

# Impact of Quality Improvement Efforts on Race and Sex Disparities in Hemodialysis

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**R**ACE AND SEX DISPARITIES IN health outcomes have been extensively documented.<sup>1</sup> For example, blacks and women are less likely to receive kidney transplantation than whites and men.<sup>2,3</sup> By improving the process of care, quality improvement efforts have the potential to reduce race and sex disparities in health outcomes.<sup>4,5</sup> Alternatively, the patient, clinician, and societal factors that created disparities in the first place may persist and result in a continued gap between whites and blacks (or men and women) even as outcomes for both white and black patients improve.<sup>6,7</sup> Examples of such factors include affordability of health care, geographic access, transportation, education, knowledge, literacy, health beliefs, racial concordance between patient and clinician, patient attitudes and preferences, competing demands such as work or child care, and clinician bias.<sup>8</sup>

Little is known about the actual impact of quality improvement activities on health disparities.<sup>8</sup> It would be particularly interesting to know if successful quality improvement efforts that do not specifically target race or sex have a beneficial impact on health disparities. This study examines the impact of national quality improvement activities on race and sex disparities among hemodialysis patients.<sup>9,10</sup>

## METHODS

### Subjects

The Centers for Medicare and Medicaid Services (formerly the Health Care

For editorial comment see p 1033.

**Context** By improving the process of care, quality improvement efforts have the potential to reduce race and sex disparities. However, little is known about whether reductions actually occur. National quality improvement activities targeting hemodialysis patients provide an opportunity to examine this issue.

**Objective** To determine the effect of quality improvement efforts on race and sex disparities among hemodialysis patients.

**Design, Setting, and Subjects** Longitudinal study of 58 700 randomly selected hemodialysis patients from throughout the United States in 1993 through 2000.

**Intervention** Medicare-funded quality improvement project involving monitoring of patient outcomes, feedback of performance data, and education of clinicians at dialysis centers.

**Main Outcome Measures** Changes in hemodialysis dose (Kt/V), anemia management (hemoglobin level), and nutritional status (albumin level).

**Results** The proportion of all patients with an adequate hemodialysis dose increased 2-fold. In 1993, 46% of white patients and 36% of black patients received an adequate hemodialysis dose compared with 2000 when the proportions were 87% and 84%, respectively. Thus, the gap between white and black patients decreased from 10% to 3% ( $P < .001$ ). The gap between female and male patients decreased from 23% to 9% over the same period ( $P = .008$ ). The proportion of all patients with adequate hemoglobin levels increased 3-fold. The proportion of all patients with adequate albumin levels remained unchanged. Race and sex disparities in anemia management and nutritional status did not change significantly.

**Conclusions** Quality improvement efforts have a variable impact on race and sex disparities in health outcomes. Further work is needed to determine how quality improvement methods can be targeted to reduce health disparities.

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Financing Administration) randomly selected several thousand adult hemodialysis patients each year as part of a quality improvement project.<sup>9,10</sup> The number of subjects sampled annually increased gradually from 6141 in 1993 to 8416 in 2000.<sup>11,12</sup>

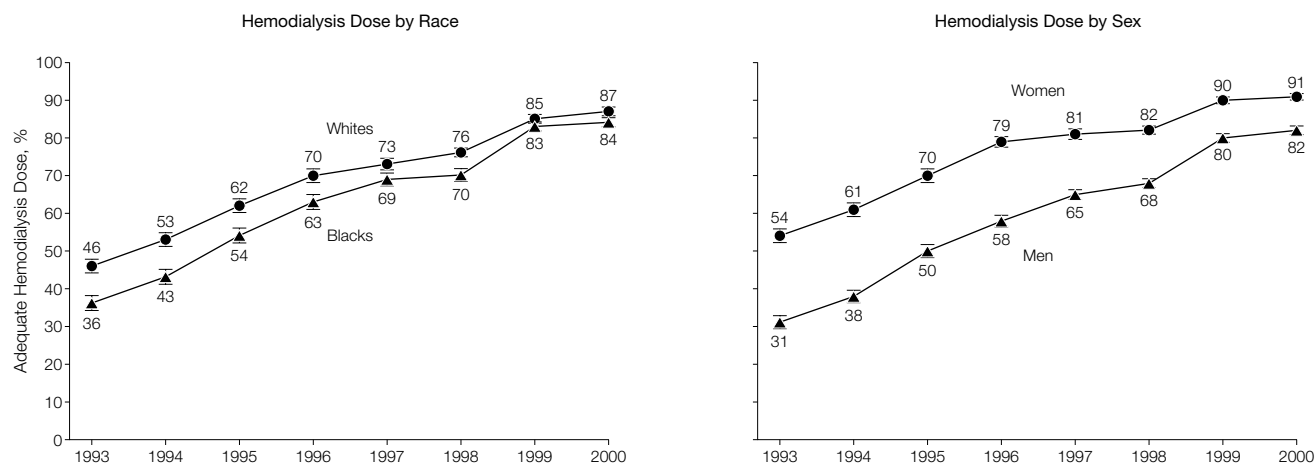
### Intervention

The national intervention involved several steps.<sup>9,10</sup> First, a work group composed of individuals with expertise in hemodialysis treatment identified indicators that represent key components of dialysis care. As such, the indicators could be used to trigger quality improvement activities. This work

group selected (1) urea reduction ratio as an indicator of adequate hemodialysis dose; (2) hematocrit as an indicator of anemia management; (3) albumin level as an indicator of nutritional status; and (4) blood pressure. These indicators are all linked with a hemodialysis patient's mortality, morbidity, and/or quality of life.<sup>13-15</sup> For ex-

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**Figure 1.** Changes in Adequacy of Hemodialysis Dose, 1993-2000

The gap between white and black patients decreased from 10% (95% confidence interval [CI], 7%-13%) to 3% (95% CI, 1%-5%) ( $P < .001$ ). The gap between female and male patients decreased from 23% (95% CI, 21%-25%) to 9% (95% CI, 8%-10%) ( $P = .008$ ).

ample, a 5-point increase in urea reduction ratio and a 0.1-g/dL increase in albumin level are associated with 11% and 13% reductions in mortality risk, respectively.<sup>14,16</sup> In addition, treatment of anemia is associated with improvements in many aspects of a hemodialysis patient's quality of life, including energy and activity level, sleep, disease symptoms, and psychological affect.<sup>13</sup> Second, regional quality oversight organizations (called End Stage Renal Disease Networks) monitored these indicators every October, November, and December for the national random patient sample. Work groups later modified the indicators by substituting Kt/V (a related measure of hemodialysis dose in which K represents dialyzer clearance [expressed in milliliters per minute] and is multiplied by time and divided by the volume of water a patient's body contains) for urea reduction ratio, substituting hemoglobin for hematocrit, and eliminating blood pressure. Third, the Centers for Medicare and Medicaid Services distributed region-specific performance data to all clinicians. Fourth, the End Stage Renal Disease Networks sent educational material to clinicians, conducted workshops, and supervised poorly performing facilities.

### Outcomes

The Centers for Medicare and Medicaid Services asked dialysis facility staff to abstract medical records to obtain quality indicator data for each patient in the national random sample for the months of October, November, and December. The Centers for Medicare and Medicaid Services then averaged the first monthly value for hemodialysis dose, hematocrit/hemoglobin level, and albumin level and compared patient-specific indicators against the following guideline-based benchmarks: urea reduction ratio of 65 or higher (or Kt/V  $\geq 1.2$ ), hematocrit of 33% or higher (or hemoglobin  $\geq 11$  g/dL), and albumin level of 3.5 g/dL or higher with the bromocresol green method (or  $\geq 3.2$  g/dL with the bromocresol purple method).<sup>17-19</sup> From publicly available annual reports, these data were obtained in sufficient detail to perform the analyses presented in this article.<sup>11,12,20-25</sup> The use of aggregational data from publicly available reports exempted this study from institutional review board approval. The first year of the project involved data collection only, while subsequent years involved data collection, feedback, and educational activities.

### Statistical Analysis

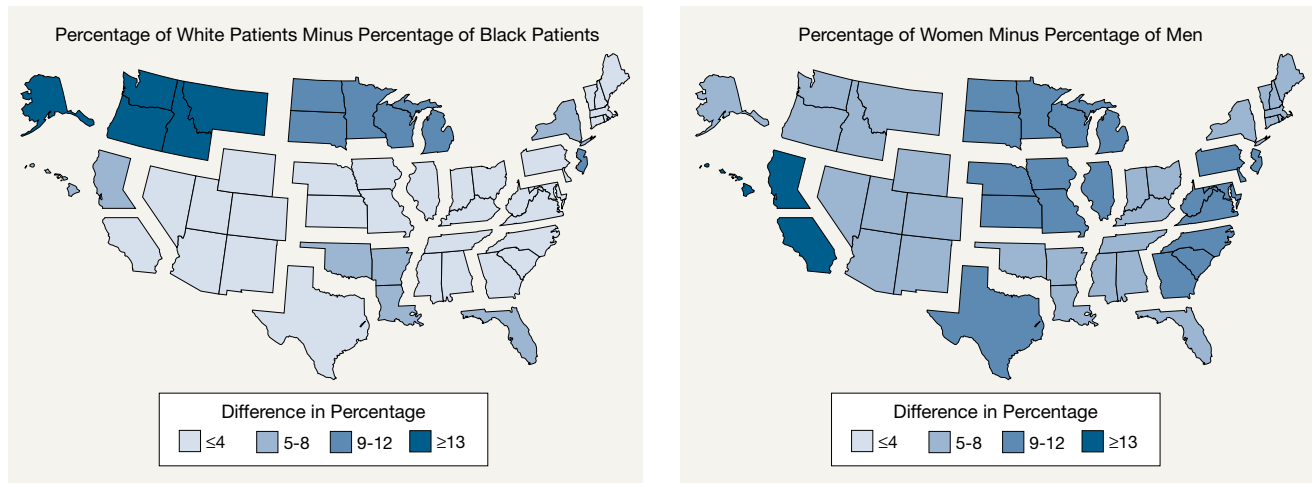
The proportion of all patients who achieved an adequate hemodialysis dose for each year from 1993 through 2000 was examined, as well as the proportion of whites and blacks achieving these benchmarks. Logistic regression was used to examine the relationship between achieving an adequate hemodialysis dose and (1) race, (2) year, and (3) race  $\times$  year interaction. A statistically significant interaction between race and year indicated that the gap between whites and blacks in achieving an adequate hemodialysis dose changed over this period. The relationship between achieving an adequate hemodialysis dose and (1) sex, (2) year, and (3) sex  $\times$  year interaction was examined. Similar analyses to examine other quality indicators were used.  $P < .05$  was the level of significance used in this study and JMP software (version 3.2, SAS Institute Inc, Cary, NC) was used to perform statistical analyses.

## RESULTS

### Subject Characteristics

Of 58 700 subjects, 53% were white, 37% were black, 52% were men, 38% had renal failure due to diabetes mellitus, and 27% had renal failure due to hypertension. The age distribution was

**Figure 2.** Differences in Percentage of Patients Receiving an Adequate Hemodialysis Dose by Race and Sex in 2000



The difference between white and black patients ranged from -2 to 15 across regions. The difference between female and male patients ranged from 6 to 14.

18 to 44 years, 18%; 45 to 64 years, 37%; and 65 years or older, 45%.

**Hemodialysis Dose**

The proportion of all patients with an adequate hemodialysis dose increased 2-fold from 43% in 1993 to 86% in 2000. In 1993, 46% of white patients and 36% of black patients received an adequate dose (FIGURE 1). Corresponding figures for 2000 were 87% and 84%, respectively. Thus, the gap between white and black patients decreased from 10% to 3% (parameter estimate for race × year interaction = -0.015; 95% confidence interval [CI], -0.024 to -0.006; *P* < .001). In 1993, 54% of female patients and 31% of male patients received an adequate hemodialysis dose (Figure 1). Corresponding figures for 2000 were 91% and 82%, respectively. Thus, the gap between female and male patients decreased from 23% to 9% (parameter estimate for sex × year interaction = -0.012; 95% CI, -0.021 to -0.003; *P* = .008). In addition, the magnitude of gaps between whites and blacks and between women and men varied by region. Eleven regions had race gaps of 4% or less (FIGURE 2). However, no region had similarly small sex gaps (Figure 2).

**Anemia Management**

The proportion of all patients with an adequate hemoglobin level increased 3-fold, from 26% in 1993 to 74% in 2000. As indicated in FIGURE 3, the gap between white and black patients varied from 2% to 6% during this period. There was no significant change in the magnitude of the gap during the interval (*P* = .90). The gap between male and female patients varied from 2% to 7%, and did not change significantly during the period (*P* = .14).

**Nutritional Status**

The proportion of all patients with an adequate albumin level did not change significantly from 78% in 1993 to 80% in 2000. The gap between black and white patients varied from 2% to 6%, and did not change significantly during this period (*P* = .43). The gap between male and female patients varied from 3% to 7% and did not change significantly during this period (*P* = .09).

**COMMENT**

Dramatic improvements in adequate hemodialysis dose from 1993 through 2000 were accompanied by reductions of about two thirds in race and sex gaps in a large, nationally representative sample. Similarly large improve-

ments in anemia management were not accompanied by reductions in race and sex gaps. In addition, neither overall nutritional status nor associated race and sex gaps changed during this interval. The reduction in race and sex gaps in hemodialysis dose suggests that quality improvement efforts may reduce disparities. However, sizeable gaps were still present for hemodialysis dose in 2000. This, along with persistent gaps related to anemia and nutrition, indicates that current quality improvement efforts may be insufficient to eliminate race and sex disparities.

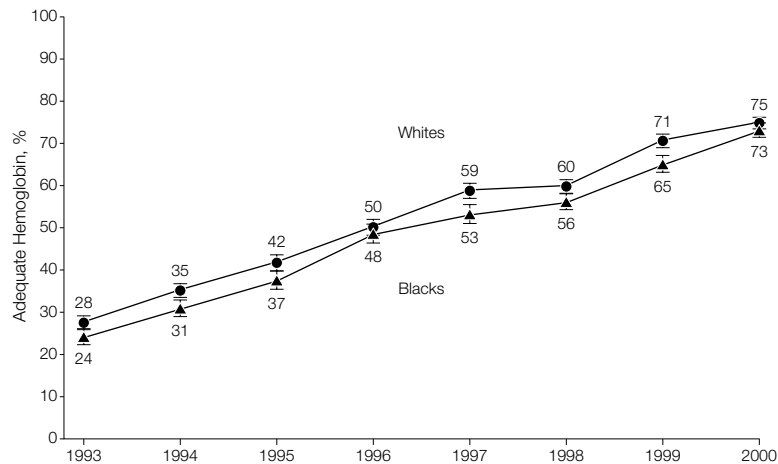
These findings raise several points. First, the observed changes appear to be due to the Medicare quality improvement project. While it is not possible to establish a causal relationship without a concurrent control group, a previous study found evidence for a dose-response relationship. Specifically, the End Stage Renal Disease Networks that engaged in more intensive intervention had larger quality improvements.<sup>10</sup> It is also worth noting that there was an approximately 5% decrease in hemodialysis patient mortality rates during the study period.<sup>26</sup> This improvement is consistent with several previous studies that noted a link between intermediate outcomes, such

as hemodialysis dose, and global outcomes, such as mortality and morbidity.<sup>14-16,27,28</sup>

Second, all of the quality indicators did not improve. The 3 indicators examined require different levels of involvement by clinicians and patients. Optimizing dialysis dose requires clinicians to adjust dialysis prescriptions (eg, by increasing blood flow rate) and patients to stay for the full treatment time.<sup>29</sup> Clinicians also play a key role in anemia management (eg, by administering intravenous erythropoietin). However, patient medical factors may limit the response to erythropoietin.<sup>30</sup> By contrast, improvements in albumin levels largely depend on patients' ability to follow dietary recommendations (eg, to increase intake of protein-containing foods) and on non-nutritional factors such as chronic inflammation.<sup>31,32</sup> The ability of clinicians to increase dialysis prescriptions or administer drugs during treatment may explain why adequate dialysis doses and hemoglobin levels improved while albumin levels did not.

Third, race and sex disparities were not eliminated. This is especially concerning because the magnitude of quality improvement from 1993 through 2000 was often much larger than baseline race and sex gaps. For example, the proportion of all patients receiving an adequate dialysis dose increased by about 45% from 1993 to 2000 (from approximately 40% to 85%) while the baseline race gap was 10% (Figure 1). Because Medicare covers the cost of dialysis-related care, the persistent race and sex gaps cannot be attributed to lack of health insurance.<sup>33</sup> A combination of patient and clinician factors is likely to be responsible for health disparities. For example, black and male patients are larger on average than white and female patients. As a result, they may need a longer treatment time to achieve an adequate dialysis dose.<sup>34</sup> However, nephrologists often fail to increase prescribed treatment time appropriately for larger patients.<sup>35</sup> Blacks and men are also more likely to

**Figure 3.** Changes in Adequate Hemoglobin Levels, 1993-2000



There was no significant change in the gap between white and black patients ( $P=.90$ ).

shorten or skip treatments than whites or women.<sup>36</sup> Similarly, the proerythropoietic effect of androgens may contribute to the differences in hemoglobin levels between men and women.<sup>30</sup> However, clinicians should be able to overcome this biological difference by administering a larger dose of erythropoietin.<sup>18</sup>

Fourth, quality improvement methods should be better used to eliminate disparities. The marked regional differences in the magnitude of disparities (Figure 2) suggest that such disparities are not an inherent feature of dialysis treatment. Studying patient and clinician factors in regions with minimal disparities may help determine what interventions are needed in regions with larger disparities. Increasing the overall intensity of quality improvement efforts may also be helpful. Two earlier reports suggested that intensive treatment of hypertension and depression in the context of clinical trials largely eliminated disparities.<sup>37,38</sup> By contrast, the intensity of intervention and follow-up in quality improvement activities is typically less than that in clinical trials.

Fifth, there are different ways to quantify health disparities. Instead of focusing on absolute differences, the results presented in the figures could also be used to calculate relative measures

of disparity. For example, the absolute difference between whites and blacks in 1993 was 10% (Figure 1). This corresponds to a white-to-black odds ratio of 1.51 (95% CI, 1.36-1.69). In 2000, the absolute difference was 3% while the odds ratio was 1.27 (95% CI, 1.12-1.45). Absolute and relative measures generally provide complementary information, but sometimes give apparently conflicting results when evaluating changes over time.<sup>1,39</sup> It is also worth noting that a reduction in disparities between whites and blacks may occur in several ways: (1) whites improve but blacks improve even more, (2) whites remain unchanged and blacks improve, and (3) whites worsen and blacks remain unchanged or improve.

Limitations of the study include the fact that other local and regional quality improvement activities were probably going on at the same time as the Medicare-funded national initiative.<sup>19</sup> Thus, the observed changes may represent the cumulative effect of multiple quality improvement activities. Nevertheless, these cumulative activities had a variable impact on health disparities. In addition, demographic and medical characteristics such as socioeconomic status and comorbid conditions were not available and could not be adjusted for. However, previous

work with hemodialysis patients suggests that process-of-care factors are much more important than such demographic and medical characteristics in determining quality outcomes.<sup>29,40</sup> Data to determine which facility characteristics are predictive of greatest improvement were not available. Further work is needed to examine clinician characteristics, to study disparities among nonrenal patients, and to explore other types of health dis-

parities, such as those related to patient socioeconomic status and comorbid conditions.

In conclusion, quality improvement methods are promising, but insufficient in their current form to eliminate health disparities among hemodialysis patients. Race and sex disparities should be targeted as part of quality improvement activities. Outcomes of whites, blacks, men, and women should be monitored separately, and race- and sex-specific

quality improvement methods should be developed when appropriate.<sup>5,8</sup>

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