Department of Health Policy

**Geiger Gibson /
RCHN Community Health Foundation Research Collaborative**

Policy Research Brief # 24

**Bending the Health Care Cost Curve in North Carolina: The Experience of
Community Health Centers**

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About the Geiger Gibson / RCHN Community Health Foundation Research Collaborative

The Geiger Gibson Program in Community Health Policy, established in 2003 and named after human rights and health center pioneers Drs. H. Jack Geiger and Count Gibson, is part of the School of Public Health and Health Services at The George Washington University. It focuses on the history and contributions of health centers and the major policy issues that affect health centers, their communities, and the patients that they serve.

The RCHN Community Health Foundation, founded in October 2005, is a not-for-profit foundation whose mission is to support community health centers through strategic investment, outreach, education, and cutting-edge health policy research. The only foundation in the country dedicated to community health centers, the Foundation builds on health centers' 40-year commitment to the provision of accessible, high quality, community-based healthcare services for underserved and medically vulnerable populations. The Foundation's gift to the Geiger Gibson program supports health center research and scholarship.

Additional information about the Research Collaborative can be found online at www.gwumc.edu/sphhs/departments/healthpolicy/ggprogram or at rchnfoundation.org.

Executive Summary

North Carolina is known for innovative practices in primary care delivery and education, and accordingly one might expect to see greater efficiencies overall in care delivery, and less direct, measurable impact by community health centers on cost and outcome. Of interest is whether community health centers (CHCs) are cost-effective providers in states with a sophisticated primary care infrastructure and focus on the needs of medically underserved communities. Building on the large body of health services research literature that has documented the quality and cost-effectiveness of federally-funded primary health centers nationwide, as well as estimates of national savings that are possible through the expanded use of health centers for medically underserved populations, we compare costs for health center users and non-CHC users in North Carolina.

In our prior work, we used the Medical Expenditure Panel Survey (MEPS) to examine differences in total health care expenditures nationwide for patients cared for at community health centers as compared with those served by other primary care providers. In North Carolina, baseline MEPS data for demographic characteristics, expenditures, and utilization were combined with data from the North Carolina Behavioral Risk Factor Surveillance System (BRFSS) in order to gain insight into the impact of CHCs at the state level.

Two models were developed, one controlling for socioeconomic factors and the second adding health conditions and behaviors. After controlling for various socioeconomic characteristics, model 1 shows health center users saved $3,759 in total expenses and $1,266 in ambulatory care expenses as compared with non-CHC users. When health behaviors and other health conditions such as diabetes, asthma, hypertension, and cardiovascular disease (CVD) were added, model 2 shows the savings remain substantial, with an average savings of $3,437 in total expenditures per user and $1,211 in ambulatory care expenses.

Adjusted Costs Savings by type of expenditures for Adult CHC Users and Non-Users in North Carolina ($2010), MEPS 2008 and BRFSS 2007-2009

	Model 1			Model 2		
	CHC Users	**Non-CHC**	**Savings**	**CHC Users**	**Non-CHC**	**Savings**
Total	2,230.79	5,989.63	**3,758.85*****	2122.78	5,559.48	**3,436.69*****
Ambulatory	9,39.59	2,205.72	**1,266.13*****	943.8128	2,154.88	**1,211.07*****

* p<0.10, ** p<0.05, *** p<0.01

On average, total annual health care spending for North Carolina patients served by health centers was 62 percent less than for those patients with similar health status and demographic characteristics served in other ambulatory care settings. When

ambulatory care costs alone are considered, health centers were able to achieve similarly impressive results, showing per-patient cost savings of $1,211 for ambulatory services.

Several factors likely contribute to lower costs for health center users: 1) health center primary and preventive care services are highly comprehensive in comparison to those offered in other primary health care service settings; 2) health center patients qualify for discounted prescriptions through the 340B Drug Pricing Program (340B program) created in 1992 to provide discounts on outpatient prescription drugs to select safety net providers; 2) health centers offer enabling services such as transportation, translation, health education, and disease management that facilitate access; 3) by offering care on a sliding fee basis, health centers are able to make their health care affordable to the community as a whole, thereby encouraging earlier and more continuous care; 5) the salaried staff model for health center physicians, which helps ensure that financial incentives do not drive practice; 6) the health center governance structure which requires that the majority of board members are health center users, which creates a level of community accountability that is unmatched in other practice settings.

Introduction

A large body of literature has documented the quality[1] and cost-effectiveness[2] of federally-funded primary health care centers serving the nation's most medically-underserved rural and urban communities. The Affordable Care Act authorized a major expansion of community health centers, while the Health Care and Education Reconciliation Act[3] allocated $11 billion for this expansion. Our prior analysis suggests that these funds will allow health centers to double number of patients served, from 19 million patients in 2009[4] to an estimated 36 million served by 2019.[5]

The expansion of health centers comes at a crucial time. State Medicaid programs throughout the country are struggling with the loss of short-term Stimulus Act funding and state economies are still overwhelmed by the effects of the recession. Direct state investments in health centers have already begun to decline, further straining the primary care safety net infrastructure.[6] Compounding these state budgetary problems is the increased demand for service and a significant growth in the numbers of uninsured who need affordable care.[7] By 2010, the number of uninsured Americans increased to approximately 51 million.

As states move toward implementation of the Affordable Care Act insurance expansions, the shortage of primary health care capacity looms as a key challenge. Health centers will become an important tool for assuring that 32 million newly-insured individuals – half covered through Medicaid and a disproportionate percentage of the rest receiving subsidized coverage through state health insurance Exchanges – have sufficient access to health care.

National estimates of the impact of community health centers on controlling health care costs played an important role in Congress' decision to invest in health

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[1] Weir R, et al., Use of enabling services by Asian American, Native Hawaiian, and Other Pacific Islander Patients at Community Health Centers. *Am J Public Health* 2010 Nov; 100(11): 2199 – 2205; Chin M, Quality improvement implementation and disparities: the case of the health disparities collaboratives. *Med Care*. Aug 2010;48(8):668-75; Shi L, Tsai J, Higgins PC, Lebrun LA, Racial/ethnic and socioeconomic disparities in access to care and quality of care for US health center patients compared with non-health center patients. *J Ambul Care Manage* Oct-Dec 2009; 32(4): 342 – 50.

[2] Rothkopf J., Brookler K, Wadhwa S, and Sajovetz M. Medicaid patients seen at Federally-qualified Health Centers use hospital services less than those seen by private providers. *Health Affair;* July 2011; 30:(7)1335-1342; Huang ES, et al. "The Cost-effectiveness of improving diabetes care in U.S. Federally Qualified Community Health Centers." *Health Services Research*, Dec 2007;42(6 Pt 1):2174-9; Ku, L, Richard, P, et al., "Strengthening primary care to bend the cost curve: The expansion of community health centers through health reform." George Washington University Geiger Gibson/RCHN Research Collaborative Brief #19. June 30, 2010.

[3] PPACA §10503; HCERA §2303.

[4] 2009 Uniform Data System, HRSA.

[5] Rosenbaum S., Jones E., Shin P. and Tolbert J., "Community Health Centers: Opportunities and Challenges of Health Reform," Kaiser Family Foundation. Aug 2010.

[6] National Association of Community Health Centers. "Entering the Era of Reform: The future of State Funding for Health Centers." *State Policy Report #33.* October 2010

[7] Cunningham PJ, The growing financial burden of health care: National and state trends. *Health Affairs* May 2010; 29(5): 1037-1044.

center expansion.[8] Building on national projections of potential savings, this study estimates the potential savings associated with health center use in North Carolina. Given the state's innovative primary care practices, one might expect to see greater overall efficiencies in the delivery of primary health care and thus, a more limited impact by health centers.[9] Of interest is whether health centers are cost-effective in relation to other primary health care providers given North Carolina's relatively robust infrastructure.

In our prior work, we used the 2006 Medical Expenditure Panel Survey (MEPS) to examine differences in total health care expenditures for health center users as compared with non-users nationwide. This analysis expands on our earlier work, estimating differences in medical expenditures for health center users and non-users at the national level using 2008 MEPS and combines MEPS with data from the 2007-2009 North Carolina Behavioral Risk Factor Surveillance System (BRFSS) to compare costs at the state level.

Study Design and Methodology

A detailed explanation of our study design and methodology can be found in the Appendix to this brief. Data from the Medical Expenditure Panel Survey were used to establish the national baseline. The North Carolina Behavioral Risk Factor Surveillance System (BRFSS) was used to supplement that national data on cost savings with information that captures the characteristics of the North Carolina (NC) population who use, or could be served by health centers. The findings below show differences in medical expenditures between health center users and non-users nationwide, and adjusted estimates of per-person savings associated with the use of health centers in North Carolina.

To compute the incremental health care cost savings associated with users of CHCs compared to non-users, we calculated the difference in direct medical costs between the two groups using predicted levels of expenditures. MEPS was used to model expenditures because information on expenditures is not available in the state BRFSS. The MEPS data were supplemented with population characteristics data from the NC BRFSS to produce estimates of the per-person cost of care for health center patients, as well as for patients who received primary care from other settings. We converted the costs savings estimates into 2010 dollars using the medical care index of the Consumer Price Index (CPI).[10]

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[8] U.S. Congressional Budget Office. *Douglas W. Elmendorf to Nancy Pelosi, U.S. House of Representatives, March 20, 2010*. Letter. http://www.cbo.gov/ftpdocs/113xx/doc11379/AmendReconProp.pdf.

[9] Takach M and buxbaum J, "Developing Federally-qualified Health Centers into community networks to improve state primary care delivery systems." Commonwealth Fund, May 5, 2011; North Carolina Institute of Medicine. "Chapter 3. Safety Net Programs in North Carolina," *North Carolina Healthcare Safety Net Task Force Report: April 2005*.

[10] Bureau of the Census, *Statistical abstracts of the United States*. Washington, DC: Bureau of the Census, June 2011.

This approach differs from our previous[11] estimates of CHC cost savings in three important ways (see the Methodology section for more details regarding the study design). First, the study is designed to maximize, to the greatest extent possible, the comparability of the CHC user and non-CHC user populations. Second, CHC users are defined here as those with at least one office visit to a CHC; in our prior analyses, CHC users were defined as those receiving at least half their care at health centers. Third, because the majority of adults in the study population had at least one provider visit, it was not necessary to adjust the model for adults with no health care utilization.

This study has some limitations due to the use of cross-sectional and self-reported data. First, there may be unmeasured factors that affect differences in medical costs. Additionally, we applied characteristics of the average North Carolina adult resident to calibrate the associated cost savings for CHC users; however, the characteristics of the average CHC user might differ from those of the average NC state resident. Finally, this is not a randomized study. These limitations are likely to underestimate the cost savings associated with the use of CHCs in NC.

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[11] Ku L., Richard P., et al., "Using Primary Care to Bend the Curve: Estimating the Impact of a Health Center Expansion on Health Care Costs," George Washington University Geiger Gibson/RCHN Research Collaborative Brief #14. Sep 1, 2009.

Findings

Unadjusted Cost Savings in the United States

Table 1 presents the unadjusted cost savings for CHC users in comparison to non-CHC users in the United States (see Appendix A for details on CHC user and non-CHC user characteristics). Based on these results, the average CHC user saved approximately $3,093 in total expenses ($2,681 vs. $5,774) and $1,298 in ambulatory care expenses ($740 vs. $2,038, p<0.001) compared to non-CHC users.

Table 1. Unadjusted Differences (Costs Savings) by type of expenditures for Adult CHC Users vs. Non-Users in the U.S. ($ 2010), MEPS 2008

	CHC Users	Non-CHC	Savings
Total	$2,681.34	$5,774.33	**$3,092.99*****
Ambulatory	$740.21	$2,038.10	**$1,297.89*****

* p<0.10, ** p<0.05, *** p<0.01
Source: Based on authors' calculations using the 2008 MEPS. Dollar amounts were adjusted for inflation as of 2010 using the CPI. This analysis is based on the total non-institutionalized adult population in the United States. Cost savings are computed as the difference in expenditures between CHC users and non-CHC users.

Adjusted Cost Savings in the United States

Table 2 presents the adjusted cost savings associated with the use of CHCs in the United States (see Appendix A for details on CHC user and non-CHC user characteristics. Based on results from model 1, which generally controlled for socioeconomic factors, health centers provided significant cost-savings per user; CHCs saved approximately $3,640 in total expenses and $1,215 in ambulatory care expenses.

Even after controlling for health behaviors and other health conditions such as diabetes, asthma, hypertension, and CVD (Model 2) the adjusted per -person costs were significantly lower for health center users than for non-users.

**Table 2. Adjusted Costs Savings by type of expenditures for
Adult CHC Users and Non-Users in the U.S. ($2010), MEPS 2008**

	Model 1			Model 2		
	CHC Users	Non-CHC	Savings	CHC Users	Non-CHC	Savings
Total	2,160.07	5,799.76	**3,639.69***	2,194.08	5,746.21	**3,552.13***
Ambulatory	901.84	2,117.09	**1,215.26***	928.87	2,120.77	**1,191.90***

* p<0.10, ** p<0.05, *** p<0.01
Source: Based on authors' calculations using the 2007-2009 BRFSS. Dollar amounts were adjusted for inflation as of 2010 using the CPI. This analysis is based on the total non-institutionalized adult sub-population in the U.S. The models adjusted for age, gender, race, education, income, marital status, health status(fair/poor), region and urban/rural characteristics. Additionally, model 2 includes health behaviors and other health conditions such as diabetes, asthma, hypertension, and CVD conditions. Cost savings are computed as the difference in expenditures between CHC users and non-CHC users.

Adjusted Cost Savings in North Carolina

As our primary interest was to estimate the cost savings by CHC users as compared with non-CHC users in North Carolina, we used state BRFSS data to adjust the results of the national models to the state level. Table 3 presents the adjusted cost savings associated with the use of CHCs in North Carolina using multivariate models (see Table A in the Appendix for characteristics of North Carolina residents). After controlling for numerous socioeconomic characteristics, model 1 shows that CHC users saved approximately $3,759 in total expenses and $1,266 in ambulatory care expenses. When health behaviors and other health conditions such as diabetes, asthma, hypertension, and CVD were added, model 2 shows the savings remain substantial. On average, NC CHC users saved $3,437 in total expenditures per user and $1,211 in ambulatory care expenses.

**Table 3. Adjusted Costs Savings by type of expenditures for Adult CHC Users and
Non-Users in North Carolina ($2010), MEPS 2008 and BRFSS 2007-2009**

	Model 1			Model 2		
	CHC Users	Non-CHC	Savings	CHC Users	Non-CHC	Savings
Total	2,230.79	5,989.63	**3,758.85***	2122.78	5,559.48	**3,436.69***
Ambulatory	9,39.59	2,205.72	**1,266.13***	943.8128	2,154.88	**1,211.07***

* p<0.10, ** p<0.05, *** p<0.01
Source: Based on authors' calculations using the 2008 MEPS and 2007-2009 BRFSS. Dollar amounts were adjusted for inflation as of 2010 using the CPI. This analysis is based on the total non-institutionalized adult sub-population of North Carolina. The models adjusted for age, gender, race, education, income, marital status, health status, region and urban/rural characteristics from the state of North Carolina. Additionally, model 2 includes health behaviors and

other health conditions such as diabetes, asthma, hypertension, and CVD conditions from the state of North Carolina. Cost savings are computed as the difference in expenditures between CHC users and non-CHC users.

Conclusion

Our findings indicate that patients served by North Carolina's health centers cost an average of 62 percent less annually across all types of care than do patients with the same health status and demographic characteristics served in other ambulatory care settings. Furthermore, when only ambulatory care is considered, North Carolina health center users cost, on average, $1,211 less than non-CHC users.

Numerous studies have shown that health centers demonstrate significant cost savings.[12] Several factors likely contribute to these consistent outcomes. First, health center services are unusually comprehensive, in comparison to those offered in other primary health care service settings.[13] In a single location, patients are typically able to receive primary and preventive dental care, mental health care and social work services in addition to the services commonly associated with a primary care clinical practice setting.[14] Pharmacy or dispensary services are often on-site, thereby easing travel challenges associated with poverty and residence in an underserved setting. Finally, because health centers are qualified to participate in the Federal 340B Drug Pricing Program, pharmacy costs are typically lower.

Health centers also offer enabling services, that is, translation services, transportation, and patient support and case management that make health centers easier to reach and facilitate access to medical care.[15] Health centers also may offer multiple access points in non-traditional settings, such as in public housing or mobile units, which in turn make care more accessible. Health centers increasingly employ evening and weekend hours, same-day walk in services,[16] and other strategies to

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[12] See Streeter S, et al., "The effect of community health centers on healthcare spending and utilization." Avalere Health, September 2010.

[13] Dor, A, et al., "Uninsured and Medicaid patients' access to preventive care: Comparison of health centers and other primary care providers." George Washington University Geiger Gibson/RCHN Research Collaborative Brief #4. August 2008; Hicks LS, et al., "The quality of chronic disease care in US community health centers." November/December 2006 *Health Affairs* 25(6):1713-1723.

[14] 42 C.F.R. §51c.304

[15] Weir R and Proser M, "Highlighting the role of enabling services at community health centers: Collecting data to support service expansion and enhanced funding." National Association of Community Health Centers and the Association of Asian Pacific Community Health Organizations. Summer 2010; Wells R, Punekar RS, Vasey J, Why do some health centers provide more enabling services than others? *Journal of Health Care for the Poor and Uninsured.* 2009; 20:507-23; Peek ME, Cargill A, and Huang Ek, Diabetes health disparities: A systematic review of health care interventions. *Med Care Res Rev.* 2007;64(5 Suppl):101S-56S; Politzer RM, et al., Inequality in America: the contribution of health centers in reducing and eliminating disparities in access to care. *Med Care Res Rev.* 2001;58(2):234-48; Falik, M. and Bernstein, A. "Enabling Services: A Profile of Medicaid Managed Care Organizations." Kaiser Commission on Medicaid and the Uninsured. 2000.

[16] Shin P., Ku L., Jones E.et al., "Financing Community Health Centers as Patient- and Community-Centered Medical Homes: A Primer," The Commonwealth Fund, May 27, 2009.

improve access, thereby reducing the likelihood that their patients will seek care in an emergency department.[17]

Third, health centers offer income-adjusted sliding fee scales and are able, through grant support, to make health care services affordable to the community as a whole, thereby encouraging earlier and more continuous care.[18]

Fourth, the health center organizational and staffing model is inherently efficient,[19] as shown by earlier studies of staff-model HMOs and group health practices. Health center professionals are employed as salaried staff.   Accordingly, health center personnel lack an incentive to maximize revenues that might be found those settings in which personal income is tied to the volume of procedures furnished.

Lastly, the governance feature of health centers, which requires that a majority of board members be users of the health center, creates a level of community accountability that is unmatched in other practice settings.[20]   Advisory boards and consultation processes can play an important role in shaping health care to meet community needs. Board participation, however, creates a higher level of fiduciary responsibility and accountability to the community. The senior management of a health center is directly and legally accountable to the patients of the center, thereby enhancing the degree to which the health center is rooted in its community and responsive to the need for high quality care.

These results for North Carolina confirm at the state level the findings of prior national-level studies that show health centers provide significant cost-savings when compared to other primary care practice settings. The results also continue to show the effectiveness of the health center model from a cost perspective and underscore the importance of key attributes of the health center model that improve access and decrease costs.

Our findings further suggest that given the extent of health center cost savings, plans to double the size of the health center program represent a sound investment of Federal and State funding. Finally, the study shows that in the absence of more detailed data and reporting systems that would allow direct comparison of cost performance, existing national and state datasets can be used to estimate differences in health care expenditures and evaluate cost effectiveness.

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[17] Government Accountability Office, Hospital emergency departments: health center strategies that may help reduce their use. (GAO-11-643T; May 11, 2011); Rust G, et al., Presence of a community health center and uninsured emergency department visit rates in rural counties. *Journal of Rural Health Winter* 2009 25(1):8-16; Falik M, et al., Comparative Effectiveness of Health Centers as Regular Source of Care. January - March 2006 *Journal of Ambulatory Care Management* 29(1):24-35.

[18] 42 U.S.C. 254b.

[19] Hing E, Hooker RS, Ashman JJ, Primary health care in community health centers and comparison with office-based practice. *J Community Health* June 2011; 36(3): 406-13.

[20] 42 C.F.R. §51c.304.

APPENDIX: METHODS

Study Design

Our primary focus was to estimate cost savings for individuals who used CHCs compared to those who received ambulatory care elsewhere. Hence, to ensure the comparability of the CHC user and non-user populations, we excluded individuals who received ambulatory care from hospital emergency departments or talked to their providers by telephone only rather than actually visiting the provider's office. The analytic sample from the MEPS to estimate the expenditure models was restricted to 15,154 individuals aged 18 or older. This sample is representative of all non-institutionalized civilian adults in the United States. The analytic sample for the analysis of cost savings associated with the use of CHCs in North Carolina was restricted to about 43,769 individuals aged 18 or older.

Data Sources

Medical Expenditure Panel Survey (MEPS): We used data from the 2008 MEPS to estimate costs savings associated with the use of community health centers (CHCs) compared to other providers of ambulatory care. Co-sponsored by the Agency for Health Care Research and Quality and the National Center for Health Statistics, the MEPS is a nationally representative longitudinal survey that covers the United States non-institutionalized civilian population.[21] MEPS is fielded based on the sampling frame of the National Health Interview Survey (NHIS) and surveys households that participated in the prior year's NHIS. The MEPS is widely used as an authoritative source of information on the nation's healthcare use and expenditures.

For this analysis, we combined data from three different components of the MEPS including the Household Component (HC) file, the Office-Based Medical Providers Visits file (OBMP), and the Outpatient Visits file (OPV) of the MEPS. The HC file is the core component of the survey that collects demographic characteristics, health expenditures, health conditions, health status, and medical services utilization, access to care, health insurance coverage, and income data for each person surveyed. The OBMP component collects data on dates of visit, diagnosis and procedure codes, charges and payments, and different types of office-based medical providers for a nationally representative sample of the civilian non institutionalized population of the United States. Similar to the OBMP component, the OPV component collects information on outpatient visits.

Behavioral Risk Factor Surveillance System (BRFSS): We used three years of data from the 2007, 2008, and 2009 Behavioral Risk Factor Surveillance System (BRFSS) for the state of North Carolina to increase the sample size of the study. The NC BRFSS is an annual on-going statewide telephone health survey that uses a

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[21] Agency for Healthcare Research and Quality. MEPS HC-121: 2008 Full Year Consolidated Data File. Accessed July 2011 at http://www.meps.ahrq.gov/mepsweb/data_stats/download_data/pufs/h121/h121doc.pdf

random-digit-dial computer-assisted telephone interview to assess health conditions and behaviors of non- institutionalized adults aged 18 years and older (www.schs.state.nc.us/SCHS/brfss). The BRFSS also collects socio-demographic, socio-economic, and health insurance coverage information from residents in the state of North Carolina. BRFSS was initially developed in the early 1980s by the Centers for Disease Control and Prevention (CDC) in collaboration with state health departments and is currently conducted in all 50 states, the District of Columbia, and three United States territories. The North Carolina Division of Public Health has participated in the BRFSS since 1987. Information is also collected on preventive health services associated with the leading causes of morbidity and mortality such as cardiovascular conditions, smoking, hypertension, cancer, diabetes, and injuries.

Dependent and Key Independent Variables

We used total expenditures and ambulatory care expenditures as the dependent variables to predict the cost savings associated with CHC users compared to non-CHC users. Total expenditures in the MEPS include both out-of-pocket and third-party payments to health care providers but do not include health insurance premiums. Expenditures for ambulatory care services include those for both facility and separately billed physician services received at hospital outpatient settings. These expenditures do not include over-the-counter purchases. Our primary independent variable was whether or not the respondent received care from a CHC. We coded CHC users as equal to one (1) if the respondent reported receiving any primary care services from health centers. We took great care in measuring non-CHC users to make sure that the treatment and the control groups are comparable. To measure non-CHC users we included only those who received services from doctor's office, group practice, medical clinic, managed care plan centers, company, school, hospital or other types of clinics.

Control Variables

We used a modified version of Aday and Andersen's behavioral health model of health services to estimate cost savings associated with the CHC users compared to non-CHC users. [22] This model hypothesizes that health expenditures depend on predisposing, enabling, and health need factors. In this conceptual framework CHC is an enabling factor. We predicted costs savings using demographic, socioeconomic status, health access, health behavior, location, and health need measures. The demographic factors were age, gender, race, and marital status. The socioeconomic or access factors were education, income, and health insurance status. To measure health behaviors, we used responses to lifestyle-directed questions, including those related to smoking and obesity. Census region and urban-rural residence were used to measure location. To measure health needs, we used self-reported descriptions of health as   fair or poor health and reported diagnoses of diabetes, asthma, hypertension or cardiovascular conditions. Cardiovascular conditions included heart disease, angina, coronary heart attack, and stroke. To measure race, we used four categorical indicators

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[22] Aday LA and Andersen R, A framework for the study of access to medical care. *Health Serv Res* Fall 1974; 9(3):208-220.

of race/ethnicity including non-Hispanic white, black, Hispanic, and Asian (white is the reference group). We used the MEPS' body mass index (BMI) measure, based on respondents' self-reported height and weight, to create an indicator variable for obesity defined as whether patients reported a BMI greater than 30 kg/m^2. Different categories of education and income were used to account for the non-linearity of the relationship between expenditures and these two variables. Education levels were defined as receiving no school, less than a high school degree, high school degree, college degree, or post-graduate degree. Income levels were defined as incomes below 100 percent of the federal poverty line (FPL), between 100 and 200 percent of the FPL, between 200 and 400 percent of the FPL, and above 400 percent of the FPL.

Estimation Strategy

As stated above, we estimated two types of cost savings including cost savings associated with total expenditures and cost savings associated with only ambulatory expenditures. We used chi square tests to compute differences in unadjusted expenditures between CHC users and non- CHC users. We also reported robust standard errors for both sets of models. We used log-transformed generalized linear models to estimate costs savings. We estimated a one-part expenditure model to estimate costs savings because less than two percent of observations in the data had some types of expenditures for both total and ambulatory care. There was no need to estimate two-part expenditure models that generally address issues of sample selection and heterogeneity.[23] However, we used generalized linear models (GLM) with log link and gamma distribution to predict expenditures conditional on individuals with positive expenditures. We used GLM models with log link and gamma distribution to address the skewness and potential heteroskedasticity in the expenditure data.[24] We eliminated outliers, i.e., observations with expenditures greater than $100,000. We conducted the different diagnostic and specification tests recommended by Manning and Mullahy.[25] We estimated the models using the survey regression procedures in STATA 11(Stata Corp, College Station, Tex), which appropriately incorporate the design factors and sample weights. We developed two models to predict costs savings and conduct sensitivity analyses for robustness. In Model 1, we only used fair/poor health indicator to measure health status. In Model 2, we added behavioral health factors and other health conditions such as diabetes, asthma, hypertension, and CVD.

[23] Cameron AC, Trivedi PK, *Micro econometrics methods and applications.* New York: Cambridge University Press, 2008; Deb P,,Manning W, and Norton E, *Modeling health care costs and counts*. Presentation at ASHE-Madison Conference, 2006. Available at http://www.unc.edu/~enorton/DebManningNortonPresentation.pdf Accessed July 12, 2011; Buntin MB and Zaslavsky AM: Too much ado about two-part models and transformation? Comparing methods of modeling Medicare expenditures. *Journal of Health Economics* May 2004; 23:525-542; Manning WG and Mullahy J, Estimating log models: to transform or not to transform? *Journal of Health Economics* March 2001; 20(4):461-494; Manning WG, The logged dependent variable, heteroscedasticity and the retransformation problem. *Journal of Health Economics* Jun 1998; 17(3):283-295; Mullahy J, Much ado about two: Reconsidering retransformation and the two-part model in health econometrics. *Journal of Health Economics* Jun 1998; 17:241-281; Heckman J, Sample selection bias as a specification error. *Econometrica* Jan 1979; 47(1):153-161.

[24] Buntin MB, Zaslavsky AM, *op. cit.*; Deb P,,Manning W and Norton E, *op. cit.*; Manning WG, ibid; Manning WG and Mullahy J, *op. cit.*; Mullahy J, *op. cit.*

[25] Manning WG and Mullahy J, *op. cit.*; Mullahy J, *op cit.*

Table A. Weighted proportions of Independent Variables Used in the Cost Savings Models for Adults aged 18 years or Older (N = 16,074)

	2008 MEPS				2007-2009 BRFSS
Variables	Total	CHC	NO-CHC	P-value	Age>17
Social Demographic Variables					
Gender					
Male [Reference]	0.43	0.36	0.43		0.4
Female	0.57	0.64	0.57	0.1278	0.6
Age (Mean, SE)	49.00 (30)	41.0 (15.14)	49.0 (30.33)	P<0.001	52.61 (0.11)
Race					
White [Reference]	0.73	0.58	0.73	0.0083	0.75
Hispanics	0.11	0.19	0.11	0.0451	0.05
Black or African American	0.1	0.15	0.10	0.0799	0.16
Other race	0.06	0.08	0.06	0.3371	0.03
Marital status					
Married [Reference]	0.57	0.44	0.57	0.0052	0.68
Divorced	0.12	0.13	0.11	0.4834	0.1
Widowed	0.08	0.07	0.08	0.7154	0.09
Separated	0.02	0.01	0.02	0.0030	0.03
Never married	0.22	0.36	0.22	0.0039	0.1
Social Economic Status					
Income					
B/w 0-100% FPL [Reference]	0.10	0.24	0.10	0.0001	0.16
B/w 100-200% FPL	0.17	0.25	0.17	0.0231	0.25
B/w 200-400% FPL	0.3	0.34	0.29	0.3197	0.35
Over 400% of the FPL	0.43	0.17	0.44	P<0.001	0.24
Education					
Less Than High School Degree [Reference]	0.15	0.29	0.15	0.0009	0.14
High school graduate	0.3	0.31	0.30	0.8402	0.29
Some college	0.24	0.19	0.24	0.0883	0.26
College graduate or more	0.31	0.20	0.30	0.0248	0.31
Behavioral Variables					
No smoker [reference]	0.83	0.75	0.83		0.8
Smoker	0.17	0.25	0.17	0.0527	0.2
Normal Weight [Reference]					0.33
Overweight					0.35
Obese/Over-obese	0.32	0.34	0.32	0.7394	0.28

	2008 MEPS				2007-2009 BRFSS
Health Status					
Excellent/Very good/Good [Reference]	0.83	0.71	0.83		0.8
Fair/Poor	0.17	0.29	0.17	0.0203	0.2
Morbidity					
No Diabetes [Reference]	0.88	0.89	0.88		0.87
Diabetes	0.12	0.11	0.12	0.6238	0.13
No Hypertension [Reference]	0.62	0.69	0.62		0.64
Hypertension	0.38	0.31	0.38	0.0567	0.36
No CVD	0.79	0.96	0.99		0.9
CVD (AMI, Coronary atherosclerosis, angina)	0.21	0.04	0.01	0.1277	0.1
No Asthma	0.9	0.84	0.90		0.92
Current Asthma	0.1	0.16	0.10	0.0815	0.08