMS) ESRD database. We created yearly cohorts of patients with incident and prevalent dialysis from 2000 to 2013. For annual incident cohorts, we identified patients whose first outpatient dialysis treatment occurred in a freestanding facility within 3 months of incident ESRD and who had uninterrupted dialysis thereafter. For annual prevalent cohorts, we identified patients undergoing dialysis in a freestanding facility on January 1 of the applicable year.

We sought to examine key goals for which data were available, namely CKD-10 ("Increase the proportion of CKD patients receiving care from a nephrologist at least 12 months before the start of RRT"), CKD-11.1 ("Increase the proportion of adult HD patients who use AVFs as the primary mode of vascular access"), CKD 14.1 ("Reduce the total number of deaths for persons on dialysis"), CKD 14.2 ("Reduce the number of deaths in dialysis patients within the first 3 months of initiation of RRT"), and CKD 14.3 ("Reduce the number of cardiovascular deaths for persons on dialysis"). Additionally, although we could not directly address CKD-9 ("Reduce kidney failure due to diabetes"), we investigated a related question: change in the percentages of patients who initiate dialysis with diabetes as the primary cause of ESRD. All kidney disease–related goals are listed in Table 1; the specific goals that we sought to address are noted.

The ESRD Medical Evidence Report (form CMS-2728) was used to determine (*1*) whether the primary cause of ESRD was diabetes, (*2*) whether nephrologist care was received before dialysis initiation, and (*3*) whether a functioning or maturing arteriovenous fistula (AVF) was present at first outpatient dialysis treatment session. Mortality information and cause of death were determined using the ESRD Death Notification (form CMS-2746). For prevalent patients, we determined mortality rates by following them from January 1 of each year until recovery of renal function, kidney transplant, interruption of outpatient dialysis for >3 months, December 31 of the relevant year, or death (all cause and cardiovascular related). For incident patients (those within 3 months of dialysis initiation), we determined mortality rates by following them from the date of the first outpatient dialysis treatment until recovery of renal function, kidney transplant, interruption of outpatient dialysis after first outpatient dialysis date, death (all cause), or 90 days.

Statistical Analyses

Unadjusted mortality rates were calculated using the total number of deaths divided by the total follow-up time expressed as the number of deaths per 100 patient-years. Other outcomes (diabetes as the primary cause of ESRD, nephrologist care for ≥12 months before dialysis initiation, and presence of a functioning or maturing AVF at dialysis initiation) were calculated in proportions for each yearly cohort.

To have rates and proportions that were comparable over the years analyzed, adjusted rates were calculated for all-cause and cardiovascular-related mortality among the prevalent patients and 90-day all-cause mortality among the incident patients. Adjusted proportions were calculated for diabetes as the cause of ESRD, nephrologist care ≥12 months before dialysis initiation, and presence of a usable or maturing AVF at dialysis initiation among the incident patients. These rates and proportions were adjusted for age, race, sex, and cause of ESRD, with the 2010 prevalent or incident dialysis population, as appropriate, as the reference. Adjusted rates and proportions are reported overall and by age, race, sex, and United States census region (Northeast, South, Midwest, and West).

Modeling Event Rate Changes over Time

Change in event rates or proportion change over the years analyzed was modeled using a Poisson regression model adjusted for age, race, sex, and primary cause of ESRD. For the broad purpose of public health messaging and because the HP 2020 goals imply the expectation of generally steady improvement in outcomes and care metrics, we made the assumption of a log linear trend (that is, continuous calendar year and log link function). Age, race, sex, and ESRD cause group– and United States census region–specific event rates or proportion changes were evaluated through interactions of calendar year with the corresponding variables in the corresponding models. One model was fit for the overall model and each age, race, sex, and ESRD cause group as well as for regions. The average annual percentage changes in the event rates or proportions were estimated from the model output overall and for each group listed above.

Results

Mortality

The HP 2020 mortality goals for patients receiving dialysis are to reduce the total number of deaths (CKD-14.1; applicable to patients on prevalent dialysis), reduce the total number of deaths within the first 3 months of dialysis initiation (CKD-14.2; applicable to incident patients), and reduce cardiovascular deaths in prevalent patients (CKD-14.3). For all-cause mortality in prevalent patients, the goal is a 10% relative improvement (decrease) between 2007 and 2020. Achieving this would require a relative annual improvement over this period of approximately 0.8%. In actuality, improvement has been substantially greater: between 2000 and 2013, the relative annual decrease was 2.7%, representing an overall decrease of approximately 30% (Figure 1A). The annual decrease was greatest for patients ages 18–44 years old (3.8%; $P<0.01$ versus 2.8% for the referent group ages 65–74 years old). Improvement for the most elderly patients, ages ≥75 years old, was significantly less (decrease of 2.3%; $P<0.01$) than for the referent group but still substantial (Figure 1B). Mortality improved somewhat more for black than for white patients (3.0% versus 2.6%; $P<0.001$). Regional improvement varied little (2.3% for the Midwest to 2.8% for the West), but the difference was statistically significant. Changes by age, sex, race, and cause of ESRD are shown for all outcomes in Table 2.

For mortality in incident patients (within 90 days of initiation), the goal is also a 10% improvement (decrease) between 2007 and 2020. Between 2003 and 2013, the relative annual decrease was 2.1% overall, representing an actual improvement more than twofold greater than the goal (Figure 2A). Incident mortality for black patients decreased nearly twice as much as that for white patients (3.2% versus 1.8%; $P<0.001$) (Figure 2B, Table 2); improvement was comparable for men and women. However, the difference across regions was 4.5-fold; mortality decreased 0.6% in the Midwest and 2.7% in the South (both $P<0.001$ compared with the West at 2.0%) (Figure 2C).

For cardiovascular mortality in prevalent patients, the goal is again a 10% improvement (decrease) between 2007 and 2020. Between 2001 and 2013, cardiovascular mortality decreased 5.0%, far exceeding the annual goal of approximately 0.8% per year. By age, improvement was greatest for patients ages ≥75 years old at 5.5% ($P<0.001$ compared with ages 65–74 years old; 5.1%) (Table 2). Improvements

Table 1. Healthy People 2020 CKD objectives

Goal No.	Stated Goal	Improvement Sought, %
CKD-1	Reduce the proportion of the United States population with CKD	10
CKD-2	Increase the proportion of persons with CKD who know that they have impaired renal function	4
CKD-3	Increase the proportion of hospital patients who incurred AKI who have follow-up renal evaluation in 6 mo postdischarge	10
CKD-4.1	Increase the proportion of persons with CKD who receive medical evaluation with serum creatinine, lipids, and microalbuminuria	10
CKD-4.2	Increase the proportion of persons with type 1 or 2 diabetes and CKD who receive medical evaluation with serum creatinine, microalbuminuria, A1c, lipids, and eye examinations	10
CKD-5	Increase the proportion of persons with diabetes and CKD who receive recommended medical treatment with ACEIs or ARBs	10
CKD-6.1	Reduce the proportion of persons with CKD who have elevated BP	Minimal statistical significance[a]
CKD-6.2	Increase the proportion of adults ages ≥50 yr old with CKD who currently take statins to lower their blood cholesterol	Minimal statistical significance[a]
CKD-7	Reduce the number of deaths among persons with CKD	Tracked for informational purposes[a]
CKD-8	Reduce the number of new patients with ESRD	10
CKD-9.1[b]	Reduce kidney failure caused by diabetes	10
CKD-9.2	Reduce kidney failure caused by diabetes among persons with diabetes	10
CKD-10[b]	Increase the proportion of patients with CKD receiving care from a nephrologist at least 12 mo before the start of RRT	10
CKD-11.1	Increase the proportion of adult patients on HD who use AVFs as the primary mode of vascular access	10
CKD-11.2	Reduce the proportion of adult patients on HD who use catheters as the only mode of vascular access	10
CKD-11.3[b]	Increase the proportion of adult patients on HD who use AVFs or have maturing AVFs as the primary mode of vascular access at the start of RRT	10
CKD-12	Increase the proportion of patients on dialysis waitlisted and/or receiving a deceased donor KT within 1 yr of ESRD start (among patients <70 yr of age)	10
CKD-13.1	Increase the proportion of patients receiving a KT within 3 yr of ESRD	10
CKD-13.2	Increase the proportion of patients who receive a preemptive KT at the start of ESRD	Tracked for informational purposes[a]
CKD-14.1[b]	Reduce the total number of deaths for persons on dialysis	10
CKD-14.2[b]	Reduce the number of deaths in patients on dialysis within the first 3 mo of initiation of RRT	10
CKD-14.3[b]	Reduce the number of cardiovascular deaths for persons on dialysis	10
CKD-14.4	Reduce the total number of deaths for persons with a functioning KT	10
CKD-14.5	Reduce the number of cardiovascular deaths in persons with a functioning KT	2

ACEI, angiotensin–converting enzyme inhibitor; ARB, angiotensin receptor blocker; HD, hemodialysis; AVF, arteriovenous fistula; KT, kidney transplant. Modified from the US Department of Health and Human Services' *Healthy People 2020: Chronic Kidney Disease* (24), with permission.
[a]Details and contextualization are in the US Department of Health and Human Services' *Healthy People 2020: Chronic Kidney Disease* (24).
[b]Goals that were addressed in this study.

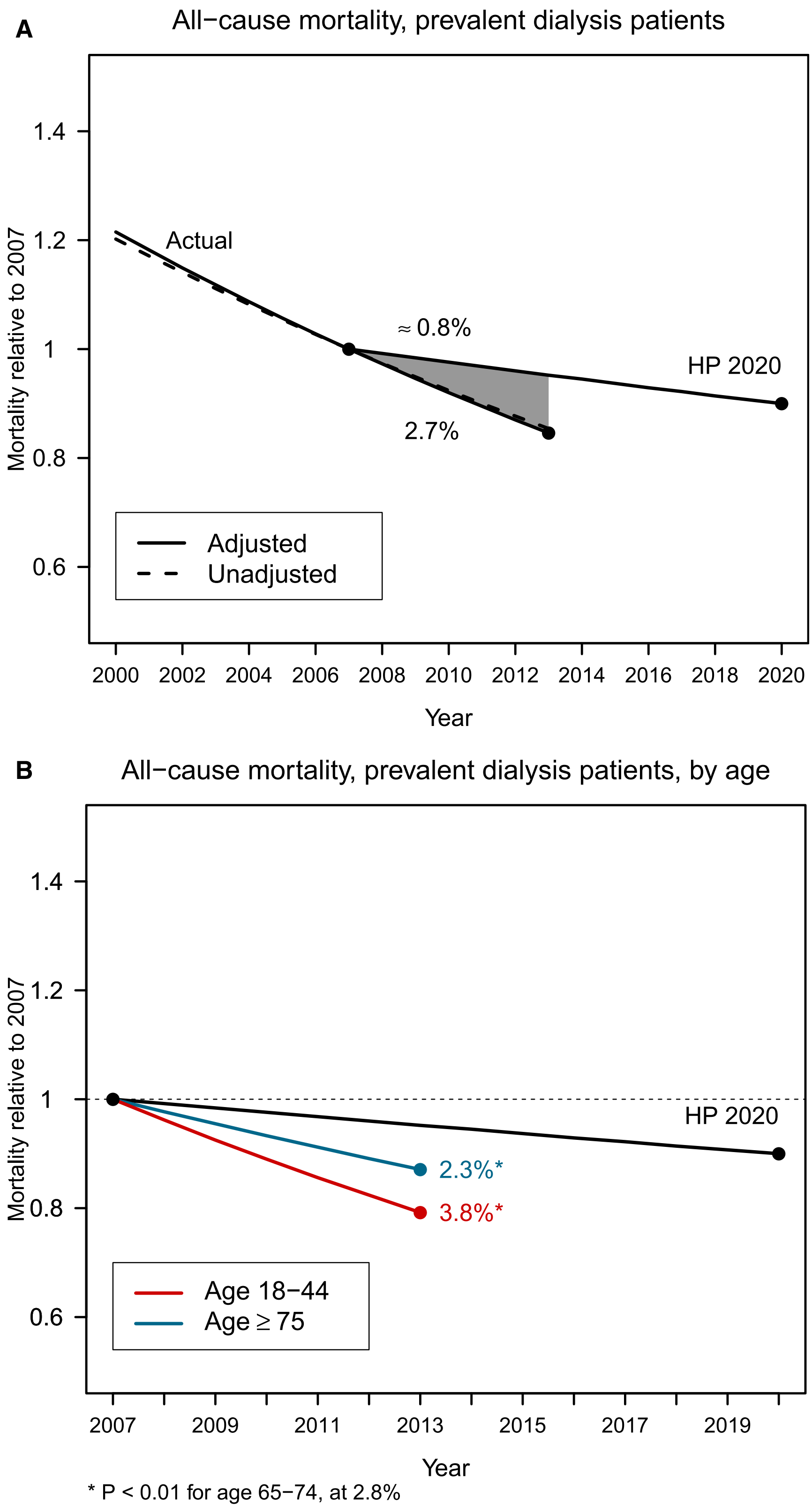

Figure 1. | **Adjusted all-cause mortality decreased annually in patients on prevalent dialysis**. Panel (A), overall; panel (B), by age. HP 2020, Healthy People 2020.

were also substantial for ages 45–64 (4.5%) and 18–44 (4.4%) years old but significantly less than for ages 65–74 years old ($P<0.001$ and $P<0.01$, respectively). Improvement was 5.2% among black patients and 4.6% among white patients ($P<0.001$), and it was 5.3% and 5.0% among women and men, respectively ($P<0.001$). Improvement was similar

Table 2. Changes in mortality of patients on dialysis from 2000 to 2013 by age, sex, race, cause of ESRD, and region

Characteristics	All-Cause Mortality				Cardiovascular Mortality in Prevalent Patients		Diabetes as ESRD Cause		Predialysis Care			
	Prevalent Patients		Incident Patients						Nephrologist Care >12 mo		AVF Placement	
	Change, %[a]	*P* Value	Change, %[a]	*P* Value	Change, %[a]	*P* Value	Change, %[a]	*P* Value	Change, %[a]	*P* Value	Change, %[a]	*P* Value
Overall model	−2.7	<0.001	−2.1	<0.001	−5.0	<0.001	−0.2	<0.001	2.8	<0.001	2.4	<0.001
Age model												
Age, yr												
65–74	−2.8	—	−2.3	—	−5.1	—	−0.4	—	3.1	—	2.6	—
18–44	−3.8	<0.001	−3.8	0.07	−4.4	0.004	1.0	<0.001	0.1	<0.001	0.9	<0.001
45–64	−3.0	<0.09	−2.0	0.37	−4.5	<0.001	−0.7	0.04	2.0	<0.001	2.0	0.09
≥75	−2.3	<0.001	−1.9	0.25	−5.5	0.001	0.6	<0.001	4.4	<0.001	3.4	0.06
Sex model												
Sex												
Men	−2.8	—	−2.1	—	−5.0	—	−0.2	—	2.8	—	2.5	—
Women	−2.9	<0.001	−2.3	0.32	−5.3	<0.001	−0.5	<0.001	2.7	0.52	3.2	<0.001
Race model												
Race												
White	−2.6	—	−1.8	—	−5.2	—	0.0	—	2.8	—	2.3	—
Black	−3.0	<0.001	−3.2	<0.001	−4.7	<0.001	−0.5	<0.001	2.9	0.95	3.2	0.002
Other	−3.0	0.004	−1.9	0.87	−4.6	<0.01	−1.4	<0.001	1.2	0.002	−0.9	<0.001
ESRD model												
ESRD cause												
Diabetes	−3.1	—	−2.9	—	−4.9	—	—	—	3.1	—	2.6	—
HTN	−2.4	<0.001	−2.3	0.09	−5.0	0.60	—	—	3.2	0.84	2.9	0.40
GN	−2.6	<0.001	−4.0	0.17	−4.9	0.88	—	—	2.2	0.04	0.5	<0.001
Other	−2.4	<0.001	−0.5	<0.001	−5.1	0.18	—	—	1.0	<0.001	0.7	<0.001
Region model												
Region												
West	−2.8	—	−2.0	—	−5.1	—	−0.2	—	3.2	—	2.5	—
Northeast	−2.7	0.51	−1.9	0.82	−4.9	0.06	0.0	0.39	3.7	0.03	2.7	0.59
Midwest	−2.3	<0.001	−0.6	<0.001	−5.3	0.02	−0.5	0.003	2.9	0.21	4.1	<0.001
South	−2.6	0.003	−2.7	0.001	−4.5	<0.001	−0.5	0.001	1.8	<0.001	2.0	0.02

Overall model is adjusted for age, sex, race, cause of ESRD, and region. Individual models are then constructed separately for each of these factors. AVF, arteriovenous fistula; —, referent or comparator group; HTN, hypertension.

[a]Percentage relative annual change.

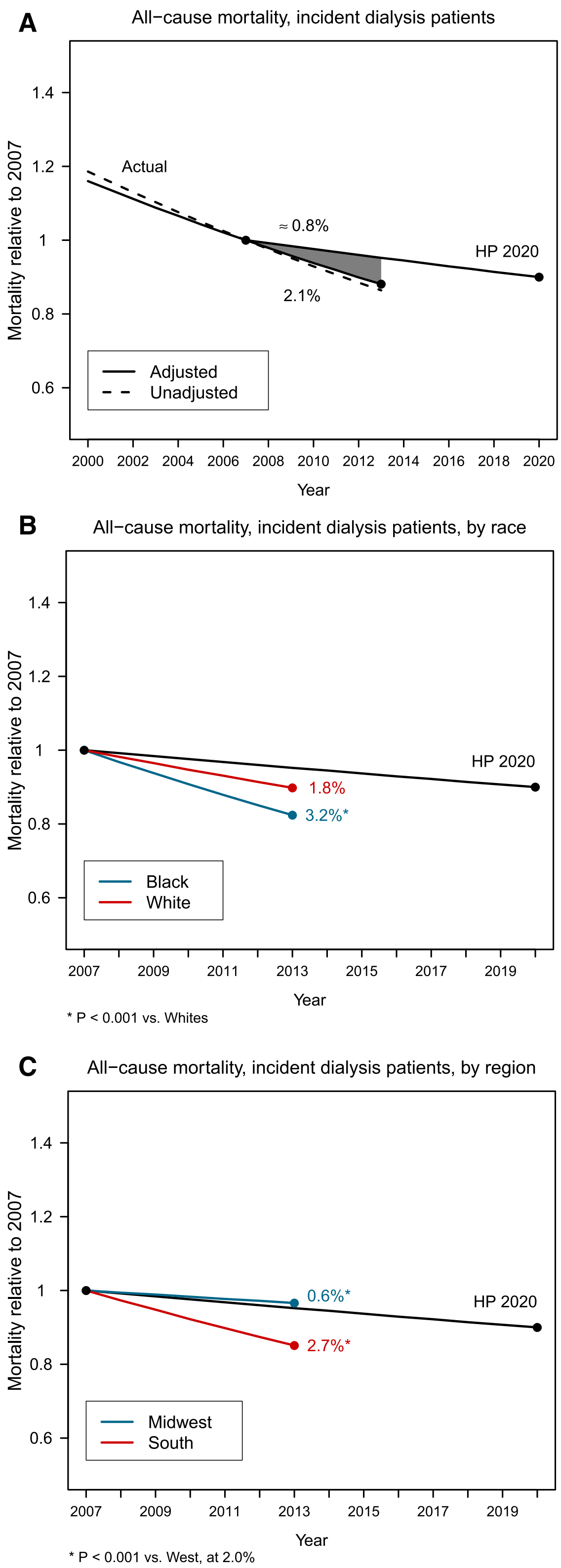

Figure 2. | Adjusted all-cause mortality decreased annually in patients on incident dialysis. Panel (A), overall; panel (B), by race; panel (C), by region. HP 2020, Healthy People 2020.

(between 4.9% and 5.1%) across ESRD cause groups. Improvement by region varied significantly but across a narrow range from 4.5% in the South to 5.3% in the Midwest.

Diabetes as a Cause of ESRD

The HP 2020 goal for diabetes as a cause of ESRD (CKD-9.1) is again a 10% improvement by 2020 (approximately 0.8% per year) using 2007 as the base year. These data cannot address progress toward this goal directly, because the denominator used is the United States population as a whole. However, a related question of whether diabetes is decreasing proportionally as a cause of ESRD among all patients who develop ESRD can be addressed. Using results from form CMS-2728, on which the cause of ESRD is specified, there seems to be little evidence that diabetes is becoming less important as a cause of ESRD. The annual percentage improvement (decrease) was only 0.2% from 2000 to 2013. Although statistically significant ($P<0.001$), this would correspond to an anticipated decrease of only approximately 2.6% between 2007 and 2020. Racial variation was significant ($P<0.001$), with no evidence for decrease for white patients but 0.5% and 1.4% annual decreases for black patients and patients of other races, respectively.

Predialysis Care

Two major goals regarding predialysis care are increasing the percentages of patients who receive nephrologist care 12 months before dialysis initiation and have a functioning or maturing AVF at time of hemodialysis initiation. The nephrology care target is an increase from 27.1% in 2007 to 29.8% in 2020 (CKD-10), an absolute increase over this period of 2.7% (and a relative increase of approximately 10%), meaning that achieving this would require relative annual improvements (increases) of approximately 0.8% per year. Between 2007 and 2013, the annual relative increase was actually 2.8%, or more than three times greater than the goal. As shown in Table 2, there is an ordinal increase by ascending age group: relative annual increases are 0.1% for those ages 18–44 years old, 2.0% for those ages 45–64 years old, 3.1% for those ages 65–74 years old, and 4.4% for those ages ≥75 years old (all $P<0.001$ compared with the referent group; ages 64–75 years old). The increases for black and white patients were statistically identical (2.9% versus 2.8%, respectively); this was also the case for sex (2.8% for men and 2.7% for women). However, there was a more than twofold variation between regions: 1.8% for the South region ($P<0.001$ compared with the referent West region) and 3.7% for the Northeast region ($P=0.03$ compared with the West).

The goal for the percentage of patients with a functioning or maturing AVF at dialysis initiation is an increase from 31.8% in 2007 to 35.0% in 2020 (CKD-11.3), an absolute increase over this period of 3.2% (and a relative increase of 10%). Progress has been substantial, with an overall relative annual increase of 2.4% between 2008 and 2013. Increase was greatest (at 3.4%) for patients ages ≥75 years old compared with the referent group (ages 65–74 years old) at 2.6%, but this difference was not statistically significant (Table 2). The relative annual increase for patients ages 18–44 years old was only 0.9% ($P<0.001$ versus ages 65–74 years old). Annual increases were greater for black than for white patients (3.2% versus 2.3%; $P<0.01$). Increases were greater for patients with diabetes (2.6%) and hypertension (2.9%) as causes of ESRD than for those with GN (0.5%) or other causes (0.7%).

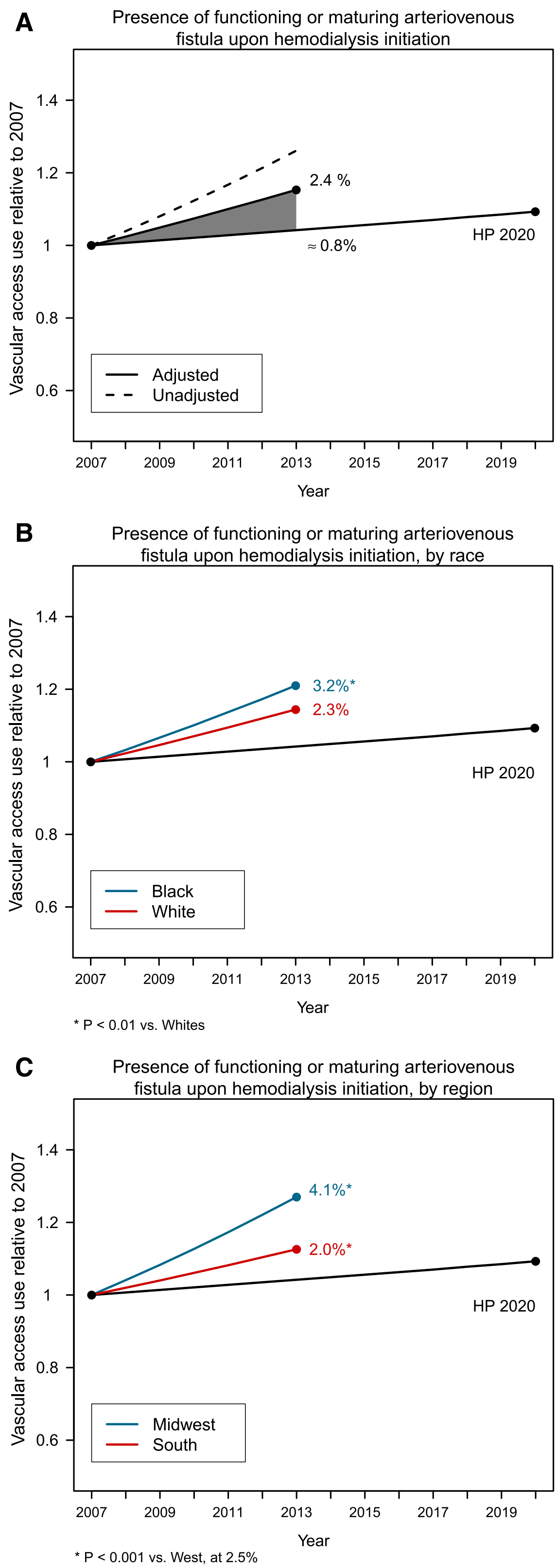

Figure 3. | Adjusted rate of presence of a functioning or maturing arteriovenous fistula on hemodialysis initiation increased annually. Panel (A), overall; panel (B), by race; panel (C), by region. HP 2020, Healthy People 2020.

Adjusted differences between regions varied more than twofold: 2.0% for the South (P=0.02 versus the referent West; 2.5%) to 4.1% for the Midwest (P<0.001) versus the West) (Figure 3).

Discussion

Recognizing the public health importance of CKD and ESRD, the HP 2020 initiative established a range of goals for patients with predialysis CKD, patients receiving maintenance dialysis, and recipients of renal transplants (3). We sought to specifically examine progress toward the HP 2020 goals in addressing all-cause mortality in patients on incident and prevalent dialysis, cardiovascular mortality in prevalent patients, and predialysis care in the form of AVF placement and nephrology care in the year before dialysis initiation. Additionally, we examined the issue of diabetes as a cause of ESRD, because it is related to the HP 2020 goal of reducing ESRD in patients with diabetes. Our findings suggest substantial progress on many fronts in the care of patients with kidney disease from approximately 2000 to 2013. Thus, progress has generally exceeded the targets set in 2006–2007 by the HP 2020 initiative, and the campaign could, therefore, be considered a success, at least for the goals that we analyzed. Although in retrospect these goals now seem conservative, caution should be exercised before overly aggressive goals are established for the future, given that the reasons for these improvements are uncertain, the improvements seem unlikely to continue indefinitely, and the gains have not been shared equally across the nation.

The public health improvement effort in dialysis can be traced back to at least 1989, when the Dallas Conference on Morbidity and Mortality and Prescription of Dialysis was convened (6). At this seminal meeting, attempts were made to assess the status of care in patients receiving maintenance hemodialysis. Other major milestones in this broad health improvement effort include development of the first National Kidney Foundation Kidney Disease Outcomes Quality Initiative Clinical Practice guidelines (7) and CMS-led initiatives, such as the 1998 introduction of Clinical Performance Measures (8), the 2003 National Vascular Access Improvement Initiative (9), and the 2008 implementation of the Conditions for Coverage for ESRD Facilities (10). As a sign of the evolving importance of kidney disease in the larger public health sphere, kidney disease–related goals were first incorporated into the 2010 HP initiative and further refined and expanded in the 2020 initiative. The HP initiative differs from other efforts in its pronounced emphasis on hard outcomes, such as mortality, rather than on process measures or surrogate outcomes.

The survival gains observed in patients on dialysis are impressive; the annual percentage decrease in mortality from 2000 to 2013 exceeded, by over threefold, the hoped for rate established in 2007 for the 2020 target. The number of person-years saved by progress beyond that sought in the HP 2020 goals can be roughly estimated under the assumptions that the times of death and censoring were uniformly distributed throughout the year and that the censoring rate for the survivors was the same as the observed censoring rate. The annual expected patient mortality can, therefore, be calculated for the scenario in which the decline in the death rate had (merely) matched the HP 2020 goal and compared with the observed mortality rate, with the difference representing excess patient-years of life saved. Under these assumptions, the nephrology community's progress in exceeding the HP 2020 has contributed to an additional 12,798 patient-years of life, contributing, in part, to a prevalent dialysis population that has grown from approximately 287,000 in 2000 to 468,000 in 2013 (1). Not unexpectedly, the improvement has been greatest for patients ages 18–44 years old; because younger patients invariably have the longest projected survivals, they will contribute a disproportionate share of the total years of life saved. Remarkably, however, even for patients ages ≥75 years old, mortality decreased by more than twice the overall rate sought in the HP 2020 goals.

However, how these impressive gains have been achieved remains unclear. Several possible explanations can be considered but remain entirely speculative. First, the rapid growth (and associated expenses) of maintenance dialysis over the past several decades may have resulted in maturation of the systems of care that render health care to patients on dialysis. Many changes to the provider landscape have occurred during the period studied, such as substantial consolidation. It is possible, although far from certain, that this led to greater consistency in care; the US Renal Data System data suggest improvements in mortality and hospitalization rates across a broad range of providers. Other changes may have occurred, such as increased specialization and professionalism in dialysis nurse and technician training and more consistent application of protocols for anemia and secondary hyperparathyroidism treatment. Although it is far from clear that protocolized approaches broadly translate into improved outcomes, such approaches may have collateral benefits, often termed center effects, in which an individual dialysis facility that improves on one front (such as implementing anemia treatment protocols) also improves on certain others (such as implementing infection control protocols) that actually confer the benefit to patients. Second, the surveys required to certify dialysis units for reimbursement became markedly more rigorous after the 2008 implementation of the CMS Conditions for Coverage, which could also have improved care in ill-defined ways (10).

Improvement in cardiovascular-related mortality has been even more dramatic than in that in all-cause mortality, with a more than sixfold larger improvement than was established for the 2020 target. Perhaps unexpectedly, improvement was significantly greater for patients ages ≥75 years old than for younger patients. As with all-cause mortality, the reasons are uncertain. One reason that may at least partially account for this finding may be increased penetration of drugs, such as β-adrenergic blockers and renin-angiotensin-aldosterone system inhibitors, into the maintenance dialysis population. For example, use of β-blockers increased in United States patients on dialysis from approximately 43% in the Dialysis Outcomes and Practice Patterns Study II data from 2002 to 2004 (11) to approximately 59% in 2011 (12). Notably, potentially beneficial effects of β-blockers were posited nearly two decades ago (13). Whether this increase was because of targeted actions by nephrologists or a general carryover phenomenon originating in the general medical population is uncertain. At present, whether increasing use of such agents, especially β-blockers, helps prevent heart failure–related, arrhythmia-related, and/or other cardiac deaths is highly speculative.

The incident dialysis population has also benefitted from marked survival gains, underscoring the continuing reality that the initiation period is fraught with risk. Although the improvement in all-cause mortality is not as great as in prevalent patients, the annual relative percentage decrease from 2000 to 2013 was still twice as great as the target established in 2007 for 2020. This improvement may be related to infection risk and permanent access placement. Rates of infection-related death after dialysis initiation show a pattern unlike those of sudden death, other causes of cardiac-related death, and unknown causes of death, all of which peak in the first month and then decrease steadily over the ensuing 6 months (2). Infection rates peak at month 2 (by which time tunneled dialysis lines have likely been in use for 4–8 weeks) and remain relatively elevated for several months thereafter. Possibly, then, increasing rates of permanent access placement might have resulted in improved 90-day survival rates. Use of tunneled hemodialysis catheters has been at the center of quality improvement efforts at least since the 2003 National Vascular Access Improvement Initiative (renamed the Fistula First Breakthrough Initiative in 2005). The effort met with initial success mainly in prevalent patients, and concerns arose that low rates (<15%) of AVFs in incident patients (who represented approximately one third of all patients 12–15 years ago) would impose a ceiling on the number of patients who could ever be using an AVF at one time (9). Our data suggest that, despite well founded concerns about AVF placement rates in incident patients, substantial improvement has occurred. The annual relative percentage improvement is roughly threefold greater than the HP 2020 target. Whether this is partially responsible for improvement in the all–cause mortality rate in incident patients should be further explored.

Improvement in rates of AVF placement and use may, in turn, be related to improvement in rates of predialysis nephrologist care at least 1 year before initiation. Again, actual improvements between 2000 and 2013 exceeded the HP 2020 target more than threefold since the goal was established in 2007. Introduction of the CKD stage classification scheme by CMS in 2005, whereby some measure of the severity of CKD could be quantified for billing purposes, may have been a factor. Additionally, automated reporting of eGFR on routine laboratory reporting may have contributed (14,15), but this is far from certain (16). If these suppositions are correct, they constitute a powerful public health message about how early referral to the appropriate specialist (the nephrologist) can facilitate a procedure (creation of an AVF) that results in reduced mortality in an ill and vulnerable population (patients on incident dialysis), a hypothesis backed by evidence (17).

Although efforts to reduce ESRD caused by diabetes cannot be directly addressed with these data, we found no evidence that diabetes as a cause of ESRD is decreasing relative to other causes. Our data suggest only that diabetes remained as important a cause of ESRD in 2013, in relative terms, as it was in 2007. This does not mean that public health efforts to decrease diabetes as a cause of ESRD on a population-wide basis are unsuccessful; data from the HP 2020 website suggest that the target of 151.8 per million population is well on the way to being met, because the rate decreased from 168.7 in 2007 to 154.0 in 2012 (18). Indeed, given the increase in the prevalence of diabetes over time (19), stabilization in the percentage of patients with diabetes as their primary cause of ESRD might be considered a modest victory.

Despite these substantial improvements, the 2020 landscape is uncertain, even on the basis of 2013 data. For most outcomes analyzed, whether event rates will continue to decline as rapidly as they have is unknown. For example, will relative annual all–cause mortality decline by >2.5% per year into 2020 and beyond? This is particularly important, because it is unclear if the recent gains will continue, making it difficult to leverage the effect of specific outcomes to the maximum benefit of all patients, including the most ill or refractory patients. Potential exceptions may be the goals related to predialysis care. For example, if current rates of AVF placement were to continue until 2020, they would project to a 39% relative increase between 2006 and 2020. Although not every patient with advanced CKD is an AVF candidate, it seems at least theoretically possible that rates could be far higher than they are; the rate is 69% in Japan (20). Perhaps even more attainable is a high rate of predialysis nephrology care in the year before initiation; given the Affordable Care Act and the increasing role of accountable care organizations in health care, the nephrology community might reasonably aspire to a rate of >90%.

Another source of caution concerns the distribution of gains observed. Regarding race, differential achievement of the goals is complex. Black patients improved relatively more than white patients in prevalent all–cause mortality, incident all–cause mortality, and cardiovascular mortality. However, the reasons remain unclear, and our findings serve as a reminder that efforts to study reasons that certain racial or ethnic groups demonstrate higher survival should be leveraged to improve the survival of patients on dialysis of all races. The situation seems different with regard to predialysis care, because black patients have lower rates of predialysis nephrology care and AVF placement. Improvement in rates of predialysis nephrology care was similar for black and white patients. Given widely acknowledged disparities in care by race (21), even equal rates of improvement could be considered a modest victory, although greater efforts to improve this care gap are needed. Increasing access to a nephrologist is important, because pre-ESRD care is associated with improved first year survival, selection of peritoneal dialysis over hemodialysis, and exploration of transplant as an option (17). In contrast, AVF placement rates increased relatively more in black than in white patients, closing that care gap and perhaps contributing to the relatively greater improvement in 90-day survival in black patients.

Finally, differential outcomes by geographic region remain a vexing problem. In many areas of health care, such as organ transplantation, diminishing the effect of geographic variation on differences in care and outcomes is a policy focus. We found a clear association of geography with outcomes. For example, we found a twofold difference between regions in predialysis access to a nephrologist and AVF placement and a more than fourfold difference in incident mortality. Variation in care may be related to historical, social, cultural, economic, demographic, or other features, such as climate or geologic features; controlling for such factors may be difficult analytically, and some comparisons may not be analytically sound (5). It may even be unrealistic to expect outcomes to improve equally across regions, even if the aspiration is laudable. The ultimate goal of studying geographic variation is to ascertain which, if any, of the preceding factors may be partially modifiable and then, encourage health entities such as ESRD Networks and state health departments, regulatory bodies such as CMS, and insurers to focus efforts on improvement.

The time to establish HP 2030 goals will soon arrive. Given the changing landscape of kidney disease in general and dialysis in particular, considering how goals might be better refined and targeted is appropriate. With the success in reaching many of the HP 2020 goals, the wisdom of even more aggressive goal setting for HP 2030 should be debated by the nephrology community. Regarding the overarching paradigm for future public health efforts, the nephrology community should consider whether, given the importance of geographic variation, region-specific goals might be appropriate. Although this might complicate public health messaging, targeted goal setting could help lower-performing regions devote most of their efforts to a few key goals; higher-performing regions, in contrast, might be better equipped to target goals across a wider front. Regarding specific goals, there is no shortage of areas requiring urgent attention. For patients new to dialysis, improvements in sudden death rates and transitions from catheters to permanent accesses should be considered as future goals; for all patients, infection-related hospitalizations and deaths, especially from difficult to treat infections, should be targeted. Additionally, the means to improving rehospitalization rates should be scrutinized, and goals should be set accordingly. From a policy perspective, the utility of setting goals for increased use of home-based therapies should be debated. Finally, the nephrology and public health communities should consider whether to include patient-centered goals. Interest in this area is resurging (22); recent intriguing data suggest, for example, that patients rate concerns about fatigue, coping with disease burden, and sleep quality more highly than concerns about mortality and cardiovascular morbidity (23). Although symptoms such as these are difficult to quantify and validated instruments for each outcome must be developed and rigorously tested, incorporating patient-centered goals might drive metrics to measure these symptoms and alter how dialysis is performed.

Our analysis has several limitations. First, we adjusted for case mix variation by using only age, sex, race, and cause of ESRD as adjusters. Patients with kidney disease, those who do and do not require dialysis, may have changed in other unappreciated ways. However, our approach is relatively standard and has been used extensively (12). Second, for purposes of broad public health messaging and to preserve framework compatibility with the HP 2020 goals, we assumed linearity of changes between the years analyzed. Although visual inspection suggested that the rates of change for all goals studied were broadly constant, we did not conduct formal analyses to determine whether a strictly constant rate of change provides the best fit for the data. As noted above, using the calculated slopes and current data to project out to 2020 is fraught with difficulty, because some outcomes (for example, all-cause mortality) are unlikely to continue decreasing indefinitely at the present rate. Third, many HP 2020 goals have undergone minor revisions in recent years. Most revisions are extremely small (for example, adjustments in targets changing a few tenths of a percent). Because most revisions occurred in 2013 and the last year of our data was 2013, we thought it fair to compare the rate of changes observed up to and including 2013 with goals originally established in 2007. Even if the observed changes were compared with targets revised in 2013, the central message, namely that improvement has substantially outstripped the HP 2020 goals, would be unchanged.

In conclusion, all-cause mortality has decreased substantially in patients on prevalent dialysis. In incident patients, the survival gain has been less but still exceeds the HP 2020 target. Cardiovascular mortality has improved strikingly, with the greatest relative annual improvement in the oldest patient group. Diabetes remains unchanged as a cause of ESRD, but this does not mean the rate of new patients with ESRD caused by diabetes has not decreased. Predialysis care, measured as the percentage of patients receiving nephrology care ≥12 months before dialysis initiation or the percentage with functioning or maturing AVFs at dialysis initiation, seems to have improved and could account for some of the survival gains observed. The reasons that patients are living longer on dialysis is unknown, but one possibility is that system factors governing how dialysis is provided on a large scale may be contributing. These gains have not been shared equally, however, particularly geographically, and close attention is required to ensure that all patients, regardless of demographic characteristics or geographic location, continue to benefit from kidney disease–related public health initiatives.

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Disclosures

None.

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