

Improving Diabetes Care in Rural Communities: An Overview of Current Initiatives and a Call for Renewed Efforts

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Diabetes is a crucial health issue that affects 180 million people worldwide, including 23.6 million people residing in the United States.^{1,2} Each year, diabetes is responsible for ~ 5% of all deaths globally (10–15% in the United States), and its prevalence is steadily increasing.^{1,2} According to the International Diabetes Federation, the number of people living with diabetes is projected to reach 380 million by 2025.³

Because of its widespread prevalence and potentially debilitating impact, diabetes has become an international and national priority area of health concern.^{2,4} Although the importance of addressing diabetes is well recognized, translating clinical, evidence-based management interventions for practical implementation has proven difficult, particularly for rural communities.^{5,6} Individuals living in rural communities often encounter difficulties obtaining appropriate health care because of distance from health clinics, financial limitations, cultural barriers, mistrust, communication issues, and high rates of health illiteracy.

In this overview, we will discuss the prevalence and severity of diabetes in rural areas, as well as some of the barriers to health access and disease management that have led to observed disparities between rural and urban areas. We will then describe strategies currently being

implemented to improve diabetes care in rural areas, including some of our own experiences and efforts in rural Alabama.

Diabetes in Rural Areas

Although a number of health disparities exist between rural and urban areas, including injury-related deaths, heart disease rates, and cancer rates, diabetes ranks as one of the most significant health concerns.⁴ Compared to urban areas, rural areas experience an ~ 17% higher diabetes prevalence rate.⁷ In fact, the impact of diabetes in rural communities has earned it prominence as a top-three priority area in *Rural Healthy People 2010*.⁸

Despite the high prevalence of diabetes in rural communities, there are surprisingly few data comparing the quality of diabetes care in rural versus nonrural communities. Significant challenges such as small sample size, technology and staffing limitations, and data collection issues have made quality of care comparisons between rural and urban centers difficult at best.⁹ There is ample evidence, however, that rural communities grapple with system-level barriers such as high rates of poverty; limited access to insurance, specialty medical care, and emergency services; and minimal exposure to diabetes education, all of which exacerbate the associated complications of detecting and managing diabetes.¹⁰ For example,

it is not uncommon for rural diabetes patients to have difficulty affording glucose meter strips for routine glucose self-monitoring^{11,12} or to have foregone screenings, such as eye examinations, that are crucial to the detection of diabetes-associated comorbidities.⁸ These system-level barriers may exert a more profound effect on rural racial and ethnic minorities, whose household incomes are 40–50% less than that of rural white households and 50–60% less than suburban white households¹³, and thereby contribute further to existing racial and ethnic disparities in diabetes prevalence and mortality.

The burden of diabetes in rural communities is further compounded by high rates of obesity and sedentary lifestyles.⁴ Jackson et al.¹⁴ found that the prevalence of obesity was 23% for rural adults compared to 20.5% for their urban counterparts, with African Americans living in rural counties adjacent to urban counties having rates as high as 31.4%. Within rural areas, access to walking tracks, safe sidewalks, exercise facilities, and grocery stores with affordable produce is sparse, thus complicating the potential for prevention and successful self-management. Given that the number of people diagnosed and living with diabetes is expected to double in the next 20–40 years,^{2,8} there is a real need for tailored, sustainable, and

replicable interventions that could be implemented within rural areas.

Strategies to Improve Diabetes Care in Rural Areas

During the past few decades, several health promotion/disease management strategies have emerged as candidates for improving diabetes management in rural areas, including telemedicine programs, Web-based efforts, telephone help lines, and support delivered via community health workers. Table 1 succinctly depicts various strengths and limitations of each approach.

Telemedicine programs

Of the above strategies, telemedicine has been the most extensively implemented to date, in both international and domestic rural communities. Particularly, telemedicine has been used in countries such as Australia to make specialists (e.g., dermatologists, psychiatrists) more accessible to rural residents, diminish waiting times, and alleviate the transportation barrier.¹⁵ Similarly, this method has been adapted in the United States and is garnering increased usage with diabetes-specific efforts.

Several recent examples of rural telemedicine projects targeting diabetes are available and could be valuable for enhancing diabetes self-management. Undergirded by funding agencies such as the National Institutes of Health (NIH) and the Robert Wood Johnson Foundation (RWJF),^{16–19} studies have demonstrated telemedicine's potential for effectiveness in the management of diabetes. For example, the University of South Carolina School of Medicine's Department of Ophthalmology conducted a 4-year randomized, controlled trial (RCT) to provide education and eye screenings to 165 rural low-income individuals. The RCT demonstrated improved

Table 1. Strategies for Diabetes Care in Rural Areas

Strategy	Strengths	Limitations
Telemedicine	<ul style="list-style-type: none"> • Provides consultation from a distance • Conserves patients' financial resources • Increases accessibility to specialists 	<ul style="list-style-type: none"> • May not detect more serious issues, which require physical proximity or touch
Web-based models	<ul style="list-style-type: none"> • Available in libraries and churches 	<ul style="list-style-type: none"> • Access to Internet • Digital divide
Telephone help lines	<ul style="list-style-type: none"> • Immediate responses for questions about diabetes self-management education • Low in cost • Potential users are familiar with mode of communication 	<ul style="list-style-type: none"> • Must satisfy 24-hour staffing needs • Recruitment and retention of appropriate personnel to answer questions • Availability and affordability of telephone service
CHAs	<ul style="list-style-type: none"> • Can motivate people with diabetes to engage in low-cost, high-impact activities such as walking • Natural helpers who understand their community • Provides social support 	<ul style="list-style-type: none"> • CHA burnout and turnover • Lack of support for CHAs • Risk of CHA dispensing medical advice

eye exam rates, self-management behaviors, and patient satisfaction levels and reduced blood glucose and cholesterol levels. Similarly, the Informatics for Diabetes Education and Telemedicine RCT resulted in net A1C, LDL cholesterol, and blood pressure improvements during a 5-year period, with an improvement in primary care providers' ability to manage diabetes.²⁰

Smaller pilot telemedicine studies such as Balamurugan et al.'s Arkansas' Diabetes Self-Management Education²¹ have also been useful, demonstrating significant improvements in knowledge, self-efficacy, and self-care practices. Other projects, such as the Georgia

Telemedicine Diabetes Education Project, which connects rural residents with diabetes to certified diabetes educators, have reached capacity and are looking for new funding partners.¹⁶ Efforts such as the aforementioned programs offer potential avenues through which interventions specifically targeting diabetes might be implemented.

Funding opportunities through various agencies such as NIH, RWJF, Health Resources and Services Administration (HRSA), the Agency for Healthcare Research and Quality (AHRQ),²² and the Federal Communications Commission (FCC)²³ have augmented and continue to augment

the infrastructure for telemedicine research and practice. Between September 2006 and October 2008, the Office for the Advancement of Telehealth,²⁴ a division within HRSA, administered 93 telemedicine projects. The FCC Rural Health Care Pilot Program recently allocated \$46 million in reimbursement for the engineering and construction of telehealth networks that will link hundreds of rural hospitals across 10 states,²³ and AHRQ²² is currently funding telehealth projects across five states in an effort to establish a business case for telemedicine. The Rural Health Resource Center²⁴ operates a Technical Services and Assistance Center to assist states in the development of health information technology, which may expand capabilities for additional telemedicine projects.

Despite promising findings and established resources, several barriers hinder effective implementation and usage of telemedicine. These include privacy and security concerns, reimbursement issues, a lack of reciprocity in state medical licensing, unfamiliarity with the technological medium, and the lack of resources for the poor (thus increasing the “digital divide”).¹⁵ Additionally, there are limitations to the conditions that can be accurately diagnosed via telemedicine; some conditions require touch or physical proximity for diagnosis.¹⁵

Web-based interventions

Web-based efforts, sometimes included as a component of telemedicine, represent a similar but distinct avenue for promotion of improved diabetes management. Meigs et al.²⁵ conducted a controlled trial testing the effectiveness of a Web-based diabetes disease management application developed to improve evidence-based management of type 2 diabetes. There was a significant reduction in A1C

and LDL cholesterol levels in the intervention group. Based on their findings, the investigators concluded that Web-based interventions have potential and should be implemented as part of diabetes self-management programs.

In a separate, RWJF-funded initiative, Project HealthDesign,¹⁹ researchers at the University of Washington are testing a program that connects patients with type 2 diabetes to their health care providers via cell phones and laptop computers. The system allows wireless transmission and analysis of health records and provides advice about nutrition, daily physical activity, blood glucose, and emotional state. Users can conduct “what if” analyses to learn the health consequences of choices they are considering. Testing of system prototypes is underway in patients’ homes.

Although Web-based programs appear promising for rural areas, the digital divide can be wide in many rural communities, compromising the applicability of the Internet for diabetes care. Numerous studies have documented a digital divide for obtaining electronic health information via the Internet, with some studies suggesting it may be wider among nonwhite people.^{14,26}

McKeehan et al.²⁶ described a community in rural South Carolina with a high African-American population (71%) and a moderate Hispanic population (1.6%) to assess their needs, preferences, and barriers for securing adequate health care information. More than 40% of the respondents reported rarely using the Internet at home or in a public place for a source of health information. Barriers reported for no or minimal use of the Internet were lack of technological skills and limited access to high-speed Internet. Similarly, Jackson et al.¹⁴ found that,

among minorities > 60 years of age, manual dexterity was a major barrier to use of the Internet, even when computer training was provided.

In addition to previously mentioned barriers, there are likely literacy, health literacy, and infrastructure issues that should also be addressed before acceptance of the Internet as a primary approach for transmission of diabetes information.

Telephone help lines

Because there is often a dearth of diabetes educators and educational programs in rural areas, telephone help lines offer the potential for providing education and guidance regarding diabetes self-management in a low-cost and efficient manner. In fact, two notable studies demonstrate this realized potential. Using a telephone help line, Barnett et al.²⁷ observed lower A1C levels and fewer “work-in” primary care visits in their 2-year follow-up study of veterans living with diabetes. In a separate study using a multi-pronged approach that included toll-free help lines for patient questions and glucose reporting with telephone follow-up and intervention, Malone et al.²⁸ reported significant improvements in A1C level, diabetes-related knowledge, and satisfaction among the intervention group. Funding represented the biggest challenge with regard to the project’s implementation and sustainability. Also, although some studies are available regarding diabetes help lines, very few data exist regarding help-line use specifically among rural populations, despite the significant access problems indigenous to rural communities.

Community health advisors

One increasingly popular approach to addressing diabetes care in remote or underserved communities is to involve trained lay individuals who

Table 2. Selected Health Status Indicators: United States, Alabama, and Black Belt Counties

	Primary Care Provider Per 10,000	Diabetes Deaths Per 100,000	Per Capita Income(\$)	Households With No Vehicle (%)
United States	7.2	25.3	36,714	10.3
Alabama	6.5	30.1	30,894	8.3
Barbour	4.2	25.3	23,910	12.5
Butler	4.8	47.8	25,545	12.1
Choctaw	3.8	2.3	25,114	11
Crenshaw	2.2	41.4	29,521	11.5
Dallas	6.8	41.6	25,250	16.2
Greene	4.1	20.7	25,918	16.3
Hale	2.7	5.6	21,970	15.6
Lowndes	2.2	40.2	23,066	15.1
Macon	4.7	48.8	20,893	18.8
Marengo	4.1	50	28,190	14.4
Perry	4.4	55.1	22,517	16.6
Pickens	5.2	32	25,269	11.8
Pike	5.2	42.4	29,805	11.4
Russell	2.5	19.5	25,112	12.6
Sumter	4.9	27.8	21,401	19.4
Wilcox	3.1	40.9	18,895	20.1

Source: Alabama Rural Health Association Publications, 2009

understand their communities and who themselves have diabetes or are intimately familiar with its day-to-day management.^{29,30} Community Health Advisors (CHAs), “natural helpers” from the community who are trained to deliver health information and facilitate health care access, are increasingly involved in health-promotion strategies to reach underserved communities.^{19,31–33}

Systematic review of existing literature examining the use of CHA models for diabetes management have documented the potential benefits of such interventions, particularly in the areas of patient knowledge and behaviors.^{34,35}

However, after comprehensive review of the literature, Norris et al.³⁵ concluded that “much additional research is needed to understand the incremental benefit of CHAs in multi-component interventions and to identify appropriate settings and optimal roles for CHAs in the care of individuals with diabetes.”

To date, very few studies have examined implementation of the CHA model for improving diabetes care in rural areas. One study that did attempt to assess such a program among rural adult women ($n = 132$) reported a high level of patient satisfaction as well as a positive change in physical activity and dietary

behavior but did not see a significant change in glycemic control or body mass index.³⁶ It is possible that the study was underpowered to detect a significant difference in glycemic control. However, it may also be that the contribution of CHAs to the care of patients with diabetes is not captured by glycemic control alone but actually relates more to increased connectedness to services, provision of social support, improvements in community capacity, and higher level of diabetes awareness. Although the CHA model appears to be well suited for use among rural communities, more information is needed regarding the specific aspects of the model that will promote effective diabetes care in rural contexts.

Although research efforts aimed at understanding the effectiveness of the CHA model within diabetes management are ongoing, practical implementation is forging ahead. A recent diabetes initiative funded by the RWJF identified CHA interventions as a successful component of many current diabetes programs.¹⁸ In fact, CHA interventions are increasingly being promoted by federal and private organizations, including the Centers for Disease Control and Prevention, the American Association of Diabetes Educators, and the American Public Health Association.

However, a more comprehensive understanding of the challenges these programs face in their efforts is only now emerging.³⁷ One important barrier is a perceived lack of a support system, leading to feelings of social isolation and anxiety.³⁸ This lack of support for lay individuals who are providing guidance to patients with diabetes also has the potential to culminate in serious medical consequences. Other barriers to the use of this model include problems with intervention fidelity



Figure 1. Traditional counties of the Alabama Black Belt. Source: Center for Business and Economic Research, University of Alabama. Alabama Maps, available from <http://cber.cba.ua.edu/data/maps/AlabamaMaps1.html>.

and high rates of CHA burnout and turnover.³⁷

Synergy Across Interventions: Experience in Alabama

In many ways, the authors' experience in Alabama reflects what may be a national trend within other rural regions toward the integration of technology with community-based participatory methods to improve diabetes care in rural communities. In the state of Alabama, diabetes in rural communities has become an increasingly crucial health issue. Twenty-nine of the 32 (91%) Alabama counties with the highest diabetes mortality rates are rural, with mortality and prevalence rates in

some counties double that of national rates.^{1,39}

These excessive rates are the result, in part, of limited access to care and education, reflected in poor patient/physician ratios (10,554:1), a dearth of endocrinologists, and only one certified diabetes educator within a six-county region.^{1,40} The number of households without a vehicle is another telling indicator. In Alabama's Black Belt region, a predominantly rural portion of Alabama where diabetes is disproportionately prevalent (Table 2 and Figure 1), nearly 15% of households have no vehicle, compared to about 8% of Alabama households statewide. Neal et al.⁴¹ reported that

living in a poverty area with lack of access to transportation and telephone is strongly associated with missed appointments, which is crucial for those with diabetes. Although disparities are evident in rural versus urban areas, the difference is more pronounced for African Americans.⁴²

Given the aforementioned heavy diabetes burden and lack of resources, we are developing an intervention to train community health workers to address diabetes prevention and self-management in a region densely populated by African Americans. During the past 12 years, researchers at the University of Alabama at Birmingham (UAB) have partnered with community coalitions in the Deep South Network and the REACH 2010 projects resulting, in part, in a network of > 1,000 trained CHAs. In the past, their goals have centered on the elimination of cancer health disparities through community-based participatory education, training, and research. However, recent community needs assessment results identified diabetes as a topic of great concern, making the current project a natural next step.

In an effort to address barriers to implementation of the CHA model discussed above, particularly those related to perceived lack of professional support and high burnout, we are developing a toll-free diabetes help line within the UAB Diabetes Research and Training Center for the purpose of providing expertise to CHAs who provide self-management support for patients with diabetes. We hypothesize that this help line will assist in retaining community health workers, thereby sustaining positive behavioral changes and outcomes among those with diabetes. To develop the help line, we have enlisted the help of a network of existing CHAs who will help ensure

Table 3. Diabetes Resources for Rural Practitioners

Resource Name	Affiliated Agency/ Organization	Web Address
Cultural Competency and Minority Health Resources	American Association of Clinical Endocrinologists	http://effectivehealthcare.ahrq.gov/healthInfo.cfm?infotype=sg#subList5
Diabetes Public Health Resource	Centers for Disease Control	http://www.cdc.gov/diabetes
ACP Diabetes Portal	American College of Physicians	http://diabetes.acponline.org
DiabetesPro: Professional Resources Online	American Diabetes Association	http://professional.diabetes.org
Professional Resources	American Association of Diabetes Educators	http://www.diabeteseducator.org/ProfessionalResources
National Diabetes Information Clearinghouse	National Institute of Diabetes and Digestive and Kidney Diseases: National Institutes of Health	http://diabetes.niddk.nih.gov/resources/organizations.htm
Effective Healthcare Summary Guides: Diabetes	Agency for Healthcare Research and Quality	http://effectivehealthcare.ahrq.gov/healthInfo.cfm?infotype=sg#subList5
Diabetes Mellitus Clinical Resources	Rural Nurse Organization Digital Library	http://ruralnurseorganization-dl.slis.ua.edu/clinical/endocrinology/diabetes/index.htm

cultural acceptability, increase buy-in, and enhance sustainability.⁴³

Conclusion

Significant strides have been made toward addressing the diabetes epidemic in rural areas. However, there remains much work to be done to optimize self-management and improve outcomes for those living with diabetes in rural communities. Several strategies have been identified, including telemedicine, telephone help lines, Web-based interventions, and CHAs, each with its own set of strengths and limitations. Future research is needed to delineate which strategy or combination of strategies will be best suited for broad-based implementation. In the meantime, some resources are available for

clinicians immersed in efforts to help patients manage diabetes in rural settings. A partial list is provided in Table 3.

In the current funding climate, competition has greatly increased. This competitive funding climate highlights the need for cost-effective interventions. However, few data are available depicting the relative cost versus benefit of telemedicine, Web-based interventions, help lines, or CHAs. Future studies should assess the cost-effectiveness of various strategies and address barriers to implementation and sustainability of effective interventions. Additionally, there must be from the outset mechanisms established by which to evaluate the process, impact, and

outcomes of diabetes self-management projects in rural areas.

Rural communities provide extremely challenging arenas for the translation of research into practice. Modalities such as telemedicine, Web-based interventions, help lines, and CHAs are promising. We must renew our efforts and continue to investigate the feasibility, applicability, and impact of each strategy and perhaps combinations of strategies in efforts to create synergy, overcome weaknesses, and enhance diabetes self-management in rural areas.

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