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Title
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Permalink
https://escholarship.org/uc/item/7xp19300

Journal
Medical care, 44(12)

ISSN
0025-7079

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Publication Date
2006-12-01

DOI
10.1097/01.mlr.0000237423.05294.c0

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The Association Between Clinical Care Strategies and the Attenuation of Racial/Ethnic Disparities in Diabetes Care

The Translating Research Into Action for Diabetes (TRIAD) Study

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Objective: We sought to determine whether greater implementation of clinical care strategies in managed care is associated with attenuation of known racial/ethnic disparities in diabetes care.

Research Design and Methods: Using cross-sectional data, we examined the quality of diabetes care as measured by frequencies of process delivery as well as medication management of intermediate outcomes, for 7426 black, Latinos, Asian/Pacific Islanders, and white participants enrolled in 10 managed care plans within 63 provider groups. We stratified models by intensity of 3 clinical care strategies at the provider group level: physician reminders, physician feedback, or use of a diabetes registry.

Results: Exposure to clinical care strategy implementation at the provider group level varied by race and ethnicity, with <10% of black participants enrolled in provider groups in the highest-intensity quintile for physician feedback and <10% of both black and Asian/Pacific Islander participants enrolled in groups in the highest-intensity quintile for diabetes registry use. Although disparities in care were confirmed, particularly for black relative to white subjects, we did not find a consistent pattern of disparity attenuation with increasing implementation intensity for either processes of care or medication management of intermediate outcomes.

Conclusions: For the most part, high-intensity implementation of a diabetes registry, physician feedback, or physician reminders, 3 clinical care strategies similar to those used in many health care settings, are not associated with attenuation of known disparities of diabetes care in managed care.

Key Words: diabetes, quality of care, quality improvement, race and ethnicity, chronic disease

(*Med Care* 2006;44: 1121–1128)

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This study was jointly funded by Program Announcement number 04005 from the Centers for Disease Control and Prevention (Division of Diabetes Translation) and the National Institute of Diabetes and Digestive and Kidney Diseases, Grant #U58/CCU923530. Drs. Duru, Mangione and Brown received support from the UCLA Center for the Health Improvement of Minority Elders/Resource Center for Minority Aging Research, NIH/NIA/NCMHD, under Grant #AG-02-004. Drs. Mangione and Brown received support from the UCLA/ DREW Project EXPORT, NCMHD, P20MD000148/P20MD000182.

Presented at the 28th Annual Meeting of the Society of General Internal Medicine, New Orleans, Louisiana, May 12, 2005.

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ISSN: 0025-7079/06/4412-1121

Overall, Americans with diabetes receive less than half of most recommended processes of care[1,2] and minorities tend to receive lower-quality care than nonminorities.[1,3–8] In population based-samples, minorities with diabetes have poor control of key intermediate outcomes as well as greater rates than whites of both lower-extremity amputations and end-stage renal disease.[9,10] Racial/ethnic disparities in long-term complications of diabetes should be attenuated with equitable delivery of processes of care along with medical treatment that achieves equal control of intermediate outcomes for all racial/ethnic groups. Addressing multiple "upstream factors" such as patient attitudes and beliefs,[11,12] physician attitudes and beliefs,[13–15] and differences in resources[16–19] will likely improve disparities in diabetes care, whereas quality improvement programs that intervene directly on screening and treatment represent a complementary approach to this issue.[20,21] The latter approach is already being implemented within many health systems and may include specific clinical care strategies such as use of a diabetes registry, physician reminders, and individualized feedback to physicians. However, most evaluations of quality improvement programs for diabetes management do not report results by race/ethnicity and have not examined the association of specific program components with variation in racial/ethnic disparities in care.[22–25]

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The Translating Research into Action for Diabetes (TRIAD) study is a prospective, multicenter cohort study of quality of care for adults with diabetes enrolled within 10 managed care plans. Although intensity of clinical care strategy use and performance on quality measures vary between different TRIAD provider groups, black participants within TRIAD overall are less likely to receive hemoglobin A1c (HbA1c) testing, low-density lipoprotein (LDL) cholesterol testing, and influenza vaccinations compared with white patients.[6] Black, Latino, and Asian/Pacific Islander participants each had poorer control of at least one intermediate outcome when compared with white participants.

In the present study, we examine the quality of care provided to whites, black, Latino, and Asian/Pacific Islander participants in provider groups with both low-intensity and high-intensity use of clinical care strategies, using measures that have been previously shown to correlate with processes of care within the TRIAD study sample.[26] Specifically, we hypothesize that observed racial/ethnic disparities in this sample will be concentrated in provider groups with low-intensity implementation of clinical care strategies, with fewer disparities observed in provider groups with high-intensity implementation of clinical care strategies.

METHODS

Study Population

The TRIAD design has been reported previously.[27] The cohort was enrolled between July 2000 and August 2001 using random sampling techniques within 10 health plans and 68 provider groups, which served approximately 180,000 patients. Between 5% and 10% of patients within each plan had diabetes. Eligibility criteria for inclusion in TRIAD were a provider diagnosis of diabetes, along being 18 years or older, having continuous enrollment in a participating health plan for a minimum of 18 months, having at least 1 health care claim in the previous 18 months, having received the majority of diabetes care through the health plan, and having the ability to speak either English or Spanish. Nursing home residents, pregnant women, and persons unable to provide informed consent were excluded. The study protocol was reviewed and approved by Institutional Review Boards at all participating sites.

Of the 13,086 contacted and eligible persons, 11,928 (91%) completed the survey (56.6% by computer-assisted telephone interview and 43.4% by written survey). We could not contact many individuals. As endorsed by the Council of American Survey Research Organizations (CASRO),[28] we assumed that persons whom we could not contact or for whom we could not confirm eligibility had the same proportion eligible as those contacted. Under that assumption, the CASRO response rate was 69%. Medical records were reviewed for 8757 of these participants who completed surveys (73%). Information on provider group clinical strategies was available for 8597 participants with medical record information (98%). We had complete data on race/ethnicity for 7426 of these participants (86%), which represents our final analytic sample.

Measures

Trained reviewers abstracted medical records from the participants' primary care providers for the 18 months before the interview date. For 5% of randomly sampled cases, 2 masked reviewers each assessed the medical record independently. Inter-rater reliability (kappa) for the main process measures derived from medical record data varied slightly across each of 6 TRIAD sites, with a low value of 0.86 and a high value of 0.94.

Race/Ethnicity

Race/ethnicity was determined using questions derived from the 2000 U.S. Census.[29] On the basis of self-identification, participants were categorized as non-Hispanic white ("white"), black or non-Hispanic black ("black"), Latino or Hispanic ("Latino"), or Asian American/Pacific Islander ("Asian/PI"). Persons who were either not captured by these categories or were missing data for race/ethnicity were excluded from these analyses.

Clinical Care Strategies

The TRIAD study did not initiate specific interventions, but many of the provider groups in the study were using organizational clinical care strategies. We obtained information on use of these strategies in 63 of the 68 provider groups from standardized interviews of medical directors and other leadership personnel. Provider groups implemented different combinations of strategies with the goal of improving the quality of care for patients with diabetes. We were not able to verify compliance with strategy implementation at the level of care. Composite scores using the interview data were constructed to measure the intensity of use of 3 specific strategies at the provider group level, physician reminders, feedback on physician performance, and the use of a diabetes registry. The use of these measures has been shown previously to correlate with receipt of diabetes care processes.[26]

The methods used to calculate each of these 3 clinical care strategy scores are described in the Technical Appendix on the TRIAD website (http://www.triadstudy.org/triad_papers/technicalappendix1.pdf). Higher scores were related to more comprehensive systems of care delivery. For example, the majority of the provider groups scoring in the lowest quintile for each strategy were unlikely to implement that strategy at all, using no physician reminders, no feedback of physician performance, or having no diabetes registry in place. Provider groups in the highest quintile for physician reminders provided prompts to perform 3 recommended processes of care on average, using both preprinted guidelines and a list of patients with needed services. Groups in the highest quintile for performance feedback, on average, fed back information on performance of 11 measures for patients of a particular physician, such as rates of LDL cholesterol testing and LDL cholesterol values. Finally, most provider groups scoring within the highest quintile for diabetes registry use incorporated information on at least 5 quality indicators within a patient-specific electronic medical record such as dilated eye exams and influenza vaccination rates.

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Because physician feedback, physician reminders, and a diabetes registry may be used independently but are used simultaneously in some practice settings, we examined correlations between strategies. Diabetes registry use and intensity of physician reminders were moderately correlated ($r = 0.66$). Intensity of physician performance feedback was not strongly correlated with either of the other 2 strategies ($r < 0.5$ in each case). We chose to model each strategy individually while controlling for the other 2, to more precisely evaluate the association of each specific measure with racial/ethnic disparities in care.

Because the items within the 3 composite scores had different measurement units, each item was Z-transformed to a mean of zero and a standard deviation of 1.0. Scores were generated for each composite by computing the mean of the Z-transformed items. A summary description of the 3 clinical care strategies is presented in Table 1.

Dependent Variables

Although the TRIAD study evaluated multiple processes of care, within this analysis we focused on the 3 processes for which racial/ethnic disparities are present within the study sample, HbA1c testing, LDL cholesterol testing, and receipt of influenza vaccinations. Using yes/no indicators, we investigated whether these 3 processes were performed within the previous 12 months, using information from both self-report (influenza vaccinations) and the medical record (HbA1c testing and LDL cholesterol testing).

Along with assessing rates of process delivery, we defined a set of endpoints to reflect medication management of the 3 intermediate outcomes. For each intermediate outcome, provider groups were assessed by the proportion of their patients with the condition who were either: (1) at/or below target, defined as HbA1c ≤8.0%, systolic blood pressure <140 mm Hg, or LDL cholesterol ≤130 mg/dL, or (2) if not in control, were currently on more medications, reflecting greater provider effort to manage the outcome. The number of medications was dichotomized as use of 2 or more oral agents or insulin for diabetes; 1 or more lipid-lowering agents for hypercholesterolemia; and 2 or more antihypertensive agents for hypertension.

Statistical Methods

Our goal was to evaluate the association of each clinical care strategy with race-specific disparities in care observed in the overall TRIAD sample. We adjusted for multiple covariates in our models: age, sex, education, income, diabetes duration, health status using the physical component summary (PCS-12) and mental component summary (MCS-12) scores from the SF-12,[30] and Charlson comorbidity index.[31] We also adjusted for type of diabetes treatment, as a proxy for disease severity, and diabetes classification (type 1 vs. type 2). Values were missing for less than 5% of all covariates with the exception of PCS-12 and MCS-12 scores, and income, missing in approximately 11% of cases. We used single imputation methods to generate missing covariates, using the transcan function in S-PLUS Version 6.1 (Seattle, WA), with each covariate predicted as a function of all other covariates in the model. Data on processes of care were missing for less than 1% of participants. Values for HbA1c, LDL cholesterol, and SBP were not recorded for 9%, 24%, and 5% of participants, and those patients were excluded from the analyses examining medication management of each of these intermediate outcomes respectively.

We constructed multivariate models using race/ethnicity and the composite scores for the intensity of clinical care strategies to test the strength of association with each dependent variable. We excluded patients without chart diagnoses

TABLE 1. Components and Distributions of Intensity Measures for Three Clinical Care Strategies

Strategy*	Components	No. Variables	Range of Raw Scores	Population Means (SD)†
Diabetes registry	Presence of registry	1	0–1	
	Percentage of patients captured by registry	1	0–100	
	Comprehensiveness of registry	21	0–21	
	Intensity index of data availability (eg, electronic medical record, written form only)	5	0–3	
	Availability to multiple providers (eg, specialists, primary care physicians, non-physician providers)	3	0–15	
	Registry use indicator	5	0–5	
	Total score			0.01 (0.89)
Physician reminders	Intensity index (eg, customized to individual patient needs, nonspecific reminders, no reminders)	6	0–5	
	Content of reminders	9	0–9	
	Total score			−0.01 (0.90)
Physician performance feedback	Content of feedback to physicians	14	0–14	
	Total score			0.01 (1.00)

*All variables derived from responses to health plan and provider group director surveys.
†Total scores for strategy are Z-transformed to allow comparisons across strategies.

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of hypertension or hypercholesterolemia from the analyses predicting management of SBP and LDL cholesterol, respectively. All models included more than 15 participants from each racial/ethnic group per covariate, which ensured sufficient statistical power in subgroup analyses. Because of clustering at the provider group and health plan level, we tested hierarchical logistic mixed-effects models using the SAS GLIMMIX Macro with penalized quasi-likelihood estimation for dichotomous measures (SAS Version 8.2, Cary, NC).

From these models, we predicted the probability of receiving each process of care as well as our dichotomous variable assessing medication management, and compared each minority group to whites within preplanned analyses at both low- and high-intensity levels of each clinical care strategy by deriving 95% confidence intervals with simulation methods.[32] We divided the distribution into quintiles, defining high intensity as the 80th percentile score for each of the 3 clinical care strategies, and low intensity as the 20th percentile score for physician feedback and use of a diabetes registry. Twenty-seven percent of provider groups had no system of physician reminders, and were defined as low intensity.

We recognize that there are a large number of comparisons included in these analyses, and although we present all single-inference associations for our main predictors, clinical care strategies and race/ethnicity, we emphasize patterns of association in the data rather than individually significant results.[33]

We conducted several sensitivity analyses to evaluate the robustness of our models. Although we were not able to measure existing differences in infrastructure and performance among health plans, we sequentially removed individual plans from the models to examine whether observed differences were unduly influenced by a particular plan. We also compared analyses with and without type of diabetes treatment included as a covariate. Because results from this sensitivity analyses did not differ substantially from the main analysis, we report only the results from the original models.

RESULTS

Analytic Sample

Of TRIAD participants within the 63 provider groups, 7426 had complete race/ethnicity information and were in 1

TABLE 2. Demographic Characteristics and Representation in Provider Groups with Low- and High-Intensity Use of Clinical Care Strategies, by Race/Ethnicity

	Blacks (n = 1380)	Latinos (n = 1277)	Asian/Pacific Islanders (n = 1186)	Whites (n = 3583)
Demographics				
Age, years (mean ± SD)	59.6 ± 12.6	61.0 ± 12.9	58.0 ± 12.3	62.1 ± 12.9
Female (%)	66.1	54.7	47.5	50.5
Education				
<High school (%)	33.1	43.0	10.5	16.7
High school graduate (%)	32.0	25.5	29.0	28.8
Some college (%)	34.9	31.5	60.5	54.5
Annual income				
<$15,000 (%)	52.6	37.7	15.3	25.9
$15,000–$39,999 (%)	25.5	35.8	31.5	31.1
$40,000–$74,999 (%)	14.6	19.3	30.3	24.6
>$75,000 (%)	7.3	7.3	22.9	18.4
Duration of diabetes (years ± SD)	12.9 ± 11.3	12.7 ± 10.8	11.0 ± 10.4	12.5 ± 11.1
% with type II diabetes				
Charlson comorbidity score (±SD)	2.4 ± 1.7	1.9 ± 1.4	2.3 ± 1.5	2.3 ± 1.7
PCS-12 (±SD)	41.5 ± 7.2	43.4 ± 6.9	45.1 ± 6.1	43.0 ± 7.3
MCS-12 (±SD)	44.0 ± 6.8	45.1 ± 6.8	45.8 ± 5.8	44.7 ± 6.4
Type of diabetes treatment				
Diet controlled (%)	5.1	6.7	10.8	7.3
Oral medications only (%)	53.6	68.4	69.9	58.7
Insulin only (%)	26.1	13.2	9.3	21.6
Oral medications and insulin (%)	15.2	11.7	10.0	12.4
Provider Groups				
In PG, <20th percentile for physician feedback	1227 (89%)	532 (42%)	550 (46%)	2412 (67%)
In PG, >80th percentile for physician feedback	67 (5%)	522 (41%)	550 (46%)	427 (18%)
In PG, <20th percentile for physician reminders	401 (29%)	260 (20%)	432 (36%)	913 (25%)
In PG, >80th percentile for physician reminders	733 (53%)	322 (25%)	623 (53%)	1522 (42%)
In PG, <20th percentile for diabetes registry use	393 (28%)	298 (23%)	942 (79%)	972 (27%)
In PG, >80th percentile for diabetes registry use	97 (7%)	143 (11%)	82 (7%)	594 (17%)

High-intensity provider groups are at or greater than the 80th percentile for that clinical care strategy.
Low-intensity provider groups are at or less than the 20th percentile for physician feedback or care management, or at or below the 27th percentile for physician reminders.
PCS indicates Physical Component Score of the SF-12 Health Survey; MCS, Mental Component Score of the SF-12 Health Survey; PG, provider group.

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TABLE 3. Predicted percentages receiving HbA1c Testing, LDL Cholesterol Testing, and Influenza Vaccinations, and White–Minority Differences by Intensity of Strategy Implementation (95% CI)

	HbA1c Testing (n = 7426)				LDL Cholesterol (n = 7426)				Influenza Vaccinations (n = 7372)			
Interquartile ranges for entire sample (25th & 75th percentiles)	80%, 91%				65%, 79%				57%, 71%			
White-minority differences	Whites–Blacks	Whites–Latinos	Whites–A/PIs	Whites–Blacks	Whites–Latinos	Whites–A/PIs	Whites–Blacks	Whites–Latinos	Whites–A/PIs
Physician Feedback									
Difference at low intensity	4%* (1%, 8%)	−1% (−5%, 5%)	−2% (−7%, 6%)	7%* (3%, 11%)	−0% (−5%, 6%)	−2% (−9%, 5%)	11%* (7%, 15%)	4% (−1%, 10%)	−1% (−7%, 6%)
Difference at high intensity	1% (−5%, 10%)	−1% (−5%, 3%)	−1% (−6%, 6%)	−2% (−10%, 7%)	2% (−3%, 7%)	−6% (−11%, 1%)	11%* (0%, 21%)	0% (−6%, 6%)	−3% (−10%, 6%)
Physician Reminders									
Difference at low intensity	2% (−3%, 7%)	−6%* (−10%, −2%)	−3% (−8%, 4%)	3% (−2%, 4%)	1% (−4%, 6%)	−9%* (−14%, −3%)	15%* (8%, 21%)	3% (−3%, 8%)	−1% (−8%, 6%)
Difference at high intensity	4%* (1%, 8%)	1% (−3%, 6%)	−1% (−5%, 4%)	4%* (1%, 8%)	1% (−4%, 6%)	−2% (−7%, 3%)	10%* (5%, 14%)	3% (−2%, 8%)	−2% (−6%, 3%)
Diabetes Registries									
Difference at low intensity	4% (−0%, 9%)	1% (−4%, 6%)	−1% (−5%, 5%)	6%* (2%, 12%)	2% (−4%, 8%)	−4% (−9%, 1%)	8%* (3%, 14%)	2% (−4%, 8%)	−3% (−8%, 3%)
Difference at high intensity	2% (−3%, 8%)	−4%* (−9%, −1%)	−4% (−9%, 2%)	−1% (−7%, 5%)	−1% (−6%, 4%)	−5% (−11%, 2%)	16%* (9%, 22%)	4% (−0%, 9%)	1% (−5%, 8%)

*$P < 0.05$.
Positive differences represent high frequencies for whites, negative differences represent high frequencies for minorities.
Models for each clinical care strategy adjusted for the other 2 strategies.
Models also adjusted for age, sex, education, income, current diabetes treatment, duration of diabetes, Charlson index, physical (PCS-12) and mental (MCS-12) components of the SF-12.
HbA1c indicates hemoglobin A1c; LDL, Low-density lipoprotein; A/PIs, Asian/Pacific Islander.

of the 4 included racial/ethnic groups (Table 2). Mean values for demographic and clinical characteristics did not differ between excluded and included cases.

Exposure to clinical care strategy implementation at the provider group level varied by race and ethnicity (Table 2). Most included participants were enrolled in provider groups below the 20th percentile of use of physician feedback, including 89% of blacks and 67% of whites. Only 5% of blacks were within provider groups using high-intensity physician feedback. Depending on racial/ethnic group, 20 to 36% of participants were enrolled in provider groups with low-intensity use of physician reminders. Although 79% of Asian/Pacific Islanders were enrolled in provider groups with low-intensity diabetes registry use, few participants were enrolled in groups with high-intensity registry use, regardless of race/ethnicity, including only 7% of blacks and Asian/Pacific Islanders.

Adjusted Results

Overall, delivery of recommended processes of care was similar for most groups. No pattern of attenuation in high-intensity implementation settings was found for most of the quality of care process measures in which disparities had been previously identified—HbA1c testing, LDL cholesterol testing, and influenza vaccination (Table 3). For example, black participants were less likely than whites to receive influenza vaccinations at both low-intensity and high-intensity implementation of all 3 clinical care strategies, with disparities ranging from 8% to 16%. There were some exceptions. Black participants were less likely than white participants to receive LDL testing with low-intensity physician feedback (disparity of 7%) or use of a diabetes registry (disparity of 6%), but no disparities were seen between the groups at high levels of implementation of those 2 clinical care strategies (Table 3). Black participants were also less likely than white participants to receive HbA1c testing within settings of low intensity physician feedback (disparity of 4%), but the difference was no longer significant in settings of high-intensity physician feedback (disparity of 1%).

We identified several disparities in the medical management of intermediate outcomes for both blacks and Asian/Pacific Islanders relative to white participants that are consistent with previous findings of disparities in the intermediate outcomes themselves.[6] However, we did not find a pattern of disparity attenuation with increasing implementation intensity, as these disparities for minority groups relative to whites were more frequent at high-intensity implementation (6 instances) than at low-intensity implementation (3 instances; Table 4). We observed modest disparities in medication management of HbA1c for Asian/Pacific Islanders, but only in settings of high-intensity implementation. Black participants had modest disparities (4–5%) in medication management of HbA1c relative to whites, and additionally had larger disparities (7–15%) in medication management of LDL cholesterol, but these disparities appeared to be unrelated to strategy implementation. No disparities in medication management were observed for Latinos relative to whites.

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TABLE 4. Predicted Percentages Receiving Medication Management of Intermediate Outcomes* and White–Minority Differences by Intensity of Strategy Implementation (95% CI)

	Medication Management of HbA1c (n = 6587)				Medication Management of SBP (n = 5337)				Medication Management of LDL Cholesterol (n = 3831)		
Interquartile ranges for entire sample (25th and 75th percentiles)	90%, 96%				68%, 82%				71%, 90%		
White-minority differences	Whites—Blacks	Whites–Latinos	Whites–A/PIs	Whites–Blacks	Whites–Latinos	Whites–A/PIs	Whites–Blacks	Whites–Latinos	Whites–A/PIs
Physician Feedback									
Difference at low intensity	4%† (1%, 8%)	1% (−2%, 15%)	4% (−1%, 10%)	−8% (−12%, 3%)	−4% (−10%, 2%)	−2% (−9%, 7%)	10%† (4%, 17%)	4% (−2%, 11%)	1% (−5%, 8%)
Difference at high intensity	4% (−2%, 12%)	2% (−1%, 6%)	4% (−1%, 10%)	−7% (−15%, 2%)	2% (−3%, 8%)	−1% (−9%, 9%)	4% (−6%, 17%)	−3% (−9%, 4%)	−3% (−10%, 6%)
Physician Reminders									
Difference at low intensity	2% (−2%, 6%)	1% (−2%, 6%)	2% (−2%, 9%)	−4% (−9%, 2%)	2% (−4%, 8%)	−2% (−9%, 7%)	9%† (1%, 19%)	3% (−4%, 11%)	−1% (−8%, 8%)
Difference at high intensity	4%† (2%, 8%)	1% (−2%, 4%)	4%† (1%, 8%)	−9%† (−13%, −4%)	−3% (−8%, 3%)	−2% (−6%, 4%)	7%† (1%, 14%)	0% (−4%, 6%)	−0% (−5%, 4%)
Diabetes Registries									
Difference at low intensity	3% (−0%, 8%)	0% (−3%, 4%)	3% (−0%, 8%)	−9%† (−14%, −4%)	−2% (−7%, 5%)	−3% (−8%, 4%)	3% (−3%, 11%)	0% (−5%, 5%)	−5%† (−9%, −0%)
Difference at high intensity	5%† (1%, 11%)	3% (−0%, 7%)	5%† (0%, 11%)	−4% (−11%, 3%)	−2% (−8%, 4%)	1% (−6%, 9%)	15%† (7%, 25%)	3% (−4%, 10%)	8% (−1%, 17%)

*Medication management of intermediate outcomes indicates that patients were either: (1) at/or below target for a particular intermediate outcome, defined as HbA1c <8.0%, systolic blood pressure <140 mm Hg, or LDL cholesterol <130 mg/dL, or (2) if not in control, were currently on 2 or more oral agents or insulin for diabetes; 1 or more lipid-lowering agents for hypercholesterolemia; or 2 or more anti-hypertensive agents for hypertension.

†$P < 0.05$.

Positive differences represent high frequencies for whites, negative differences represent high frequencies for minorities.

Models for each clinical care strategy adjusted for the other 2 strategies.

Models also adjusted for age, sex, education, income, current diabetes treatment, duration of diabetes, Charlson index, physical (PCS-12) and mental (MCS-12) components of the SF-12.

HbA1c indicates hemoglobin A1c; LDL, low-density lipoprotein; A/PIs, Asian/Pacific Islander.

DISCUSSION

This analysis evaluated the association between implementation of clinical care strategies and racial/ethnic disparities within a large cohort of managed care patients with diabetes and is the first study to examine the relationship between such strategies and quality of care for Latinos and Asian/Pacific Islanders. The quality of diabetes care was high in this study when compared with national results during the same period for commercial and Medicare health plans.[34] Relatively few racial/ethnic disparities were evident, particularly for Latinos and Asian/Pacific Islanders in comparison with white participants. Even when disparities in processes of care or medication management of intermediate outcomes were observed, mainly for blacks relative to white participants, no consistent pattern of attenuation with high-intensity implementation of clinical care strategies was seen. These results are likely related to difficulty in "moving the needle" in a system where most patients are already receiving quality care. Obstacles to quality care for those remaining individuals below target goals are likely to be complex and differ from case to case, which may limit the effectiveness of broadly designed programs at the provider group level.

Prior studies in the literature, including a previous analysis of the TRIAD sample, have consistently identified disparities in influenza vaccinations for blacks with diabetes relative to comparable white participants.[6,8,35] A recent study of managed care enrollees also found that blacks were less likely than whites to receive the influenza vaccine.[36] Influenza vaccination rates are strongly influenced by patient-level factors such as prior experience with the vaccine, perceived risk of side effects, and perceived benefit,[37,38] and a recent analysis found that the black–white disparity in rates may be related to individual differences in seeking vaccination opportunities.[12] Our analysis suggests that intense use of physician feedback, physician reminders, or a diabetes registry by provider groups in managed care are not associated with an attenuation of this disparity among patients with diabetes.

Unlike influenza vaccinations, disparities in LDL cholesterol screening were attenuated at high intensity implementation of 2 of the 3 clinical care strategies. Although the initial disparities were modest, and are noted within the context of multiple comparisons, these findings are consistent with 2 recent studies showing that quality improvement programs narrowed black–white racial disparities in LDL cholesterol testing.[39,40] Laboratory testing is commonplace in diabetes care, and deficiencies observed for any racial/ethnic group are relatively simple to identify with patient data templates and correct with directed feedback. With intense use of a diabetes registry or implementation of physician feedback, but not intense use of physician reminders, the frequency of LDL cholesterol testing reached approximately 75% to 80% for each of the 4 racial/ethnic groups in the study.

We did not find evidence of "hidden" disparities in process delivery within provider groups with low-intensity implementation of clinical care strategies, which could potentially have been masked by high levels of care provided in high-intensity implementation settings. This study therefore

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suggests that the quality of care for recommended processes of care such as influenza vaccinations and LDL cholesterol testing is at least equivalent for Latinos and Asian/Pacific Islanders in managed care when compared with whites, even in provider groups with low-intensity of clinical care strategy use.

On the other hand, the finding of disparities in medication management of intermediate outcomes, even in high-intensity implementation settings, shows that quality improvement efforts may not be consistently linked to equal rates of treatment. We identified disparities in medication management for blacks and Asian/Pacific Islanders relative to whites within provider groups using high-intensity implementation of a diabetes registry or physician reminders. This lack of association between clinical care strategies and medication management is not entirely surprising, given that multiple upstream factors contribute to racial and ethnic disparities in clinical outcomes, including patient-level and physician-level factors such as conscious and unconscious stereotyping and the subjectivity of interpreting clinical scenarios (IOM).[41] Intervention studies not directly addressing these factors, including broadly targeted initiatives for patients with end-stage renal disease,[42] congestive heart failure,[43] and depression[44] have reduced disparities in processes of care but have had less impact on outcomes. In contrast, smaller-scale interventions such as the Centers for Disease Control REACH 2010 projects, which emphasize changing attitudes, beliefs, and behaviors, and are specifically targeted toward minority populations with diabetes, have demonstrated some improvement in both processes and outcomes.[45]

Previous studies outside managed care settings indicate that black subjects in particular are likely to receive care at sites in which providers have less access to important clinical practice resources such as easy access to specialty care.[16,19] In studies of managed care populations, disproportionate enrollment within lower-performing plans explained, some, but not all, of disparities in care.[3,39] Within the TRIAD study cohort, black subjects were significantly underrepresented in provider groups with high-intensity physician feedback (only 5%) and use of diabetes registries (only 7%). Further studies examining multiple differences in resources at the site of care delivery, including but not limited to the use of quality improvement strategies, could suggest promising approaches for effective interventions.

This study has limitations. First, because the analyses were cross-sectional, we could not assess the causal effect of any significant associations. Second, the strategies described in this report are less comprehensive than some disease-management programs that have been shown to improve outcomes among minority populations with diabetes.[25] However, strategies similar to the ones we describe are used in many health systems, and our results may be useful in that context. Third, as this study was performed in managed care plans, extrapolation to other settings may be limited. The inclusion of ethnically diverse provider groups; however, strengthens our ability to generalize to organizations caring for multiethnic insured populations. Fourth, patients not enrolled continuously for 18 months were excluded from the TRIAD sampling frame, and our study may therefore over-represent persons with a regular source of care. Finally, since Asian/PIs who speak languages other than English or Spanish were excluded from the sample, we cannot generalize to these populations.

This analysis did not observe a consistent pattern of racial/ethnic disparities in settings with low-intensity implementation of a diabetes registry, physician feedback, or physician reminders. Similarly, with the exception of LDL testing for blacks, no pattern of attenuation of racial/ethnic disparity attenuation was observed at high-intensity implementation of these strategies. This study therefore provides evidence that broadly targeted clinical care strategies appear unlikely to reduce disparities, particularly in control of intermediate outcomes, within managed care.

ACKNOWLEDGMENTS

Significant contributions to this study were made by members of the Translating Research into Action for Diabetes (TRIAD) Study Group. The authors acknowledge the participation of our health plan partners.

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