ORIGINAL RESEARCH

Association between Social Determinants of Health and Glycemic Control in an Inner City Primary Care Population

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Abstract

Background: Diabetes is among the 10 leading causes of death in the US. Effective disease management comprised of medical care, self-management education, and ongoing diabetes support is key to improving quality of life and reducing acute and long-term complications. Evidence suggests that social determinants of health acting through social support, neighborhood quality, and physical activity influence diabetes prevention, management, and outcomes. The Chronic Illness Resource Survey (CIRS) is a reliable and valid instrument for assessing support and resources for chronic disease management and is based on a multi-level socio-environmental model. We conducted this study to assess the relationship between social resources as estimated by CIRS subscales and glycemic control in our urban safety-net clinic. We hoped to identify specific types of support that are associated with glycemic control.

Methods: Adult patients (n= 110) with a diagnosis of type 2 diabetes were recruited from an academic, urban safety-net clinic in Buffalo, New York. Eligible patients were approached during a regularly scheduled clinic appointment while waiting for their provider. Average hemoglobin A1c values were compared between subjects with values above and below the median for each CIRS subscale. The age and BMI-adjusted relative risks for having a hemoglobin A1c value >7% were also estimated for each subscale.

Results: In this sample of patients having established medical care, lower neighborhood support was associated with elevated A1c (OR: 3.1, 95% CI: 1.4 to 6.9). Social determinants related to support from family and friends, community organizations, personal factors, and media and policy were not associated with A1c. Exploration of individual items in the neighborhood support subscale suggested that social interaction with neighbors was associated with improved diabetes control.

Conclusions: In our population of patients from an inner city primary care clinic, a higher level of neighborhood support and greater interaction with neighbors was associated with better glycemic control. Future research should evaluate how neighborhood support influences self-management behaviors, and how self-management behaviors may be modified by increased social interactions with neighbors.

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Introduction

Diabetes is among the 10 leading causes of death in the U.S. Nearly 29 million Americans are affected by type 2 diabetes (DM2), with a disproportionate burden occurring among African Americans, Hispanics, and Native Americans.[1] In addition to its toll on individuals and its contributions to health care disparities, the total direct and indirect cost of diabetes in 2012 was $245 billion, with predictions that this will increase threefold by 2030.[2-4]

Effective disease management, comprised of medical care, self-management education, and ongoing diabetes support, is key to improving quality of life and reducing acute and long-term complications.[5] Diabetes self-management support is a critical part of effective disease management,[6, 7] but socio-environmental factors can contribute significantly to patients' non-adherence to self-care behaviors, even when the quality of care delivered by healthcare providers is optimal.[8]

Type 2 diabetes can be considered a paradigmatic condition for which social determinants play a critical role in disease development and control. The social determinants of health include social and economic conditions that influence health status. The main categories include material circumstances (such as housing and neighborhood quality, access to healthy food, and physical work environment), psychosocial circumstances (including psychosocial stressors, stressful living circumstances, and social support), behavioral and biological factors (like nutrition and physical activity), and the healthcare system.[9-11] Evidence suggests that social determinants of health acting through social support, neighborhood quality, and physical activity influence diabetes prevention, management, and outcomes.[12, 13]

The last two decades have seen an improvement in glycemic control among those diagnosed with diabetes; this is likely due to improvements in diagnostic and medical care. Unfortunately, many have diabetes that is not well controlled and this particularly affects African Americans and Mexican Americans[14], who often reside in lower resource communities where the social determinants of health can be particularly disadvantageous.

The Chronic Illness Resource Survey (CIRS) is a reliable and valid instrument for assessing support and resources for chronic disease management and is based on a multi-level socio-environmental model. This model addresses supportive and inhibitory factors that contribute to self-management of chronic diseases at multiple levels. Thus, the CIRS assesses socio-environmental conditions within patients' neighborhood and communities as well the resources available to them through family, friends, physicians, and healthcare teams.[15] It has been used to pilot interventions to enhance community resources for chronic conditions including diabetes [16, 17]. The 64-item survey is segmented to reflect eight distinct levels of psychosocial support: physician and healthcare team, family and friends, personal actions, neighborhood, community, media and policy, community organizations, and workplace.

We conducted this study to assess the relationship between social resources as estimated by CIRS subscales and glycemic control in our urban safety-net clinic to identify specific types of support that are associated with diabetes control.

Methods

Subjects

Adult patients with a diagnosis of DM2 (n=110) were recruited from an academic urban safety-net clinic in Buffalo, New York. Eligible patients had an established relationship (≥2 clinic visits in the past year) for diabetes care in our center, were able to communicate in English or Spanish, and were able to provide informed consent. The study received approval by the University at Buffalo Institutional Review Board prior to study enrollment.

Data collection

Eligible patients were approached during a regularly scheduled clinic appointment while waiting for their provider. A description of the study was given and those interested in participating were consented and given the social determinants survey to complete. The CIRS subscales include six to nine items each with scores ranging from 1 to 5 for each item. The subscale score was generated by summing the individual items. Because the CIRS subscales were mostly skewed, we dichotomized each subscale at the median for our primary analyses. A low subscale score means that the subject perceived relatively low support from that resource. Since there was a high proportion of subjects who were not currently working, we did not include the workplace scale in our analysis. A Spanish translation was used for primary Spanish speakers. Demographic data and the most recent hemoglobin A1c (generally within 6 months of CIRS administration for these established patients

Table 1: Subject Characteristics Stratified by Hemoglobin A1c				
	Overall Sample (n=110)	Stratified		
Characteristic		A1c < 7% (n=44)	A1c ≥7% (n=66)	p-value
Age (SD)	59 (13)	64 (13)	55 (13)	<0.001
Female	72%	70%	73%	0.795
Ethnicity				0.920
White non-Hispanic	31%	32%	30%	
Black non-Hispanic	31%	27%	33%	
Hispanic	34%	36%	32%	
Other	5%	5%	5%	
Language				0.920
English	72%	70%	73%	
Spanish	28%	30%	27%	
High school or less education	70%	77%	65%	0.175
Household income < $30,000	80%	91%	72%	0.020
Not currently employed	76%	89%	68%	0.013
BMI (SD)	33.1 (6.9)	31.4 (5.1)	34.3 (7.7)	0.030

were recorded directly from the electronic medical record.

Spearman correlations were calculated for each CIRS subscale and A1c. Average hemoglobin A1c values were compared between subjects with values above and below the median for each CIRS subscale (Wilcoxon rank sum test). The odds ratio for having a hemoglobin A1c value ≥ 7% (based on the usual A1c target) was also estimated by logistic regression for subjects with CIRS subscale scores above and below the median. Age and BMI-adjusted odds ratios were also estimated due to baseline differences between patients with high vs. low A1c. All analyses were completed using SAS version 9.2 (SAS Institute Inc., Cary, NC).

Results

Descriptive data are presented in Table 1. The 110 patients who participated in our study were ethnically diverse (roughly equal representation of non-Hispanic black, non-Hispanic white, and Hispanic white subjects), included both primary English (72%) and Spanish (28%) speakers, were mostly not currently employed (76%), and usually had no greater than a high school education (70%). Relative to subjects with A1c values < 7%, those with higher A1c values were younger, had a higher average BMI, were less likely to be unemployed, and less likely to have a household income < $30,000 per year. Although the subjects were not selected randomly, the population of patients with type 2 diabetes in the clinic overall had the same average age with a modestly lower percentage of women (59%). Thus the sample was reasonably representative of the targeted population by these two demographic measures, but the other descriptive variables could not be obtained with administrative data.

Spearman correlations between CIRS subscales and A1c were not significant with the exception of the neighborhood support scale (r = -0.2, p = 0.041), indicating that greater perceived neighborhood support weakly correlated with lower A1c results. Looked at from a categorical perspective, Table 2 includes the comparison of A1c values in those with high as well as low CIRS subscale scores dichotomized at the median. In this sample having established medical care, determinants related to support from family and friends, community organiza

Table 2: Median A1c Comparisons Between Subjects with High vs. Low CIRS Subscale Scores			
CIRS Subscale	Median A1c w/high support (n=55)	Median A1c w/low support (n=55)	p-value
Total CIRS	7.7	8.1	0.171
Neighborhood	7.5	8.4	0.014
Health care	7.7	8.1	0.208
Personal	7.9	7.9	0.853
Family/friends	7.9	8.0	0.567
Community	7.7	8.2	0.151
Media/policy (e.g., information via TV, newspaper,internet, health insurance)	8.2	7.7	0.351
Organizations	8.1	7.7	0.933
*High and low scores defined as above and below the median score for each CIRS subscale.			

tions, personal factors, and media and policy were not associated with A1c. However, consistent with the Spearman correlation results, patients who had higher levels of neighborhood support had lower levels of A1c. The figure (p. 97) illustrates the odds ratio for suboptimal DM2 control (i.e., A1c ≥ 7%) in those with lower vs. higher CIRS subscale scores. Again, only perceived neighborhood social support was significantly associated with DM2 control (odds ratio 3.1, 95% confidence interval 1.4-6.9). Adjustment for age, BMI, and current unemployment attenuated this risk (OR 2.3, 95% confidence interval 1.0 – 5.5, p = 0.058), a finding that was marginally significant.

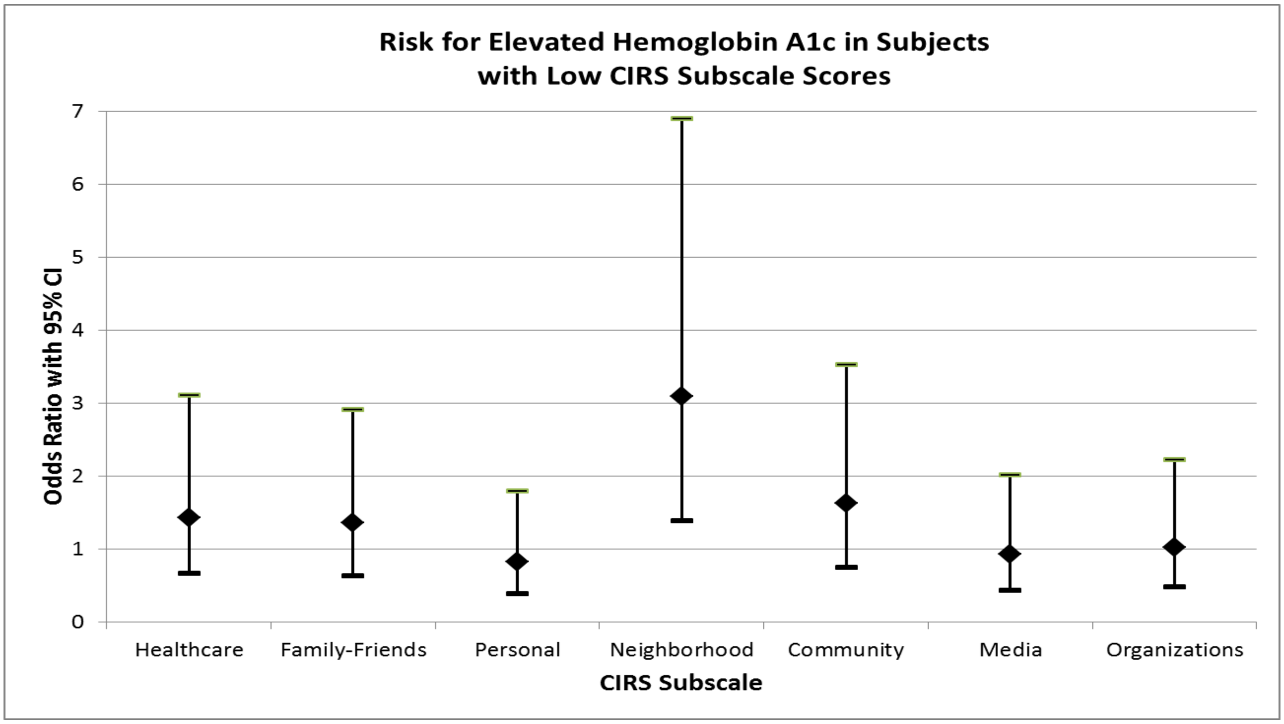
Given the association of DM2 control with neighborhood support, we repeated our analyses using each neighborhood subscale item rather than overall subscale score. Results showed that three items were individually associated with A1c. Patients who were less likely to discuss their illness with their neighbors (odds ratio 2.6,

95% confidence interval 1.1–6.1, p=0.025), less likely to get together with their neighbors for activities (odds ratio 3.4, 95% confidence interval 1.5–8.1, p=0.005), and less likely to walk with their neighbors (odds ratio 2.9, 95% confidence interval 1.3–6.9, p=0.013) had higher odds of suboptimal glycemic control. The items about adequate supply of fresh fruits and vegetables, adequate exercise outdoors, and sharing recipes with neighbors were not individually associated with A1c.

Discussion

The Institute of Medicine has identified DM2 as one of the nine exemplar chronic conditions that have a significant effect on our nation's health and economy, and improved methods for DM2 control are needed. We identified social determinants of health factors that were associated with glycemic control. Incorporating certain facets of the social determinants of health directly into the medical management of an urban safety-net primary care population may have benefits for DM2 control. While most of the CIRS subscales were not associated with A1c, we found that patients who perceived a higher level of neighborhoo support had better glycemic control higher level of neighborhood support had better glycemic control. This was particularly associated with items that specifically evaluated social interactions with neighbors.

These findings are consistent with prior research, as neighborhood characteristics have been shown to facilitate or hinder health-related behaviors, such as physical activity and dietary



patterns, and to contribute to overall physical health.[18-20] One study found that neighborhood characteristics were represented through four latent variables, including neighborhood aesthetics, neighborhood safety, access to healthy foods, and social support [21], and that these factors had a significant association with DM2 self-care behaviors.[22] Furthermore, a recent study showed that physical environments with resources that support physical activity were associated with a lower incidence of DM2.[23] This may be reflected in the specific CIRS neighborhood scale items that were individually associated with DM2 control in our study. Patients who were less likely to engage in exercise with neighbors or to meet with their neighbors for social events had significantly poorer glycemic control.

Strengths of our study included a sample that represented a population carrying a high burden of social factors that may impair chronic disease management. This enabled us to evaluate the relative importance of different social determinants of health as a prelude to developing interventions designed to improve DM2 care. Limitations include the non-random sampling strategy. However, our sample was diverse across ethnicity, language, age, and gender and was likely representative of our clinic and clinics serving similar populations. Also, while odds ratios for DM2 control were near 1 for most CIRS subscales (Figure 1), confidence intervals do not rule out clinically significant relationships. Future research targeting perceived neighborhood support will be conducted to assess cause and effect, clarify the mechanisms underlying the association, and to better define the effects of age and BMI on this relationship. In particular, given the association between items assessing social interaction with neighbors, detrimental health associations may involve health risks related to social isolation from peers residing in close proximity.

In conclusion, social determinants of health influence DM2 care through various pathways. Our study of inner-city subjects with well-established primary medical care found that higher perceived levels of neighborhood support were associated with better glycemic control. Further research evaluating the relationship between perceived neighborhood support and diabetes self-management may lead to primary care-based interventions that supplement medical care and enhance diabetes care and outcomes.

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