Effectiveness of Disease Management Programs on Improving Diabetes Care for Individuals in Health-Disparate Areas*

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ABSTRACT

In addition to race and ethnicity, specific geographic regions are associated with poorer outcomes of care. Individuals with diabetes experiencing health disparities typically have worse long-term outcomes, such as increased diabetes complications and mortality. Zip code mapping, or geocoding, was utilized in this study to identify regions of the United States with high diabetes prevalence rates and to identify areas with high densities of minority populations. Use of this methodology to examine the effect of disease management on a large, diverse diabetes population revealed greater improvement in clinical testing rates in health disparity zones compared with members living outside of these areas. In particular, significant improvement was achieved by members living in minority zip codes and by members aged 65 years or older. These findings demonstrate that members living in areas of health disparity obtain even greater benefit from diabetes disease management program participation, helping to reduce gaps in care. (Disease Management 2007;10:147–155)

INTRODUCTION

RECOMMENDED CARE GUIDELINES have been established for treatment of diabetes to improve long-term outcomes.1 However, gaps in preventive care practices still exist for many individuals with diabetes, despite the known health hazards.2–5 Of additional concern is the increased risk of poor diabetes care for individuals experiencing the effect of health disparity as a function of age, gender, race/ethnicity, socioeconomic status, geographic location, and/or access to health care.6–9 Evaluation of racial or ethnic minorities has revealed poorer quality of diabetes care and increased morbidity and mortality compared with non-minorities.10–15 Ethnic minorities are less likely to receive appropriate process measures for diabetes, including eye examinations and clinical testing for glucose, lipids, and blood pressure.15–17 Similarly, minorities have worse intermediate outcomes such as poor glycemic and lipid control.15, 18–20 The inferior health outcomes achieved by minorities are likely associated with the higher incidence of nephropathy, retinopathy, and amputations

1Healthways, Inc., Nashville, Tennessee.
2National Minority Health Month Foundation, Washington, DC.
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observed for these populations. Overall health disparity experienced by minorities is of great consequence, as these groups have higher prevalence rates for diabetes and are more likely to experience diabetes complications.

Efforts to understand the key factors contributing to gaps in care have identified the relationship between geographic location and health disparity. These studies have demonstrated that where an individual lives is associated with the level and quality of care he or she receives. Geographic locations vary by socioeconomic composition and accessibility to health care. In some cases, geographic location can have a larger role in health disparity than racial differences. An additional consideration is that minority populations tend to live in different areas than non-minority populations. Therefore, quality of care and the variations in care received by minority populations are likely influenced by where they reside in the country.

The purpose of this study was to determine the degree to which participants in diabetes disease management (DM) programs are living in areas of health disparity and to evaluate the ability of these programs to improve the quality of care within these areas. Previous studies have demonstrated the association between participation in diabetes DM programs and improved diabetes process measures and clinical outcomes. However, it is unclear what the impact of diabetes DM is on a geographically diverse commercial population that is also burdened with health disparity. Because both ethnicity and geographic location are associated with health disparity, a proprietary methodology was developed to identify members living in areas with high diabetes disease prevalence (ie, health disparity zones) and within populations that are predominantly minority. This type of analysis or geocoding has been suggested as a useful tool for mapping disparities in quality of care.

METHODS

Study population

An Oracle 9i member database was constructed of members identified as having diabetes by their administrative claims, using DM identification algorithms. This Oracle database was then queried to identify members with at least 10 months of eligibility in Healthways diabetes DM programs for this retrospective study. A total of 37,425 members were selected for examination.

Members were grouped together based on how long they had participated in the program, regardless of which calendar or contract year participation began. This approach reduced the potential for external factors, such as changes in standards of care or other medical trends that could possibly bias the outcomes measured. In addition, grouping members together in this manner generated a study population comprising members from multiple and geographically diverse health plans, providing broader applicability than would a study examining an individual health plan population.

Health Disparity Zones and Minority Zip Codes

The National Minority Health Month Foundation developed a proprietary algorithm to categorize US postal zip codes by the prevalence of a particular disease. A zip code in which more than 50% of the population are minorities was defined as a minority zip code. A diabetes algorithm was developed by examining the diabetes disease prevalence rates in the minority zip codes and the average diabetes prevalence rate for these areas was calculated.

A diabetes health disparity zone (HDZ) was defined as an area in which the diabetes disease prevalence was above the national average for minority zip codes (Table 1). This ref-
reference point was selected because minority populations have higher diabetes prevalence rates to begin with, and regions of the country with prevalence rates above this value allowed identification of areas in the greatest need of diabetes care. For the purpose of this study, members were evaluated to determine whether they lived in HDZs. Members living in these HDZs were compared with members living outside of HDZs (referred to hereafter as non-HDZs). Members living in HDZs were then further examined to determine whether they were also living in minority zip codes. Members living in minority zip codes were compared with those living in non-minority zip codes.

**Adherence to A1C testing**

Member records were evaluated for evidence of a medical claim for an A1C test performed during the 12-month period prior to the start of DM (baseline) and during the 12 months of DM intervention (Year 1). For each period, the A1C testing rate was calculated. In addition, A1C testing rates were calculated separately for members aged 18–64 years and members aged 65 years or older to evaluate the influence of age on the observed clinical testing rates.

The effectiveness of telephonic intervention (receiving calls) to improve A1C testing rates on previously non-adherent members was assessed. Non-adherent members were defined as those who lacked an A1C test in the baseline period. The A1C testing rates for members who received calls were compared with those for members who did not receive calls, primarily due to inaccurate phone numbers. A relative percent improvement in A1C testing was calculated for called members compared with members not called, and this value was reported.

**Statistical Analyses**

Statistical analyses were performed using SAS software, version 9.1.3. The Z-test procedure was used to compare A1C testing rates of members living in HDZs or minority zip codes with rates of members living outside of these areas. Similarly, the Z-test procedure was employed to compare the A1C testing rates observed for members who were called with those of members not called. The resulting p-values from these statistical analyses are reported.

**RESULTS**

The retrospective study population was comprised of 37,425 members with continuous participation in diabetes DM programs. The average age was 56.8 years and approximately 46.5% of the population was female. The majority of these members lived outside of HDZs (Fig. 1). Approximately 9% of the study population lived in HDZs, and of these members, approximately 62% lived in minority zip codes (Fig. 2).

Members living in HDZs had lower A1C testing rates compared with members living in non-HDZs (Fig. 3). Prior to the start of DM programs, the A1C testing rate for members living in non-HDZs was 64.0%, whereas the rate observed for members living in HDZs was 51.8%. Members residing in both areas significantly improved their A1C testing rates during participation in the DM programs. The greatest improvement was achieved by members living in HDZs: a 7.6% relative increase in testing ($p < 0.001$). In comparison, members living in non-HDZs improved their A1C testing rates by 4.6% ($p < 0.0001$).

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<tr>
<th>Table 1. Identifying Areas of Health Disparity</th>
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<tr>
<td><strong>Health disparity zones</strong></td>
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<td><strong>Description of US zip codes</strong></td>
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<td>Non-health disparity zone</td>
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<td>Diabetes prevalence rate at or below national average for minority zip codes.</td>
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<td>• Minority zip code</td>
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<td>• Non-minority zip code</td>
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<td>Diabetes prevalence rate above national average for minority zip codes.</td>
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The influence of age on A1C testing rates was observed in HDZs and non-HDZs (Fig. 4). Members aged 65 years or older had lower starting A1C testing rates compared with the age 18–64 group, but the age 65 and older group achieved greater improvement in A1C testing during DM program participation. Members aged 65 years and older living in non-HDZs and HDZs significantly improved their A1C testing rates, by 19.3% and 16.6%, respectively. The age 18–64 group also achieved improvements, with a significant increase observed for members living in non-HDZs (3.7% relative increase) and a non–statistically significant increase observed for members living in HDZs (1.9% relative increase).

Of the 3,359 members living in HDZs, 61.6% lived in minority zip codes (Fig. 5). Members living in minority zip codes had lower starting A1C testing rates compared with members living in non-minority zip codes. Members living in minority zip codes achieved statistically significant improvement in their A1C testing rates during participation in the DM programs ($p < 0.0001$). Members living in minority zip codes had a 15.5% relative increase in A1C testing, whereas members living in non-minority zip codes attained a 0.22% increase (not statistically significant).

Previously non-adherent members who received telephonic intervention as part of the DM program achieved higher A1C testing rates compared with members not called (Fig. 6). Members living in HDZs demonstrated even greater improvement than members in non-HDZs. Called members living in HDZs achieved a statistically significant increase in A1C testing (38.3% relative increase) compared with members living in HDZs who were not called ($p < 0.001$). In comparison, called members living in non-HDZs achieved a 9.7% relative increase in A1C testing compared with members living in non-HDZs who were not called ($p < 0.001$).

Further examination of the impact of telephonic intervention on members living in HDZs revealed that most of the improvement in A1C testing was achieved by called members residing in minority zip codes (data not shown). Called members living in minority zip
codes improved their A1C testing rates by 56.1% compared with members who were not called ($p < 0.0001$). In contrast, called members living in non-minority zip codes improved their A1C testing rates by 2.6% compared with members who were not called (not statistically significant).

**DISCUSSION**

All members had suboptimal testing rates at baseline, underscoring the overall poor quality of care received by individuals with diabetes. In fact, most members who participated in the diabetes DM programs lived outside of HDZs and received substandard diabetes care. Members living in HDZs demonstrated even lower testing rates. These findings are consistent with reports describing the association between geographic variations and quality of care, particularly in areas of high diabetes disease prevalence. Even more striking were the outcomes observed during further examination of these areas of health disparity. Of those living in HDZs, members who resided in minority zip codes had markedly lower A1C testing rates than members living in non-minority zip codes. Such differences in testing rates demonstrate that both geographic location and racial differences are associated with adherence to diabetes process measures.

A unique feature of this study is the zip code mapping methodology. Previous studies have
examined the adherence to diabetes standards in care by ethnicity or other sociodemographics.\textsuperscript{5, 10–12, 14, 18, 31, 32} However, there are additional factors that contribute to greater disparity experienced by minorities, including geographic variation. As opposed to other approaches, this identification methodology does not measure for a specific ethnicity, but instead targets individuals living in areas with the highest diabetes disease prevalence. Once identified, the areas of health disparity were further examined for minority composition. This methodology was applied to a commercial population consisting of 20 different health plans with members in all 50 states. The result was the identification of members with the lowest testing rates in different geographic locations within a diverse commercial population.

The positive impact of these diabetes DM programs on reducing health disparity was observed for both members living in HDZs and those in non-HDZs. Diabetes clinical testing rates were most improved by members living in areas of health disparity, and particularly among those localized to minority zip codes. Such findings indicated that members experiencing health disparity in these areas are gaining even greater benefit from participation in these diabetes DM programs. This increase in testing is critical to raising members’ awareness to help them better manage their disease, as individuals living in these areas of health disparity will likely have higher incidence and progression of diabetes complications.\textsuperscript{10, 13}

Members aged 65 years or older had lower testing rates at baseline compared with younger members regardless of where they lived. Older individuals with diabetes are known to receive poorer quality of care despite their Medicare eligibility, which should minimize issues related to access to care.\textsuperscript{6, 11, 16, 33} Older minority populations are in an even
worse position for receiving diabetes preventive care.\textsuperscript{16, 19, 33, 34} In this study, older members achieved greater improvement in testing than younger members, helping to reduce gaps in diabetes care. These findings suggest that diabetes DM programs are particularly successful at assisting older members experiencing greater disparity. This is promising given the growing Medicare population.

The effectiveness of telephonic intervention as part of DM programs was demonstrated by the markedly greater improvement in testing rates for called members compared with members not called. Of particular interest was the sizable difference in improvement for previously non-adherent members living in areas of health disparity compared with members outside these areas. The amount of improvement achieved by members in HDZs more than doubled that of members living in non-HDZs. Such results suggest that targeting telephonic interventions to members residing in HDZs provides health assistance to those in greatest need.

Most of this commercial health plan population resided outside of HDZs. This result may be due to the intrinsic selection bias of restricting the analyses to individuals with health care coverage (i.e., access to care). There is evidence to support the claim that minorities are less likely to have health insurance and more likely to live in health-disparate areas.\textsuperscript{32, 35} However, a recent study demonstrated that even in a managed care environment, minorities with diabetes experience poorer outcomes.\textsuperscript{31} Therefore, the increased benefit of diabetes DM on improving diabetes care for members who live in HDZs and in minority zip codes is significant.

There may be a number of variables influencing the outcomes observed in the HDZs evaluated, including socioeconomic status and access to health care.\textsuperscript{5, 12, 14} Lower socioeconomic status has been associated with increased diabetes prevalence rates in previous studies.\textsuperscript{9, 23} In addition, lower A1C testing rates have been observed for individuals in a lower income bracket compared with those in a higher income bracket in a managed care environment.\textsuperscript{14} These findings may be comparable to the results observed in this study. Those members living in areas with highest diabetes disease prevalence, and particularly those also residing in minority zip codes, had the lowest A1C testing rates. Interestingly, these findings were in contrast to what was observed for individuals with universal access to health care in another country, where lower socioeconomic status was associated with higher diabetes prevalence, but greater rates of A1C testing.\textsuperscript{9}

All members who participated in the DM programs had health care coverage provided by their health plan and therefore had some level of access to care. Thus, health disparity experienced by individuals with diabetes is likely due to more than just access to health care or socioeconomic status.\textsuperscript{31}

\textit{Limitations and future directions}

Select information is released to DM companies by health plans, and currently, ethnicity is not a metric that is typically provided. As a result, it was not possible to directly evaluate the clinical testing rates of members of specific ethnicities as separate cohorts. Future studies may benefit from incorporating this information to better understand how ethnicity alone and in combination with geographic location may contribute to the health disparity observed in this diabetes population. As additional metrics such as socioeconomic status and barriers to access of care become available, the role of these variables on health disparity will also be assessed.

The responsiveness of members to telephonic intervention may be influenced by spe-
specific characteristics or attributes. For instance, members who received or accepted more calls may have been more motivated toward healthy behaviors than members who did not receive or accept calls. Members who do not receive calls due to inaccurate phone numbers may be less likely to utilize health care (ie, have infrequent or long periods of time between physician visits) and therefore less likely to have the opportunity to update their patient information. These long intervals between visits could possibly be due to lower disease burden. Future studies will evaluate members’ characteristics to assess whether additional demographic characteristics may potentially influence responsiveness to these diabetes DM programs.

A methodology was successfully developed to identify members living in areas of health disparity, and the process measure selected was effective for identifying members with the greatest gaps in care. Future studies will explore the impact of DM on improving diabetes in a variety of intermediate and long-term outcomes, including control of clinical values and reduced morbidity.

CONCLUSIONS

Members experiencing health disparity were successfully identified using a newly developed zip code mapping methodology. Participation in diabetes DM programs was associated with statistically significant improvement in diabetes testing rates for members living in areas of health disparity, particularly in minority zip codes. The ability of DM programs to effectively improve the quality of diabetes care for members in the greatest need is encouraging.

REFERENCES


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