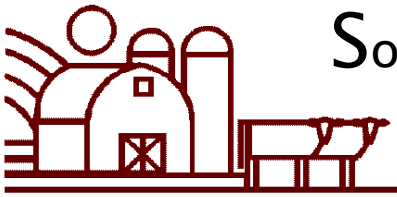
Hospitalization for Ambulatory Care Sensitive Conditions: Asthma, Diabetes, and Congestive Heart Failure in South Carolina



South Carolina Rural Health Research Center

Arnold School of Public Health
Department of Health Services Policy & Management

Hospitalization for Ambulatory Care Sensitive Conditions: Congestive Heart Failure, Diabetes and Asthma in South Carolina

Authors:
Janice C. Probst, PhD
Charity Moore, PhD
Elizabeth G. Baxley, MD
John L. Lammie, MD

South Carolina Rural Health Research Center

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Joan Van Nostrand, DPA, Project Officer

Executive Summary

Introduction

Hospitalization rates for ambulatory care sensitive conditions, diseases for which primary care in the preceding six months could have reduced or eliminated the need for hospitalization, are a commonly used indicator of disparities in access to care. Previous research in South Carolina found that rural African American adults aged 50-64 years had higher population-based hospitalization rates than rural white adults. For all hospitalizations, the African American to white ratio in this age group was 1.17. For diabetes, the ratio was 5.82, and for congestive heart failure, 2.70. Earlier work also found disparities in emergency department use in this population. For example, the African American to white ratio among persons 50-64 years for emergency department visits for asthma was 3.13.

To continue the exploration of health service disparities, the present study examined hospitalization for diabetes, congestive heart failure and asthma among residents of South Carolina who were insured by Medicaid or by a large private insurance plan. Because these two populations are so different, each was analyzed separately. For both groups, the analysis was limited to persons in the 50-64 year age group who had no mental impairment that might prevent them from caring for themselves and who were continuously insured. Patient records for the period 1997 – 1999 were examined. Hospitalization was examined two ways. The rate of hospitalizations per year among rural and minority residents was compared to a baseline, urban whites. Rural was defined as residence in a county that outside a metropolitan statistical area. Second, multivariate analysis was conducted to control for demographic factors, comorbidities, and community resources.

Key findings

Hospitalization

Hospitalization rates were *not* consistently higher for rural or minority populations than for urban white populations.

Among persons with asthma:

- In a privately insured population, rural non-whites had rates of hospitalization three times than the baseline population, urban whites (adjusted rate ratio 3.20). However, after controlling for age, sex, and visit pattern, differences were not significant.
- In the Medicaid population, urban African Americans had higher rates of hospitalization than urban whites (adjusted rate ratio, 1.58). Again, differences were not significant after controlling for age, sex and visit pattern.

Among persons with diabetes:

- In a privately insured population, rural whites had higher hospitalization rates than urban whites (adjusted rate ratio, 1.46). This relationship persisted even after controlling for age, sex, visit pattern, and co-morbid asthma (Relative Risk, 1.78, CI 1.34 - 2.34). Nonwhite beneficiaries, whether rural or urban, did not differ from urban whites.

- In the Medicaid population, African Americans in both rural areas and urban areas had *lower* rates of hospitalization than urban whites (adjusted rate ratios, 0.64 and 0.68, respectively). The reduced risk among rural and urban African Americans persisted after controlling for age, sex, comorbid asthma, and visit patterns (Relative Risk: rural African Americans 0.75, CI 0.61 – 0.91; urban African Americans, 0.73, CI .060 – 0.90).

Among persons with congestive heart failure:

- In both a privately insured population and among persons insured by Medicaid, there were no differences by race or residence in either rates of hospitalization per person year or in relative risk for hospitalization, after controlling for age, sex, visit pattern and co-morbid diagnoses.

Other Services

Use of services differed between privately insured patients, who were principally white, and Medicaid patients, who were principally non-white.

- Medicaid patients had nearly twice the rate of hospitalizations per patient year as privately insured patients with the same diagnoses.
- Emergency department visit rates per patient year were at least twice as high among Medicaid patients as those among privately insured patients with the same diagnoses.
- Rates of office-based visits were lower among Medicaid patients than among privately insured patients for two of the three conditions examined.
- Medicaid recipients within each diagnosis were less likely to receive most of their care from an office-based practitioner, rather than an ED.

Community resources

We found no effect of community resources, measured as physicians per population, presence of an ED in the county, and presence of a federally qualified CHC in the county, on hospitalization rates for the diseases and patients studied.

Limitations to the Study

The analysis reported here is restricted to two population groups and three diagnoses within a single Southern state. Additional limitations include a restrictive definition of co-morbidity, which was confined to co-occurrence of the three disorders studied, limitation of visit information to visits for the conditions studied rather than all visits, and lack of pharmacy data.

Conclusions

Reducing health disparities

Earlier intervention with weight and exercise counseling, lipid management, and hypertension control could reduce the prevalence of diabetes and congestive heart failure among African Americans as well as whites. The ability of low-income rural minority adults to access preventive services, however, is limited by high rates of uninsurance in this population. In the current financial situation, providing health insurance or other access to care to young working

age adults will be difficult. States are cutting back Medicaid, the principal vehicle for expanding access. Expanding employer-based coverage will also be difficult.

In a context of fiscal constraint, expanding the number of practitioners who provide free or low cost services, particularly outreach and preventive screening, becomes the most viable alternative for reaching low income and minority population. Targeted expansion of federally qualified community health center sites and increasing focus on prevention as part of their mission is one way of providing access to low income persons.

Implications for disparities research

- Disparities research must begin to correct for prevalence to better direct policy. Population-based analyses point to the presence of disparities, but detailed patient-level analyses are needed to identify remediable sources of disparities. As noted, the remedy for high hospitalization rates for diabetes among African Americans may lie in providing preventive services while persons are in their 20's and 30's, rather than better disease care when they are in their 50's.

- Research into possible treatment differentials across insurers is needed. In theory, all patients should be treated according to clinical guidelines for number of visits, types of medication, and so on. Are differences in hospitalization, physician visits and ED visits between Medicaid and privately insured patients a function of differing clinical severity, or of inadequate care within one specific insurance plan? To what extent are patient behaviors, such as poor medication compliance, a factor in differing utilization patterns? What patient education approaches could be effective at preparing Medicaid patients for effective disease self-management. If discrepancies are independent of patient behaviors or clinical severity, what changes are needed in the Medicaid system? Research must address these questions and suggest policy remedies where appropriate.

- Disparities research has to step back from the clinical arena into the circumstances that dictate type of coverage. Racial disparities in education and employment may be driving disparities in health more strongly than any actions within the health care system. Efforts to enhance education systems and expand employment opportunities in rural areas will have long-term dividends in terms of improved community health.

Chapter One

Introduction

Background: Hospitalization for Ambulatory Care Sensitive Conditions

For some conditions, hospitalization is unavoidable. Hip fracture is an example of a medical event that cannot be treated on an outpatient basis. For selected conditions, however, expert panels have agreed that hospitalization can generally be avoided if the individual receives adequate outpatient care (Brown, Goldacre, Hicks et al, 2001; Billings, Zeitel, Lukomnik et al 1993; Weissman 1992). These diagnoses are characterized as "ambulatory care sensitive conditions" (ACSCs). Analysis of ACSCs has been used to assess the availability of outpatient care to various populations (see multiple citations in Appendix C), with varying results. In general, low levels of community resources, including socioeconomic indicators and provider availability, and high proportions of persons of minority status have been associated with high rates of ACSC hospitalization, although the relative roles of health care infrastructure and other factors remains to be determined (Ricketts et al, 2001). ACSC hospitalizations have been used as an index of health disparities experienced by vulnerable populations, in particular, minorities, the poor, and the uninsured (Bindman et al., 1995; Culler, Parchman, and Przybylski, 1998; Parker and Schoendorf, 2000; Shi and Lu, 2000).

Analysis of population-based hospitalization rates in South Carolina found significant racial disparities in ACSC hospitalization rates (Samuels, Probst et al; 2001). During calendar year 1998, rural African Americans aged 50 and above were hospitalized at greater rates than rural whites for diabetes mellitus without complications (3.9 times the white rate), diabetes mellitus with complications (3.3), congestive heart failure (1.5 times the white rate), and asthma (1.4 times the white rate).

Multiple causes can be hypothesized for racial and rural differences. Rural residents are generally in poorer health (Holzer et al., 1996; Mainous & Kohrs, 1995), more likely to be disabled (Blank et al. 1996; Lishner et al 1996) and less likely to have insurance than urban residents (Shi, 2000; Mueller, Patil, and Boilesen, 1998). Rural residents, and particularly rural minorities, are also more likely to live in impoverished communities (Albrecht, Albrecht, and Albrecht, 2000; Hirschl and Brown, 1995; Jensen, 1994; Brown and Warner, 1991; Rowland and Lyons, 1989). From a medical systems perspective, possible contributors to excess hospitalization include practitioner type and organization, lack of primary care practitioners, lack of health insurance leading to lack of access to existing practitioners, and difficulty obtaining needed medications (Epstein, 2001; Schreiber and Zielinski, 1997; Parchman and Culler, 1994; Brown and Warner, 1991). Other researchers have argued that physician supply, the presence of a subsidized clinic, physician practice style, and having a regular source of care do *not* significantly reduce hospitalizations for ambulatory care sensitive conditions (Ricketts et al., 2001; Komaromy et al., 1996; Gill, 1997). These analyses conclude that race and income are stronger predictors of preventable hospitalizations (Ricketts et al., 2001; Komaromy et al., 1996).

Purpose of This Report

The purpose of this report is to carry forward the investigation into health disparities in South Carolina. While hospital discharge data indicated that rural African Americans were being hospitalized at a greater rate than their white peers for certain ACSC diagnoses, the previous study did not provide guidance regarding the source of these disparities that could be used to direct policy. For example, higher rates of hospitalization could indicate poor care for rural African Americans, or could indicate that a higher proportion of rural African Americans suffered from the condition being studied. The point at which to intervene to reduce disparities in hospitalization is different in those two scenarios.

Our study examines three specific ACSC diagnoses, asthma, diabetes, and congestive heart failure, among two groups of South Carolinians: persons insured by a large, state-wide private insurance plan offered to employees and their dependents, and Medicaid recipients. These two groups were chosen because for each we could study both inpatient and outpatient care received, thus leading to better understanding of the factors associated with ACSC hospitalization. We attempt, in the report that follows, to address the following key questions regarding persons with the three diagnoses listed above:

- Among persons studied, does the receipt of outpatient care differ by race and residence? Outpatient care includes physician visits and emergency department (ED) visits.
- Among persons studied, does the rate of hospitalization differ by race and residence?
- When personal characteristics (age, sex, diagnoses), county demographics (racial makeup, presence of CHC and presence of ED), and usual patterns of care are held equal, do race and residence affect the probability of hospitalization for ACSCs?
- Do health resources measured at the county level affect the rate of hospitalization?

Privately insured enrollees and Medicaid recipients are studied separately. While analysis of different insurance effects would be valuable, we believe that the two groups differ in ways that go beyond source of health insurance, and so may not be comparable. Privately insured enrollees include healthy persons still in the work force, as well as their dependents, while Medicaid recipients in this age group are likely to be extremely poor and/or disabled, such as persons receiving Supplemental Security Income.

Chapter Two

Asthma

Privately Insured Enrollees

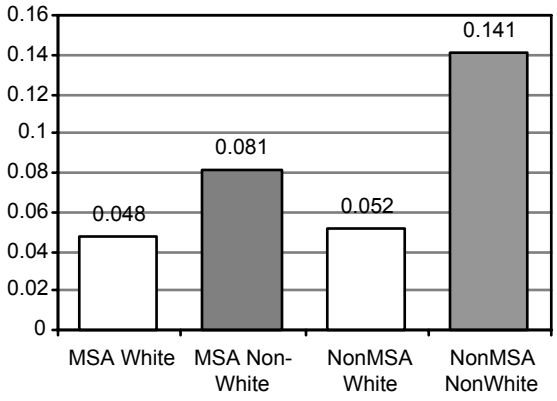
Patient characteristics

From our study database, a total of 661 privately insured enrollees aged 50-64were identified as having asthma, with no other study diagnoses (Table 1). Privately insured enrollees with asthma were largely white (85%), female (67%), and residents of metropolitan counties (78%). Privately insured enrollees were followed for an average of two years, generating slightly more than 1,300 person years of observation (Table 2).

Use of services

Overall, privately insured enrollees were hospitalized at the rate of 0.057 discharges per person year (pyr; Table 2). Put another way, about 1 in every 18 enrollees with asthma was hospitalized each year. Rural non-white enrollees were hospitalized at nearly three times the rate of white enrollees living in metropolitan counties (adjusted rate ratio, 3.20, CI 1.10-9.49). About one in seven rural, nonwhite enrollees was hospitalized for asthma, versus one in 20 urban white residents.

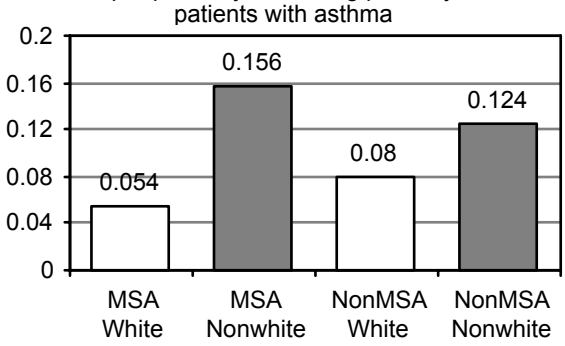
Figure 1
Discharges per person year among privately insured patients with asthma



All privately insured enrollees, regardless of race and residence, averaged about 2 office visits per year specifically for asthma. This includes both private physician offices and hospital-based clinics (Table 2).

Non-white enrollees in metropolitan counties and enrollees living in rural areas did not differ significantly from urban whites in outpatient visits per year. ED visit rates for asthma were lowest among white, metropolitan enrollees (0.054 visits/pyr), followed by white, rural enrollees (0.080 visit/pyr). Non-white metropolitan enrollees had significantly higher ED visit rates compared to white enrollees in metropolitan areas (adjusted rate ratio 3.43, CI 1.63-7.62). Non-white rural county residents showed a similar trend of higher ED visit rates, but differences were not significant (adjusted rate ratio 2.30, CI 0.68 – 8.34).

Figure 2
ED visits per person year among privately insured patients with asthma



Nearly all privately insured enrollees with asthma (95%) received most of their care in an office based setting, with no significant differences by race or residence (Table 3). Because there was so little variation in usual source of care, this factor was not included in multivariate analysis for the privately insured enrollees.

Factors affecting the risk of hospitalization

With personal characteristics held equal, rural non-white privately insured enrollees were *not* statistically more likely than white, urban enrollees to have been hospitalized (From the patient characteristics model: Risk ratio [RR] 1.68, CI 0.39 – 7.20; see Table 4). Personal characteristics, such as sex and age, were not important in any model; neither were community characteristics. Interpretation of the absence of disparities among rural nonwhite enrollees in the privately insured group must take into consideration that only 26 of 661 persons fell into this category. The power to detect differences in a group this size is relatively small, as indicated by the large confidence intervals.

The principal factors statistically associated with whether an enrollee with asthma would be hospitalized were visit pattern and ED use. Enrollees with no office-based outpatient visits for asthma during a six month period, but with some visits across the study period, were at lower risk for hospitalization than those who made one or two visits (RR 0.27, CI 0.09-0.78). These enrollees may represent persons with low level, well controlled asthma. Enrollees with *no* office visits across the entire study period were at very high risk for hospitalization (RR 20.72, CI 3.00 – 143.93).

Again, we must note that interpretation is limited by the small number of rural, nonwhite privately insured enrollees included in the data set. When the model includes ED use, being rural and nonwhite becomes *protective* against hospitalization. The experience of two of the 26 rural, non-white patients affects this result. One patient went to the ED and was admitted the same day, while the other visited an ED and was admitted within the month.

Conclusion: Rates of hospitalization among non-white, rural, privately insured enrollees were significantly higher than among white, urban enrollees. In multivariate analysis, differences in hospitalization between white and nonwhite privately insured enrollees with asthma were largely driven by differences in visit frequency and ED use, with race and residence ceasing to be statistically significant. Persons who visited the ED for asthma were more likely to be hospitalized than those who did not. Without a clinical records review, however, it is difficult to determine whether or not differences stem from increased clinical severity of illness among persons whose condition leads them to visit the ED or from lack of adequate comprehensive outpatient care (as opposed to episodic ED care).

Medicaid Recipients

Patient characteristics

A total of 820 Medicaid recipients were identified with asthma, but no other study diagnoses. Recipients were followed, on average, for about 25 months (2.17 years), resulting in nearly 1,800 person years of observation (see Table 5). The recipients were 40% African

American, 45% white, and 15% persons of other or unknown race. Just over three quarters were female (78%), while about two thirds were residents of metropolitan counties (63%; Table 1).

Use of services

The overall rate of hospitalization was 0.127 per person year (Table 5 and Figure 3), or about one hospitalization per year for every eight persons. The rate of hospitalization was significantly higher among urban African American enrollees than among urban whites (adjusted rate ratio 1.58, CI 1.05-2.40). In rural counties, on the other hand, the hospitalization rate was highest among white enrollees, and lowest among African Americans and persons whose race was "other" or not recorded; these differences were not statistically significant.

Medicaid recipients averaged 1.46 office visits per year specifically for asthma (Table 5). Visit rates did not differ significantly across race and residence. The lowest visit rate was seen among rural white recipients (1.22 visits/pyr) and the highest was among persons of other or unknown race living in metropolitan areas (1.63 visits/pyr).

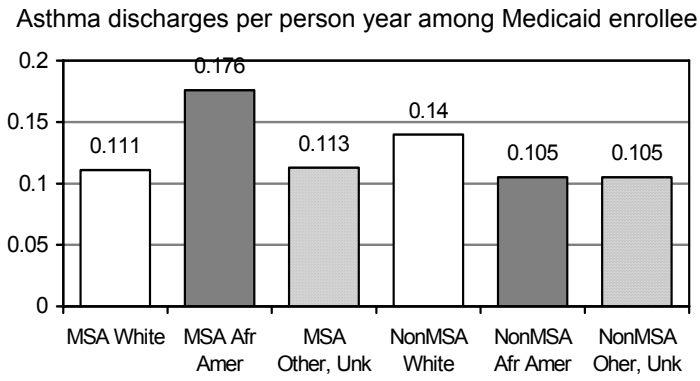
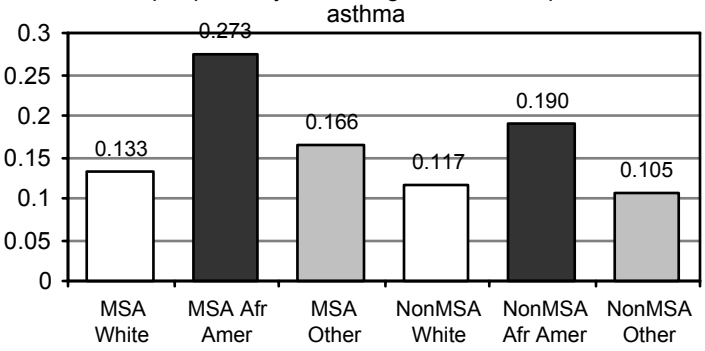


Figure 4
ED visits per person year among Medicaid recipients with asthma



ED visit rates were lowest among rural Medicaid recipients of other or unknown race (0.105 visits/pyr), followed by rural white recipients (0.117 visit/pyr). The rate of ED visits among urban African American recipients was twice as high as that among white metropolitan recipients (adjusted relative rate 2.06, CI 1.05-2.40). Expressed differently, more than one in every four urban African American Medicaid recipients with asthma visited the ED each year, versus just fewer than one in every eight urban, white recipients.

On average, four of every five Medicaid recipients (80.2%) received most of their care in an office based setting rather than an ED (Table 6). Urban African American recipients were least likely to receive most of their care in an office-based setting (72%), while rural residents of "other" or unknown race were most likely to do so (91%). Rural African Americans and rural and urban whites all were similar, with between 81 and 83% primarily receiving office-based care. (Overall differences, p = .0468)

Factors affecting recipient hospitalization

As we did for privately insured enrollees, we performed a multivariate analysis of the risk of hospitalization among Medicaid recipients. Results are shown in Table 7.

Urban African Americans were the group at highest risk for hospitalization for asthma, with approximately twice the risk for hospitalization as urban whites. This effect was consistent across all four models, even when holding constant the higher ED visit rate among this population (RR 1.94, CI 1.15-3.30). The risk for hospitalization among rural African Americans and rural residents of other or unreported race was very similar to that of urban whites.

Neither county characteristics nor usual source of care affected the risk for hospitalization with asthma among Medicaid recipients, when holding age, sex, race and residence constant. The pattern of care received for asthma was strongly associated with risk for hospitalization. Persons falling in the upper quartile for the number of office-based visits (3 or more visits) were nearly three times as likely to be hospitalized as persons in the lower three quartiles, perhaps indicating that their level of severity was higher (RR 3.21, CI 1.88-5.46). In addition, persons who made at least one ED visit during the period had an increased likelihood of hospitalization (RR 1.87, CI 1.06-3.23).

Conclusion: Even holding personal characteristics, patterns of care and ED use constant, urban African American Medicaid recipients with asthma were more likely to be hospitalized than were urban white recipients. Rural African Americans, on the other hand, did not differ from urban whites. Two factors that may be associated with disease severity, frequent office visits and ED use, were the strongest predictors of hospitalization among Medicaid patients with asthma.

Chapter Three
Diabetes

Privately Insured Enrollees

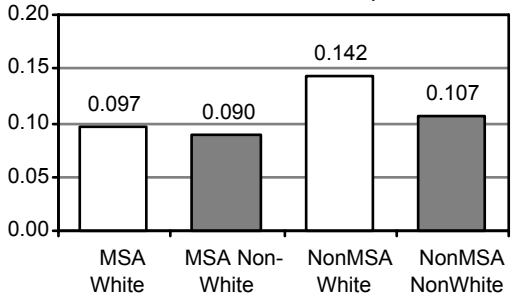
Patient characteristics

There were 2,088 privately insured enrollees with a recorded diagnosis of diabetes during the study period, of whom 136, or 6.5%, also had asthma. This chapter includes both types of patient, with asthma considered a co-morbidity in the multivariate analysis. Privately insured enrollees with diabetes were followed, on average, slightly more than two years (2.24 years), generating approximately 4,683 person years of observation. About two thirds of privately insured enrollees (63%) were white. Enrollees were evenly distributed by sex (51% male, 49% female). More than two thirds (69%) were residents of urban counties (Table 1).

Use of services

About one in ten privately insured enrollees with diabetes or diabetes plus asthma was hospitalized each year (0.104 hospitalization/pyr). The hospitalization rate was highest among rural, white enrollees, who were hospitalized significantly more than urban white enrollees (adjusted rate ratio 1.48, CI 1.11 – 1.98). Non-white enrollees, whether rural or urban, were not hospitalized at a statistically higher rate than urban white enrollees.

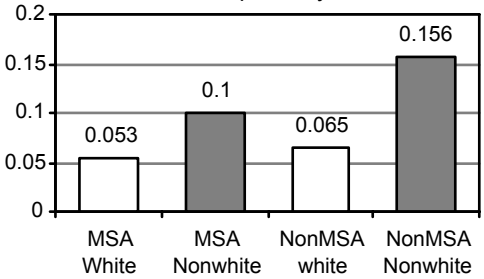
Figure 5
Discharges/person year among privately insured with diabetes or diabetes plus asthma



The physician visit rate per person year was similar across all types of enrollee, averaging 3.6 visits per person year overall. This is very close to the four visits per year recommended by current guidelines for the treatment of diabetes. There were no significant differences associated with rural residence or minority race. Virtually all privately insured enrollees (98.9%) received most of their care from a physician's office or hospital outpatient clinic, rather than an ED (Table 9).

ED visits rates were approximately twice as high among non-white as white enrollees (Table 8). The adjusted rate ratio was highest among rural non-white enrollees, who were nearly three times as likely to have visited an ED as were white urban enrollees (adjusted rate ratio 2.91, CI 1.99 – 4.28). Nonwhite urban enrollees made nearly twice as many ED visits as their white counterparts (adjusted rate ratio 1.83, CI 1.31 – 2.55). About one in twenty urban white enrollees with diabetes visited an ED each year, versus one in every 10 urban non-white enrollees and one in every six to seven rural nonwhite enrollees.

Figure 6
ED visits per person year, by race and residence, privately insured



Factors affecting hospitalization for diabetes among privately insured enrollees

Multivariate analysis was used to identify factors associated with risk for hospitalization among privately insured enrollees with diabetes. The results are shown in Table 10 in the appendix.

The greatest risk factor for hospitalization across all three models was having an ED visit in the preceding six months. Enrollees with an ED visit were hospitalized at three times the rate of those without such a visit (RR 3.02, CI 2.00 – 4.60). The next largest factor increasing the rate of hospitalization was the presence of asthma, in addition to diabetes, in an enrollee's clinical profile. Enrollees with both diabetes and asthma were more than twice as likely to be hospitalized as were other enrollees with diabetes (RR 2.05, CI 1.45 – 2.90). Rural non-white enrollees did not differ significantly from urban whites enrollees in any of the models. Echoing the results of simple rate comparisons, rural white enrollees were significantly more likely to be hospitalized than urban white enrollees (RR 1.75, CI 1.30– 2.40), even after controlling for the presence of comorbid asthma.

Persons who fell in the upper quartile for visit frequency (four or more visits) had higher relative rates of hospitalization than those in the lower quartile (RR 1.50, CI 1.11 – 2.00), while persons with no office visits across a six month interval, but some visits during the period of observation, were at lower risk (RR 0.66, CI 0.46 – 0.93). A pattern including no visits across a six month period would not reflect current diabetes guidelines. It is possible that this group includes patients who are mildly glucose intolerant but controlled by diet, as well as patients who either do not receive or are not compliant with recommended follow-up intervals. Higher hospitalization among enrollees who have visited an ED may reflect poorer control of their diabetes.

Conclusion: Overall, rural non-white privately insured enrollees with diabetes were not at higher risk for hospitalization than were their urban white counterparts. However, patterns of care and comorbidity strongly influenced the risk of hospitalization.

Medicaid Recipients with Diabetes

Recipient characteristics

There were 3,577 Medicaid recipients with a recorded diagnosis of diabetes during the study period, of whom 374 or 10.5% also had asthma. As before, persons with asthma are included in the analysis.

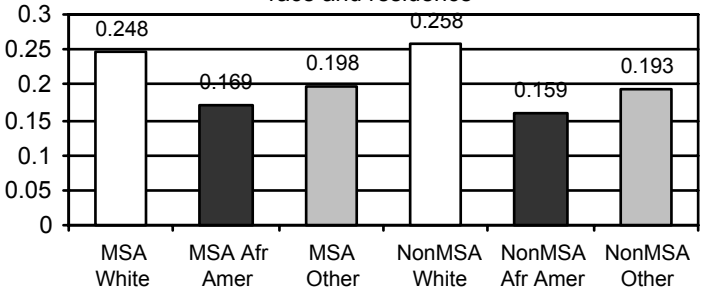
Medicaid recipients with diabetes were primarily women (76.0%). Approximately three of every five persons were African American (58.2%), followed by whites (28.8%) and persons of other or unreported race (13.0%). Just over half of persons with diabetes (54.9%) lived in metropolitan counties (Table 1).

Use of services

On average, Medicaid beneficiaries were hospitalized at the rate of 0.193 discharges per person year, or about one hospitalization each year for every five recipients. Hospitalization rates were highest among white recipients, whether in urban or rural counties, as shown in Figure

7. Urban African Americans had only about two-thirds the rate of hospitalization of urban whites (adjusted rate ratio 0.68, CI 0.56-0.84). Rates among rural African Americans were also significantly lower than those of urban whites (adjusted rate ratio 0.64, CI 0.52-0.79). Rates for persons whose race was given as "other or unknown" fell midway between those of whites and African Americans, and did not differ significantly from those of urban whites.

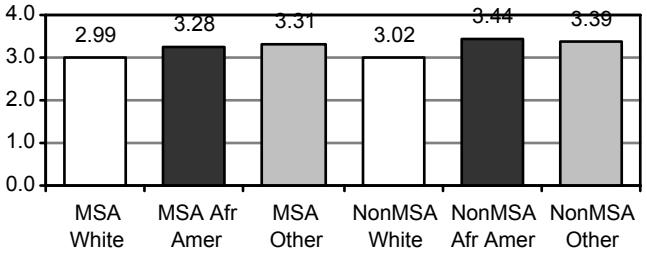
Figure 7
Hospitalizations per person year, Medicaid recipients, by race and residence



Across all race and residence categories, Medicaid patients with diabetes averaged just over three physician visits per person year (see Figure 8), fewer than the quarterly visits recommended by diabetes care guidelines. African Americans with diabetes had slightly higher rates of physician visits per patient year than did urban white recipients. Urban African Americans made about 10% more visits per person year, and rural African Americans about 15% more visit per year, than did urban white recipients (Table 11.)

Medicaid patients with diabetes averaged 0.19 ED visits per patient year, or roughly one visit per year for every five patients. There were no significant differences in ED utilization by race and residence. Overall, 19 of every 20 Medicaid recipients (94.7%) received the majority of their outpatient care from an office-based setting, such as a physician's office or a hospital outpatient clinic, rather than an ED (Table 12). However, all urban Medicaid recipients, white, African American and "other" or unreported race, were statistically less likely than rural recipients to get most of their care from an office-based setting.

Figure 8
Physician visits per person year among Medicaid recipients, by residence and race



Factors affecting hospitalization among Medicaid recipients

African American Medicaid recipients with diabetes, both rural and urban, had *lower* rates of hospitalization, other things held equal, than did urban whites (RR in full model, 0.75, CI 0.61-0.91 for rural African Americans and RR 0.73, CI 0.60 – 0.90, for urban African Americans; see Table 13). Other factors affecting the relative risk of hospitalization included comorbidities, usual source of care, visit frequency, and ED use.

Across all models, persons with asthma in addition to diabetes were almost twice as likely to be hospitalized as those without this complicating factor (RR 1.75, 1.83, CI 1.46 – 2.10). Patterns of care also influenced the risk of hospitalization. Compared to persons who obtained most of their care from an office-based setting, persons who obtained most of their outpatient care from an ED had nearly double the risk of hospitalization (RR 2.10, CI 1.50 – 2.94). Persons with visit frequencies in the top quartile (4 or more) were more likely to be hospitalized than those in the lower three quartiles (RR 1.67, CI 1.40 – 2.00), while persons with

no visit in a six-month period, but some office visits across the study period, were less likely to be hospitalized. Finally, persons who had visited an ED in a six-month period were more than twice as likely to be hospitalized as those who had not (RR 2.75, CI 2.31 – 3.30).

Conclusion: Both population-based hospitalization rates and multivariate analysis found that rural and urban African Americans with diabetes were significantly *less* likely to be hospitalized than were urban whites (RRs ranged from 0.73 to 0.77). Co-morbid asthma, ED use, and high visit frequency were associated with a higher risk of hospitalization.

Chapter Four
Congestive Heart Failure

Privately Insured Enrollees with Congestive Heart Failure (CHF)

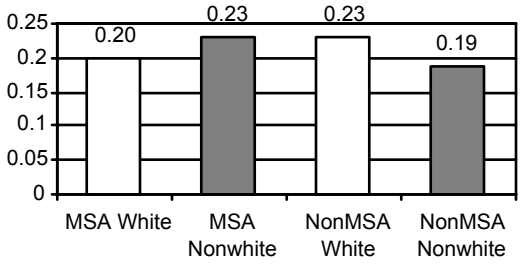
Personal characteristics

There were 745 privately insured enrollees with a recorded diagnosis of CHF during the study period, of whom 70 or 9.4% also had asthma, and 225 or 30.2% also had diabetes. No enrollees in the study had all three diagnoses. A majority of enrollees with CHF were men (52.4%). Approximately one of every three persons was non-white (34.4%) and 6 out of 10 (60.7%) lived in metropolitan counties (Table 1). Enrollees were followed for an average of slightly more than two years, accumulating 1,606 person years of observation.

Use of Services

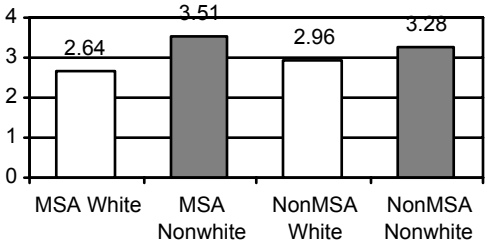
The rates of hospitalization for CHF among privately insured enrollees did not differ significantly by race and residence. Across all groups, the average was about one hospitalization per five person years (Figure 9).

Figure 9
Hospitalizations per person year among privately insure patients with CHF, by race & residence



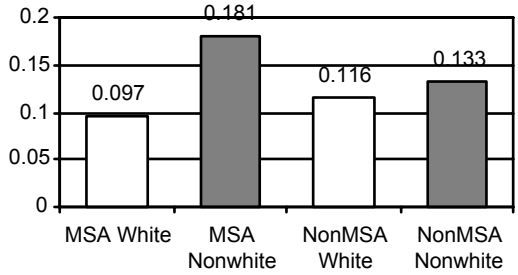
Physician visit rates differed sharply by race, as shown in Figure 10. Urban white enrollees had the lowest physician visit rates per enrollee year. Nonwhite enrollees, both urban and rural, made significantly more visits per year than did urban white enrollees. Urban non-whites made 29% more visits, and rural nonwhites 23% more visits, than urban white enrollees. In addition, rural white enrollees made 19% more visits than urban whites.

Figure 10
Physician visits per person year for CHF among privately insured patients, by race and residence



ED visit rates were nearly twice as high among urban nonwhite enrollees as among urban whites (adjusted rate ratio, 1.85, CI 1.11-3.13). Rural enrollees, whether white or nonwhite, did not have visit rates significantly higher than those of urban whites (See Figure 11). Nearly all privately insured enrollees with CHF (95.3%) received the majority of their care from office based practitioners rather than from an ED (Table 15). There were no significant race or residence differences in usual source of care.

Figure 11
ED visit rates per person year, privately insured patients with CHF, by race and residence



Factors affecting privately insured enrollee hospitalization for CHF

With all other factors held equal through multivariate analysis, race and residence were not statistically associated with the risk for hospitalization among privately insured persons with CHF. Other characteristics, including gender, comorbidities and patterns of care, had strong effects. Women were at reduced risk of hospitalization when compared to men (RR 0.66, CI 0.47– 0.93; Table 16). Enrollees who suffered from diabetes in addition to CHF were nearly five times as likely to be hospitalized as persons who did not (RR 4.72, CI 3.06-7.30; Table 16). Similarly, persons whose CHF was complicated by asthma had mRRe than three times the risk of hospitalization as persons with CHF alone (RR 3.74, CI 2.12, - 6.58). Persons with no office-based outpatient care across the study period were highly likely to be hospitalized (RR 6.21, CI 1.80-21.50), as were those who received any care at an ED (RR 4.70, CI 2.94 – 7.53). Community characteristics did not affect risk of hospitalization.

Conclusion: Among privately insured enrollees with CHF, rates of office based visits were higher among nonwhite enrollees and among rural white enrollees than among urban white enrollees. The risk of hospitalization was not associated with race or residence. Factors increasing the risk of hospitalization included male gender, comorbidities, lack of any office-based visits, and presence of ED visits.

Medicaid Recipients with Congestive Heart Failure

Personal characteristics

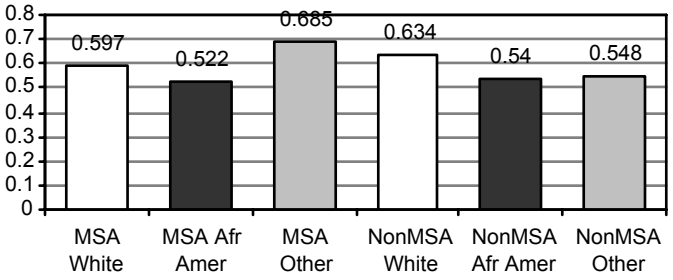
There were 2,255 Medicaid beneficiaries with a recorded diagnosis of CHF during the study period. Medicaid recipients present a more complicated clinical picture than do privately insured enrollees. Nearly two thirds of all Medicaid recipients with CHF (64%) had one or more of the other diseases studied: 223 or 9.9% also had asthma, 974 (43.2%) had diabetes, and 241 (10.9%) had both asthma and diabetes. The high proportion of persons with comorbidities suggests a much sicker population than the privately insured group. The analysis presented here includes all Medicaid recipients who had CHF, either alone or in conjunction with other health problems. Medicaid recipients with CHF were followed for an average of 2.4 years, accumulating 5,269 person years of observation.

Medicaid recipients with CHF were primarily women (70.3%). Just over half of Medicaid recipients with CHF were African American (54.8%), followed by whites (32.4%) and persons of other or unknown race (12.8%). Just over half of persons with CHF (55.4%) lived in metropolitan counties (Table 1).

Use of services

Rural and urban residents, regardless of race, did not differ in hospitalization rates. The overall hospitalization rate, 0.57 hospitalizations per person year, suggests that over a two year period most persons would have been

Figure 12
Hospitalization rates per person year among Medicaid recipients with CHF, by residence and race



hospitalized at least once (Figure 12 and Table 12). Small differences across races were not significant.

Medicaid CHF patients averaged 3.4 physician visits per person per year. Rural African Americans (adjusted rate ratio 1.21, CI 1.08 – 1.36) and urban residents of "other non-white" race had slightly higher visit rates than urban whites (see Figure 13 and Table 12). Most Medicaid recipients with CHF (90%) received the majority of their ambulatory care in an office-based setting, with no significant differences by race or residence (Table 18).

ED visit rates were significantly higher among urban African Americans and urban persons of other or unknown race, and among rural African Americans, than among urban whites (figure 14 and Table 12).

Figure 13
Visits per person year for CHF among Medicaid Recipients, by residence and race

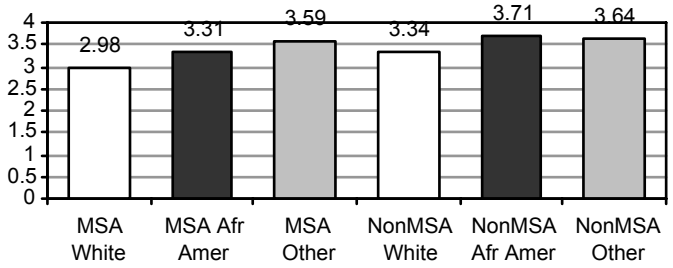
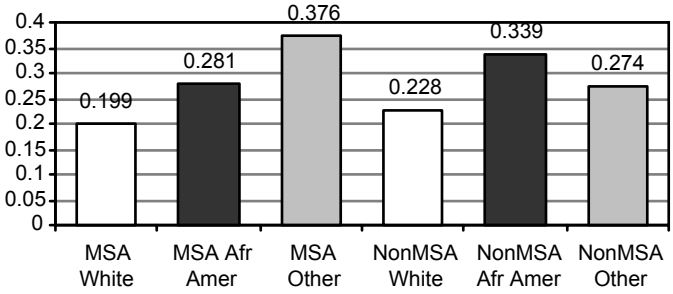


Figure 14
ED visit rates per person year among Medicaid recipients with CHF, by residence and race



Factors affecting hospitalization among Medicaid recipients with CHF

Multivariate analysis was performed, as in the previous chapters, to identify factors leading to hospitalization holding various personal characteristics equal. Among Medicaid recipients with CHF, race and residence were not significantly associated with risk for hospitalization. The factors most strongly related to hospitalization were those pertaining to comorbidity and patterns of care. Persons with diabetes in addition to CHF were more than twice as likely as other patients to have been hospitalized (RR 2.57, CI 2.27 – 2.98), after controlling for race and residence, age, sex, usual source of care, and comorbid asthma. Similarly, patients with asthma complicating the management of their CHF were about one third more likely to be hospitalized (RR 1.35, CI 1.17– 1.56).

Patterns of care also affected the risk of hospitalization. Persons whose number of office based visits placed them in the upper quartile (4 or more visits) were more likely to be hospitalized (RR 1.36, CI 1.16 – 1.60) than those in the bottom three quartiles. On the other hand, persons who had no office visits across a six month period, but who had some office visits across the entire study period, were less likely to be hospitalized (RR 0.78, CI 0.65 – 0.93). These findings are consistent with an interpretation that sicker people visit a physician more often and are hospitalized more often than persons whose level of disease leads to fewer office visits. On the other hand, persons with no office-based visits across the study period were more likely to be hospitalized (RR 1.70, CI 1.20 – 2.40). Finally, persons who had visited an ED during the preceding six months were more likely to be hospitalized than persons who had not (RR 1.83, CI 1.55 – 2.16).

Conclusions: Race and residence had no effect on the probability of hospitalization among Medicaid recipients with CHF after other factors were held constant. African Americans, both rural and urban, had rates of hospitalization highly similar to those of urban whites. Factors associated with hospitalization included the presence of comorbid asthma and/or diabetes, a high rate of office-based visits or no such visits, and use of an ED.

Chapter 5
Conclusions and Recommendations

Effects of Race and Residence on Risk for Hospitalization

Our study found no indication that hospitalization rates during 1997 – 1999 were uniformly higher for African American or rural populations than for urban, white populations, when the underlying prevalence of disease and insurance status were held equal. Findings are summarized in Table A, below. No race or residence based differences were found for congestive heart failure, whether studied as the rate of hospitalization per 100 person years or considered in a multivariate analysis that controlled for demographic factors and patterns of ambulatory care. Among persons with diabetes, rural whites were at increased risk for hospitalization among privately insured patients, while rural and urban African Americans actually had reduced risk for hospitalization among Medicaid patients, when compared to urban whites. Only among persons with asthma were nonwhite patients at higher risk for hospitalization than urban whites across both privately insured and Medicaid patients.

Table A
Are there racial or rural differences in rates for *hospitalization*?

Condition	Initial rate ratios		Multivariate results	
	Privately Insured	Medicaid	Privately Insured	Medicaid
CHF	NS	NS	NS	NS
Diabetes	Rural whites at higher risk than urban whites (1.46)	Urban and rural Afr Amer at reduced risk (0.68 & 0.64)	Rural whites at higher risk than urban whites (1.78)	Urban, rural Afr Amer at reduced risk (0.78, 0.82)
Asthma	Rural non-white higher (3.20)	Urban AA higher (1.58)	NS	NS

Our findings were surprising in that they appeared to contradict previous research (Samuels, Probst et al; 2001). In earlier work, rural African American adults age 50 – 64 had higher population-based hospitalization rates than rural white adults (African American/white ratio 1.17) and, more specifically, had higher rates of hospitalization for congestive heart failure (ratio 2.70) and diabetes (ratio 5.82). Earlier work also found racial differences in ED use in this age group, with African Americans having higher utilization for asthma (ratio 3.13), diabetes (ratio 4.42) and congestive heart failure (ratio 3.74). Why were the racial disparities previously documented in South Carolina's population not found in the present study?

In the previous analysis, hospitalization rates were calculated across *all* rural and urban residents, regardless of their health status or their insurance type. The present study looked only *within groups of persons with a specific diagnosis*. Thus, the first potential source for differences between population-based rates and the hospitalization rates found by the current study is its restriction to persons with diagnosed disease. Other evidence (Mainous, King et al; 2002) indicates that diagnosed diabetes, for example, is twice as common among rural African Americans (8.7%) as among urban whites (4.3%). Even if all persons with diabetes, regardless

of race, were hospitalized at the same rate, a population-based hospitalization rate would be expected to be twice as high among African Americans because the disease is twice as prevalent. The work reported here is limited to persons with known disease, rather than inclusive of the whole population.

The second possible explanation for the absence of racial disparities in the present study is its restriction to *insured persons, with two different insured populations analyzed separately*. Persons without health insurance, or with inadequate coverage, may have different hospitalization patterns than those within insured groups. In addition, while racial disparities were not large within either of the two insurance groups studied, the groups themselves differed sharply. There are vast economic and social differences between a population that is insured because of employment (privately insured) and one that is insured because of poverty (Medicaid). This difference worked to the advantage of whites in this study and to the disadvantage of minorities, as will be discussed below. The privately insured population was principally white (65.6%), while the Medicaid population was principally non-white (67.7%).

Medicaid patients, who were largely non-white, had nearly twice the rate of hospitalizations per patient year as privately insured patients with the same diagnoses (Table B). ED visit rates per patient year were also at least twice as high, while rates of office-based visits were lower among Medicaid than among privately insured enrollees for two of the three conditions examined.

Table B
Service Use Rates, by Insurer

Condition:	Privately Insured	Medicaid
Asthma	N=661	N=820
Office visits	1.95	1.46
ED visits	0.74	0.17
Hospitalization	0.06	0.13
Diabetes	N=2,088	N=3,577
Office visits	3.55	3.25
ED visits	0.08	0.20
Hospitalization	0.10	0.19
CHF	N=745	N=2,255
Office visits	3.00	3.41
ED visits	0.13	0.28
Hospitalization	0.21	0.57

One may speculate that differences in care patterns between Medicaid and privately insured patients, as well as multiple unmeasured differences, led to the differences in hospitalization rates. Privately insured enrollees were consistently more likely to have received most of their care in an office based setting than were Medicaid recipients. We cannot ascertain from the data used whether this difference is a result of reduced access to office-based practitioners on the part of Medicaid recipients, greater illness severity leading to increased Medicaid visits to EDs, or some other cause. The effect of usual source of care, as measured, was not consistent across all diagnoses. However, among Medicaid recipients with diabetes, having more ED than office visits was associated with increased risk of hospitalization when compared to the reverse, receiving most care in an office-based setting (RR 2.10, CI 1.50 = 2.94;

Table C
Usual Source of Care, by Insurer

Office-based rather than ED or none	Privately Insured	Medicaid
Asthma	95%	80%
Diabetes	99%	95%
CHF	95%	90%

Table 13).

We cannot, from the secondary data used for the analysis, state why Medicaid and privately insured patients have such different experiences. Level of illness is one possible explanation for differences in hospitalization and ED visit rates between privately insured and Medicaid patients. The Medicaid population may be sicker and have poorer control over their illness. However, if the Medicaid population were sicker, one would expect *more* office based visits, not fewer, than the privately insured population, assuming the same level of access. Thus, the possibility of different access to health care for Medicaid recipients arises.

Further research is needed, including research using both administrative databases and in-depth clinical analyses, to clarify differences between Medicaid and privately insured groups with the same disease. One example of research using administrative data bases could be the development of a more sensitive measure of physician access than physician/population ratios when studying the Medicaid population. Medicaid recipients per "engaged" provider, that is, providers willing to accept 10% or more Medicaid patients in their outpatient mix, may be a better measure of access for this population than total physician/population ratios. On the clinical side, additional research could incorporate measures of severity based on a more inclusive examination of each patient's diagnoses and medications. Interviews with Medicaid patients might clarify access issues, perceptions of disease and how it is managed, and any other barriers experienced by this population.

Effect of Health Services Infrastructure on Hospitalization Rates

We found no effect of community resources, measured as physicians per population, presence of an ED in the county, and presence of a federally qualified CHC in the county, on hospitalization rates for the diseases and patients studied. Several reasons could be offered for the absence of a community effect. First, the basic analysis already sorted patients by urban/ rural status, so that the addition of community factors to the model may have had only modest additional effects. Second, all patients were insured. The presence of a provider likely to accept uninsured or low income patients, such as the ED or a CHC, may have less significance if the patient has some method of payment. Physician/population ratios, as noted earlier, may be too simple to measure a complex phenomenon, such as the degree to which an outpatient practice is willing to accept Medicaid patients. Finally, the small number of counties in South Carolina (46) may not provide sufficient variation to detect differences in provider availability.

Limitations to the Study

The analysis reported here is limited in its generalizability, because it is restricted to two population groups and three diagnoses within a single Southern state. Further limitations have come to light as we completed the analytic process.

Our principal limitation was a restrictive definition of co-morbidity, which was confined to co-occurrence of the three disorders studied. Future research needs to consider each patient's complete clinical picture, using all diagnoses. Second, our data analysis was limited to visits for which one of the listed conditions was a relevant diagnoses; other visits may have contributed important information to the analysis. For example, hypertension is a common co-morbidity with diabetes in the 50 – 64 age population, but we could not address it. In addition, a practitioner could have addressed diabetic control, for example, within the context of a visit that principally reviewed hypertension management. Next, we were not able to employ pharmacy

data, as had been hoped, as it was not available for the privately insured population. Pharmacy data may be used as a measure of severity of illness (Parker et al, 2003) as well as an indicator of patient compliance or ability to comply with a therapeutic regimen.

Conclusions

Our conclusions are presented in two areas. We offer conclusions regarding racial disparities in health and how they might best be addressed, and conclusions regarding future research.

Reducing health disparities

Population-based disparities in hospitalization for asthma, diabetes and CHF are eliminated or greatly reduced when the analysis is restricted to insured persons with a known diagnostic status. This does not imply that racial disparities do not exist. Rather, it suggests that population level disparities in health care, for the specific diseases studied, occur because of the differential distribution of disease and to the differential distribution of racial and residence groups into the insured/uninsured category, and into Medicaid rather than private insurance.

Two of the conditions studied, diabetes[1] and congestive heart failure, represent the failure of previous preventive activities. While the importance of personal responsibility and self-care cannot be discounted, adult onset diabetes may also reflect the failure of practitioners throughout the patient's lifetime to offer effective weight management counseling. Congestive heart failure is the terminal result of decades of cardiovascular disease. Earlier intervention with weight and exercise counseling, lipid management, and hypertension control could reduce the prevalence of heart failure among African Americans as well as whites. For both disorders, intervention when the patient has developed the condition is less likely to be effective than preventive activities in the patient's 20's and 30's. Reduction in health disparities would appear to require early interventions which will not become feasible until more minority persons have access to clinical preventive services throughout early adult life.

The ability of low-income rural minority adults to access preventive services, however, is limited by high rates of uninsurance in this population (Probst, Samuels, Moore, 2003). In the current financial situation, providing health insurance or other access to care to young working age adults will be difficult. A recent review (Kaiser Commission, 2002) found that states are reducing Medicaid, the principal vehicle for expanding access. Expanding employer-based coverage will also be difficult. In this context, expanding the number of practitioners who provide free or low cost services, particularly outreach and preventive screening, becomes the most viable alternative. Targeted expansion of federally qualified community health center sites and increasing focus on prevention as part of their mission is one way of providing access to low income persons.

Implications for disparities research

Future research into race and rural disparities must become more sophisticated:

- Disparities research must begin to correct for prevalence to better direct policy. Population-based analyses point to the presence of disparities, but detailed patient-level analyses are needed to identify remediable sources of disparities. High hospitalization rates given equal

[1] Some persons studied may have had Type I diabetes. However, in the age group studied, the overwhelming majority of cases are Type II, or adult-onset, diabetes.

prevalence may in fact imply inadequate access to appropriate ambulatory care. Different prevalence rates, but equal hospitalization rates within diagnosed persons, suggest that preventive interventions are needed to reduce disparities. As noted, the remedy for high hospitalization rates for diabetes among African Americans may lie in providing preventive services while persons are in their 20's and 30's, rather than better diabetic care when they are in their 50's.

- Research into possible treatment differentials across insurers is needed. In theory, all patients should be treated according to clinical guidelines for number of visits, types of medication, and so on. Are differences in hospitalization, physician visits and ED visits between Medicaid and privately insured patients a function of differing clinical severity, or of inadequate care within one specific insurance plan? To what extent are patient behaviors, such as poor medication compliance, a factor in differing utilization patterns? What patient education approaches could be effective at preparing Medicaid patients for effective disease self-management. If discrepancies are independent of patient behaviors or clinical severity, what changes are needed in the Medicaid system? Research must address these questions and suggest policy remedies where appropriate.

- Disparities research has to step back from the clinical arena into the circumstances that dictate type of coverage. Racial disparities in education and employment may be driving disparities in health more strongly than any actions within the health care system. Efforts to enhance education systems and expand employment opportunities in rural areas will have long-term dividends in terms of improved community health.

APPENDIX A

DETAILED TABLES

Table 1. Patients with one or more health care visits for asthma, congestive heart failure, or diabetes during 1997-1999, by insurer and patient demographics

	Privately Insured		Medicaid	
	N	%	N	%
TOTAL	**3494**	**100.0%**	**6,652**	**100.0**
Location				
NonMSA	1,087	31.1	2,916	43.8
MSA	2,407	68.9	3,736	56.2
Sex				
Male	1,682	48.1	1,710	25.7
Female	1,812	51.9	4,942	74.3
Race				
White	2,366	67.7	2,153	32.4
African American	1,128	32.3	3,647	54.8
Other & Unknown	-	-	852	12.8
ASTHMA	**661**	**100.0**	**820**	**100.0**
Location				
NonMSA	149	22.5	297	36.2
MSA	512	77.5	523	63.4
Sex				
Male	219	33.1	183	22.3
Female	442	66.9	637	77.7
Race				
White	559	84.6	370	45.1
African American	102	15.4	329	40.1
Other & Unknown	-	-	121	14.8
CHF	**745**	**100.0**	**2,255**	**100.0**
Location				
NonMSA	293	39.3	1,006	44.6
MSA	452	60.7	1,249	55.4
Sex				
Male	390	52.4	670	29.7
Female	355	47.7	1,585	70.3
Race				
White	489	65.6	754	32.4
African American	256	34.4	1,235	54.8
Other & Unknown	-	-	266	12.8
DIABETES	**2,088**	**100.0**	**3,577**	**100.0**
Location				
NonMSA	645	30.9	1,613	45.1
MSA	1,443	69.1	1,964	54.9
Sex				
Male	1,073	51.4	857	24.0
Female	1,015	48.6	2,720	76.0
Race				
White	1,318	63.1	1,029	28.8
African American	770	36.9	2,083	58.2
Other & Unknown	-	-	465	13.0

*Study group excludes persons turning 65 within over course of study period, persons with comorbid mental retardation or serious mental illness, and among Medicaid recipients, persons who spent time in a nursing home.

Table 2. Asthma visit rates per person year and rate ratios among privately insured patients.

		Urban		Rural	
	Total	White	Non-White	White	Non-White
Total Persons	661	436	76	123	26
Avg Follow Time (years)	1.99	1.96	2.11	2.02	2.18
Total Person Years	1318.66	852.82	160.68	248.51	56.64
Rates & Rate Ratios					
Office visit (ppy)	1.95	1.97	2.12	1.88	1.59
Crude Rate Ratio		1.00	1.08	0.95	0.81
Adj Rate Ratio		1.00	1.04	0.94	0.80
95% CI for Rate Ratio			0.84, 1.29	0.79, 1.13	0.56, 1.16
ED visit (ppy)	0.074	0.054	0.156	0.080	0.124
Crude Rate Ratio		1.00	2.89	1.48	2.30
Adj Rate Ratio		1.00	3.43	1.55	2.30
95% CI for Rate Ratio			1.63, 7.62	0.76, 3.17	0.68, 8.34
Inpatient visit (ppy)	0.057	0.048	0.081	0.052	0.141
Crude Rate Ratio		1.00	1.69	1.08	2.94
Adj Rate Ratio		1.00	1.77	1.18	3.20
95% CI for Rate Ratio			0.80, 3.86	0.56, 2.43	1.10, 9.49

Table 3. Usual source of care among privately insured patients with asthma

	Inpatient only	More ED than MD visits	Equal numbers of ED and MD visits*	More MD than ED visits
Rural NonWhite (n=26)	3.9	3.9	0	92.3
Urban Nonwhite (n=76)	4.0	1.3	1.3	93.4
Rural White (n=123)	4.1	1.6	0.8	93.5
Urban White (n=436)	1.6	0.2	2.1	96.1
Total (n=661)	2.4	0.8	1.7	95.2

*At least one physician visit; persons with no physician or ED visits would fall into the first category, "inpatient only."
Fisher's Exact p-value testing "More MD than ED" against all other categories, p = 0.1012

Table 4. Factors affecting the risk of first hospitalization, privately insured patients with asthma

	Patient characteristics		Patient plus county characteristics		Patient plus Care characteristics	
Variable	Risk Ratio	95% CI	Risk Ratio	95% CI	Risk Ratio	95% CI
Gender						
Female	0.86	0.43, 1.75	0.86	0.42, 1.73	0.75	0.37, 1.53
Male	1.00	-----	1.00	-----	1.00	-----
MSA/Race						
Nonwhite Rural	1.68	0.39, 7.20	1.52	0.32, 7.23	0.63	0.09, 4.21
Nonwhite Urban	2.20	0.97, 4.96	2.14	0.93, 4.93	1.95	0.86, 4.44
White Rural	0.52	0.15, 1.73	0.51	0.14, 1.80	0.42	0.12, 1.50
White Urban	1.00	-----	1.00	-----	1.00	-----
Age in yrs	0.96	0.88, 1.05	0.96	0.88, 1.06	0.97	0.88, 1.07
County characteristics						
MDs / 1,000			1.00	0.76, 1.31		
Any ED in county			0.56	0.11, 2.85		
Any CHC in county			1.13	0.43, 2.94		
Visit Pattern						
High (≥3 visits)					1.90	0.78, 4.62
None in 6 months					0.27	0.09, 0.78
None in study					20.72	3.00, 143.93
ED visit in 6 months					2.60	0.87, 7.77

Excludes persons with less than 6 months follow time and those with hospitalization being the first event seen without a second hospitalization. See Appendix B, Methods.

Table 5. Asthma visit rates per person year and rate ratios among Medicaid recipients.

	Total	Urban			Rural		
		White	African-American	Other	White	African-American	Other
Total Persons	820	269	177	77	101	152	44
Avg Follow Time (years)	2.17	2.19	2.21	2.19	2.12	2.18	1.95
Total Person Years	1780.68	588.16	391.97	168.32	214.55	331.96	85.72
Rates & Rate Ratios							
Doctor visit (ppy)	1.46	1.44	1.55	1.63	1.22	1.44	1.46
Crude Rate Ratio	-----	1.00	1.08	1.13	0.85	1.00	1.01
Adj Rate Ratio	-----	1.00	1.02	1.05	0.83	0.95	0.96
95% CI for Rate Ratio	-----	------	0.84, 1.25	0.81, 1.38	0.65, 1.07	0.76, 1.17	0.68, 1.37
ED visit (ppy)	0.174	0.133	0.273	0.166	0.117	0.190	0.105
Crude Rate Ratio	-----	1.00	2.05	1.25	0.88	1.43	0.79
Adj Rate Ratio	-----	1.00	2.06	1.25	0.90	1.39	0.82
95% CI for Rate Ratio	-----	-----	1.37, 3.11	0.70, 2.22	0.50, 1.57	0.89, 2.17	0.34, 1.86
Inpatient visit (ppy)	0.127	0.111	0.176	0.113	0.140	0.105	0.105
Crude Rate Ratio	-----	1.00	1.59	1.02	1.26	0.95	0.95
Adj Rate Ratio	-----	1.00	1.58	1.02	1.25	0.93	0.97
95% CI for Rate Ratio	-----	-----	1.05, 2.40	0.55, 1.83	0.74, 2.09	0.57, 1.50	0.41, 2.10

Table 6. Usual Source of Care for Medicaid recipients with asthma

	Inpatient only	More ED than MD visits	Equal numbers of ED and MD visits*	More MD than ED visits
Rural				
White (n=101)	6.9	6.9	3.0	83.2
African American (n=152)	5.3	9.2	4.0	81.6
Other (n=44)	6.8	2.3	0	90.9
Urban				
White (n=269)	7.4	7.8	3.4	81.4
African American (n=177)	7.9	13.6	6.2	72.3
Other (n=77)	6.5	5.2	6.5	81.8
Total (n=820)	7.0	8.7	4.2	80.2

*At least one physician visit; persons with no physician or ED visits would fall into the first category, "inpatient only."
Chi Square p-value testing "More MD than ED" against all other categories, p=0.0468

Table 7. Factors affecting risk of hospitalization for asthma among Medicaid recipients with asthma

Variable	Risk Ratio	95% CI	Risk Ratio	95% CI	Risk Ratio	95% CI	Risk Ratio	95% CI
Gender								
Female	1.25	0.76, 2.08	0.75, 2.10	0.75, 2.10	1.25	0.74, 2.10	1.26	0.76, 2.09
Male	1.00	-----	-----	-----	1.00	-----	1.00	-----
MSA/Race								
Rural African American	1.04	0.56, 1.95	0.50, 1.84	0.50, 1.84	0.88	0.45, 1.73	1.04	0.55, 1.95
Rural Other	0.91	0.31, 2.62	0.30, 2.50	0.30, 2.50	0.98	0.34, 2.85	0.92	0.32, 2.65
Urban AA	2.05	1.22, 3.45	1.22, 3.50	1.22, 3.50	1.92	1.11, 3.30	1.94	1.15, 3.30
Urban Other	1.21	0.56, 2.60	0.57, 2.70	0.57, 2.70	1.26	0.58, 2.72	1.15	0.54, 2.50
Rural White	1.64	0.85, 3.15	0.75, 3.00	0.75, 3.00	1.73	0.89, 3.35	1.74	0.90, 3.35
Urban White	1.00	-----	-----	-----	1.00	-----	1.00	-----
Age in yrs	0.99	0.94, 1.04	0.94, 1.04	0.94, 1.04	0.98	0.93, 1.03	0.99	0.94, 1.04
County Characteristics								
MDs per 1000			0.96	0.70, 1.33				
Any ED in county			0.96	0.69, 1.34				
Any CHC in county			1.11	0.71, 1.75				
Usual source of care*								
ED > DR					1.32	0.70, 2.50		
ED = DR (neither is 0)					1.46	0.63, 3.36		
DR > ED					1.00	-----		
Visit pattern								
High							3.21	1.88, 5.46
None in 6 months							0.74	0.41, 1.33
None in study							1.36	0.68, 2.73
ED visit in 6 months							1.87	1.06, 3.23

Excludes persons with less than 6 months follow time and those with hospitalization being the first event seen without a second hospitalization. See Appendix B, Method

Table 8. Diabetes visit rates per person year and rate ratios among privately insured patients with diabetes

		Urban		Rural	
	Total	White	Non-White	White	Non-White
Total Persons	2088	927	516	391	254
Avg Follow Time (years)	2.24	2.22	2.30	2.16	2.32
Total Person Years	4682.57	2059.04	1187.96	846.31	589.27
Rates & Rate Ratios					
Doctor visit (ppy)	3.55	3.55	3.68	3.29	3.65
Crude Rate Ratio	-----	1.00	1.04	0.93	1.03
Adj Rate Ratio	-----	1.00	1.01	0.93	1.04
95% CI for Rate Ratio	-----	------	0.94, 1.10	0.85, 1.01	0.94, 1.15
ED visit (ppy)	0.080	0.053	0.100	0.065	0.156
Crude Rate Ratio	-----	1.00	1.89	1.23	2.94
Adj Rate Ratio	-----	1.00	1.83	1.89	2.91
95% CI for Rate Ratio	-----	-----	1.31, 2.55	0.80, 1.76	1.99, 4.28
Inpatient visit (ppy)	0.104	0.097	0.090	0.142	0.107
Crude Rate Ratio	-----	1.00	0.93	1.46	1.10
Adj Rate Ratio	-----	1.00	0.94	1.48	1.10
95% CI for Rate Ratio	-----	-----	0.70, 1.25	1.11, 1.98	0.77, 1.56

Table 9. Usual source of care among privately insured patients with diabetes

	Inpatient only	More ED than MD visits	Equal numbers of ED and MD visits*	More MD than ED visits
Rural NonWhite (n=254)	0.4	0.4	0.8	98.4
Urban Nonwhite (n=516)	0.8	0	0.4	98.8
Rural White (n=391)	1.0	0.3	0.3	98.5
Urban White (n=927)	0.5	0.2	0.1	99.1
Total (n=2,088)	0.7	0.2	0.3	98.9

*Where at least one visit is made.

Table 10. Factors associated with hospitalization for diabetes among privately insured enrollees

	Personal characteristics		Personal plus community		Personal plus utilization	
Variable	Risk Ratio	95% CI			Risk Ratio	95% CI
Gender						
Female	0.97	0.77, 1.22	0.96	0.76, 1.21	0.94	0.75, 1.20
Male	1.00	-----	1.00	-----	1.00	-----
MSA/Race						
Nonwhite Rural	1.20	0.82, 1.75	1.13	0.75, 1.70	1.10	0.74, 1.60
NonwhiteUrban	1.04	0.76, 1.40	0.98	0.72, 1.34	1.00	0.74, 1.36
White Rural	1.78	1.33, 2.35	1.75	1.30, 2.40	1.79	1.34, 2.34
White Urban	1.00	-----	1.00	-----	1.00	-----
Age in yrs	1.02	0.98, 1.04	1.01	0.98, 1.04	1.02	0.99, 1.05
Asthma Comorbidity	2.30	1.63, 3.25	2.34	1.70, 3.31	2.05	1.45, 2.90
Docs per 1000			0.99	0.89, 1.10		
Any ED			0.89	0.52, 1.54		
Any CHC			1.30	0.98, 1.73		
Visit pattern						
High					1.50	1.11, 2.00
None in 6 months					0.66	0.46, 0.93
None in study					4.96	0.70, 36.02
ED visit in 6 months					3.02	2.00, 4.60

Table 11. Visit Rates per person year and Rate Ratios among Medicaid recipients with diabetes.

		Urban			Rural		
	Total	White	African-American	Other	White	African-American	Other
Total Persons	3577	642	1034	288	387	1049	177
Avg Follow Time (years)	2.37	2.35	2.37	2.36	2.34	2.39	2.34
Total Person Years	8463.72	1507.17	2452.38	680.97	905.72	2502.51	414.96
Rates & Rate Ratios							
Doctor visit (ppy)	3.25	2.99	3.28	3.31	3.02	3.44	3.39
Crude Rate Ratio	-----	1.00	1.10	1.11	1.01	1.15	1.13
Adj Rate Ratio	-----	1.00	1.10	1.09	0.99	1.13	1.12
95% CI	-----	------	1.02, 1.20	0.97, 1.23	0.90, 1.10	1.04, 1.23	0.97, 1.28
ED visit (ppy)	0.197	0.220	0.208	0.198	0.187	0.180	0.178
Crude Rate Ratio	-----	1.00	0.95	0.90	0.85	0.82	0.81
Adj Rate Ratio	-----	1.00	0.96	0.90	0.85	0.82	0.83
95% CI	-----	-----	0.78, 1.19	0.67, 1.23	0.64, 1.12	0.66,1.02	0.57, 1.22
Inpatient visit (ppy)	0.193	0.248	0.169	0.198	0.258	0.159	0.193
Crude Rate Ratio	-----	1.00	0.68	0.80	1.04	0.64	0.78
Adj Rate Ratio	-----	1.00	0.68	0.78	1.02	0.64	0.78
95% CI for Rate Ratio	-----	-----	0.56, 0.84	0.59,1.04	0.80, 1.31	0.52, 0.79	0.55, 1.10

Table 12. Usual source of care among Medicaid recipients with diabetes

	Inpatient only	More ED than MD visits	Equal numbers of ED and MD visits*	More MD than ED visits
Rural				
African American (n=1049)	1.6	1.7	0.6	96.1
Other (n=177)	1.1	0.6	1.1	97.2
White (n=387)	1.6	1.8	1.0	95.6
Urban				
African American (n=1034)	1.8	3.1	1.5	93.6
Other (n=288)	1.7	3.1	1.4	93.8
White (n=642)	2.3	3.1	0.9	93.6
Total (n=3577)	1.8	2.4	1.0	94.7

*Where at least one visit is made.

Chi-square comparing last column to others: p = 0.0447

Table 13. Factors affecting risk of hospitalization for diabetes among Medicaid recipients

Variable	Risk Ratio	95% CI	Risk Ratio	95% CI	Risk Ratio	95% CI	Risk Ratio	95% CI
Gender								
Female	0.96	0.81, 1.13	0.96	0.81, 1.13	0.97	0.82, 1.15	0.91	0.77, 1.08
Male	1.00	-----	1.00	-----	1.00	-----	1.00	-----
MSA/Race								
Rural AA	0.76	0.63, 0.93	0.76	0.61, 0.94	0.78	0.64, 0.96	0.75	0.61, 0.91
Rural Other	0.90	0.64, 1.25	0.88	0.63, 1.24	0.93	0.66, 1.30	0.88	0.63, 1.23
Urban AA	0.77	0.63, 0.95	0.77	0.62, 0.94	0.78	0.64, 0.96	0.73	0.60, 0.90
Urban Other	0.86	0.65, 1.14	0.86	0.64, 1.14	0.84	0.63, 1.12	0.83	0.62, 1.10
Rural White	1.02	0.80, 1.30	1.01	0.78, 1.30	1.04	0.82, 1.33	1.05	0.82, 1.34
Urban White	1.00	-----	1.00	-----	1.00	-----	1.00	-----
Age in yrs	1.00	0.98, 1.02	1.00	0.98, 1.02	1.00	0.98, 1.02	1.00	0.98, 1.02
Comorbid asthma	2.00	1.70, 2.40	2.00	1.67, 2.40	2.04	1.70, 2.44	1.75	1.46, 2.10
County Characteristics								
MDs per 1000			1.05	0.93, 1.20				
Any ED			0.95	0.83, 1.10				
Any CHC			1.02	0.87, 1.20				
Usual source of care*								
ED > DR					2.10	1.50, 2.94		
ED = DR (neither is 0)					0.48	0.20, 1.16		
DR > ED					1.00	-----		
Visit pattern (office-based)								
High							1.67	1.40, 2.00
None in 6 months							0.65	0.53, 0.80
None in study							1.41	0.93, 2.13
ED visit in 6 months							2.75	2.31, 3.30

Table 14. Visit Rates per person year and Rate Ratios among privately insured patients with Congestive Heart Failure (CHF).

		Urban		Rural	
	Total	White	Non-White	White	Non-White
Total Persons	745	301	151	188	105
Avg Follow Time (years)	2.16	2.12	2.23	2.16	2.15
Total Person Years	1605.59	638.55	336.57	405.14	225.33
Rates & Rate Ratios					
Doctor visit (ppy)	2.99	2.64	3.51	2.96	3.28
Crude Rate Ratio	-----	1.00	1.33	1.12	1.24
Adj Rate Ratio	-----	1.00	1.29	1.19	1.23
95% CI for Rate Ratio	-----	------	1.07, 1.55	1.01, 1.42	1.00, 1.52
ED visit (ppy)	0.125	0.097	0.181	0.116	0.133
Crude Rate Ratio	-----	1.00	1.86	1.19	1.37
Adj Rate Ratio	-----	1.00	1.85	1.29	1.46
95% CI for Rate Ratio	-----	-----	1.11, 3.13	0.77, 2.18	0.79, 2.71
Inpatient visit (ppy)	0.212	0.200	0.229	0.230	0.186
Crude Rate Ratio	-----	1.00	1.15	1.15	0.93
Adj Rate Ratio	-----	1.00	1.06	1.17	0.94
95% CI for Rate Ratio	-----	-----	0.69, 1.65	0.78, 1.77	0.56, 1.58

Table 15. Usual Source of Care among privately insured patients with CHF

	Inpatient only	More ED than MD visits	Equal numbers of ED and MD visits*	More MD than ED visits
Rural NonWhite (n=105)	2.9	1.9	3.8	91.4
Urban Nonwhite (n=151)	0	0.7	1.3	98.0
Rural White (n=188)	2.1	0	1.6	96.3
Urban White (n=301)	3.7	0.7	1.0	94.7
Total (n=745)	2.4	0.7	1.6	95.3

*Where at least one visit is made.

Table 16. Factors affecting risk of first hospitalization among privately insured enrollees with CHF

	Patient characteristics		Patient plus county characteristics		Patient plus care pattern	
Variable	Risk Ratio	95% CI	Risk Ratio	95% CI	Risk Ratio	95% CI
Gender						
Female	0.67	0.48, 0.94	0.68	0.48, 0.96	0.66	0.47, 0.93
Male	1.00	-----	1.00	-----	1.00	-----
MSA/Race						
Nonwhite Rural	0.98	0.59, 1.61	1.02	0.58, 1.79	1.04	0.63, 1.72
Nonwhite Urban	1.04	0.67, 1.61	0.95	0.61, 1.50	0.99	0.64, 1.55
White Rural	0.78	0.50, 1.20	0.86	0.53, 1.40	0.80	0.51, 1.23
White Urban	1.00	-----	1.00	-----	1.00	-----
Age in yrs	1.03	0.99, 1.10	1.04	0.99, 1.08	1.03	0.99, 1.07
Comorbid Asthma	3.67	2.11, 6.35	3.61	2.08, 6.30	3.74	2.12, 6.58
Comorbid Diabetes	5.44	3.68, 8.03	5.60	3.78, 8.25	4.72	3.06, 7.30
County characteristics						
MDs / 1,000			1.06	0.93, 1.22		
Any ED			1.56	0.37, 6.50		
Any CHC			1.30	0.86, 1.97		
Visit Pattern						
High					1.36	0.85, 2.18
None in 6 months					0.92	0.56, 1.52
None in study					6.21	1.80, 21.50
ED visit in 6 months					4.70	2.94, 7.53

Table 17. Visit Rates per person year and Rate Ratios among Medicaid recipients with Congestive Heart Failure (CHF).

		Urban			Rural		
	Total	White	African-American	Other	White	African-American	Other
Total Persons	2255	477	619	153	277	616	113
Avg Follow Time (years)	2.34	2.29	2.37	2.41	2.27	2.38	2.23
Total Person Years	5269.02	1091.57	1464.66	369.24	627.81	1463.84	251.90
Rates & Rate Ratios							
Doctor visit (ppy)	3.41	2.98	3.31	3.59	3.34	3.71	3.64
Crude Rate Ratio	-----	1.00	1.11	1.20	1.12	1.24	1.22
Adj Rate Ratio	-----	1.00	1.10	1.25	1.06	1.21	1.16
95% CI for Rate Ratio	-----	------	0.98 1.23	1.06, 1.49	0.92, 1.23	1.08, 1.36	0.96, 1.42
ED visit (ppy)	0.280	0.199	0.281	0.376	0.228	0.339	0.274
Crude Rate Ratio	-----	1.00	1.41	1.89	1.15	1.70	1.38
Adj Rate Ratio	-----	1.00	1.42	1.86	1.07	1.64	1.32
95% CI for Rate Ratio	-----	-----	1.10, 1.82	1.30, 2.68	0.78, 1.47	1.27, 2.10	0.86, 2.03
Inpatient visit (ppy)	0.568	0.597	0.522	0.685	0.634	0.540	0.548
Crude Rate Ratio	-----	1.00	0.87	1.15	1.06	0.90	0.92
Adj Rate Ratio	-----	1.00	0.87	1.13	1.02	0.89	0.93
95% CI for Rate Ratio	-----	-----	0.74, 1.03	0.88, 1.44	0.83, 1.25	0.75, 1.05	0.70, 1.25

Table 18. Usual source of care among Medicaid recipients with CHF

	Inpatient only	More ED than MD visits	Equal numbers of ED and MD visits*	More MD than ED visits
Rural				
African American (n=616)	4.1	3.4	1.5	91.1
Other (n=113)	6.2	0.9	1.8	91.2
White (n=277)	7.9	2.5	1.8	87.7
Urban				
African American (n=619)	4.5	2.9	1.9	90.6
Other (n=153)	5.2	4.6	2.0	88.2
White (n=477)	6.5	3.6	1.7	88.3
Total (n=2255)	5.4	3.2	1.7	89.8

Chi-square comparing last column to all others: p = 0.4535

Table 19. Factors affecting first hospitalization for CHF among Medicaid recipients

Variable	Risk Ratio	95% CI	Risk Ratio	95% CI	Risk Ratio	95% CI	Risk Ratio	95% CI
Gender								
Female	0.99	0.86, 1.14	0.99	0.86, 1.14	0.99	0.86, 1.14	0.97	0.84, 1.11
Male	1.00	-----	1.00	-----	1.00	-----	1.00	-----
MSA/Race								
Rural AA	0.89	0.74, 1.06	0.87	0.72, 1.06	0.89	0.74, 1.07	0.87	0.72, 1.04
Rural Other	1.16	0.87, 1.56	1.15	0.85, 1.54	1.16	0.86, 1.55	1.13	0.85, 1.52
Urban AA	0.87	0.73, 1.04	0.87	0.73, 1.05	0.87	0.72, 1.04	0.86	0.72, 1.03
Urban Other	1.09	0.83, 1.42	1.10	0.83, 1.42	1.09	0.83, 1.42	1.05	0.81, 1.37
Rural White	1.04	0.84, 1.30	1.03	0.82, 1.30	1.06	0.85, 1.32	1.07	0.86, 1.33
Urban White	1.00	-----	1.00	-----	1.00	-----	1.00	-----
Age in yrs	1.00	0.99, 1.02	1.00	0.99, 1.02	1.00	0.99, 1.02	1.01	0.99, 1.02
Comorbid asthma	1.44	1.25, 1.65	1.43	1.24, 1.65	1.47	1.30, 1.70	1.35	1.17, 1.56
	2.84	2.47, 3.26	2.83	2.50, 3.25	3.05	2.65, 3.53	2.57	2.22, 2.98
County Characteristics								
MDs per 1000			1.00	0.89, 1.11				
Any ED			0.99	0.88, 1.11				
Any CHC			1.03	0.89, 1.20				
Usual source of care*								
ED > DR					1.36	0.94, 1.97		
ED = DR (neither is 0)					1.27	0.79, 2.03		
DR > ED					1.00	-----		
Visit pattern (office-based)								
High							1.36	1.16, 1.60
None in 6 months							0.78	0.65, 0.93
None in study							1.70	1.20, 2.40
ED visit in 6 months							1.83	1.55, 2.16

Appendix B
Method

Background: How ACSC hospitalizations have been studied in previous research

Most studies demonstrating excess ACSC hospitalizations made this determination by one of two methods. One analytic approach compares hospitalization rates among different populations, using the population within a geographic region as the denominator when calculating rates (e.g., National: Pappas et al, 1997; Zip Code: Billings et al, 1993; Bindman et al., 1995; Epstein, 2001; Clusters of Zip Codes: Komaromy et al., 1996; Urban areas: Billings et al, 1996 , Primary care target areas: Ricketts et al., 2001; County: Silver, Babitz and Magill, 1997. See Appendix C.). A second analytic approach analyzes the risk of hospitalization and/or the type of hospitalization among a group of individuals, with sociodemographic information such as rural residence or nonwhite race being a descriptive characteristic of the person (e.g., Blustein et al, 1998, Culler et al., 1998, Falik et al., 2001, Parchman and Culler, 1999, Shi et al., 1999, Shi and Lu, 2000. See Appendix C.)

Both of the preceding approaches are limited by the assumption that the disease entities being studied are equally distributed across all population groups. The possibility that different rates of underlying illness are the cause of differing hospitalization rates cannot be discounted when using population–based analyses. For example, if hospitalization rates for diabetes are greater in population A than in population B, there are two possible explanations: poorer control of diabetes in population A, or a higher rate of diabetes in population A.

Understanding racial disparities in hospitalization rates requires that research address aggregate measures of utilization, such as hospitalization, while controlling for the underlying rates of disease within populations of different racial/ethnic backgrounds. When disease prevalence is held constant, issues of the adequacy of care across groups can be explored with greater confidence. Findings from this approach become more policy relevant. If disease prevalence is equal but disparities exist, problems likely lie in access to and correct treatment within the health services sector. If prevalence differs but treatment results are similar, programs of detection, education, and prevention are called for.

Method Summary

The study employed a retrospective, longitudinal design, analyzing records for the period 1997-1999. We examined factors influencing ACSC hospitalizations among African American and white residents in South Carolina who were insured by either Medicaid or by a large, employment-based private insurance plan. This study focuses on three conditions: asthma, diabetes, and congestive heart failure (CHF). The analysis was limited to persons aged 50 - 64 who were continually enrolled in one of those two insurance plans from January 1, 1997 through December 31, 1999. Records were matched to vital records death files to identify persons who died during the study period. Among the group of continuously insured persons, we identified persons with any billed service, including inpatient stays, outpatient visits, and emergency department (ED) visits, for which the diagnosis was one of the three conditions studied. Thus, our population is limited to persons with the diagnosis of interest.

Sample:

Population: All South Carolina Medicaid recipients and members of an in-state population with employer-subsidized private insurance plan constituted the population from which the study sample was drawn. Analysis was limited to persons age 50 – 64 at the time they were first identified for the study.

Selection and exclusion criteria: We excluded those recipients who reached the age of 65 within the time period of 1997 to 1999 due to Medicare eligibility, which might dilute use of private or Medicaid coverage. A minimum age of 50 was set because hospitalization for the conditions of interest is rare at younger ages.

An individual was selected for inclusion in the study if he or she had one or more outpatient visits (office or emergency department based) or hospitalizations from January 1997 to June 1999 with a primary or secondary diagnosis for the following chronic conditions:

- Asthma (ICD-9 493)
- Diabetes (ICD-9 250.0, 250.1, 250.2, 250.3)
- Congestive heart failure (ICD-9 428, 402.1, 402.01, 402.11, 402.91, 518.4).

The criteria were more inclusive than those used by Powe et al (1996), who required that patients both have a recorded diagnosis and have filled a relevant prescription. Since our intent included examining rates of prescription filling, diagnosis code alone was used identify study subjects. Subjects were followed from first identification through December, 1999. Thus, the minimum period of observation for a single person was six months (July through December, 1999). A total of 10,843 Medicaid and 4,217 privately insured patients 50 years of age or older with one of the three subject diagnoses were identified (Table B-1).

Table B-1. Study population, by diagnosis, insurer, and exclusion criteria.

Diagnosis:	Initial total	After deleting persons with mental retardation or serious mental illness	After deleting persons with episode of nursing home care during study period	Final study population after deleting persons who turned 65 before end of study period
Total				
Privately insured	4,217	4,082	-----	3,494
Medicaid	10,843	9,493	8,835	6,652
Asthma				
Privately insured	783	761	-----	661
Medicaid	1,076	960	928	820
Diabetes				
Privately insured	2,476	2,393	-----	2,088
Medicaid	5,944	5,163	4,849	3,577
CHF				
Privately insured	958	928	-----	745
Medicaid	3,823	3,370	3,058	2,255

Persons with recorded diagnoses indicating mental retardation (ICD-9 317-319), nonpsychotic mental disorders due to organic brain damage (ICD-9 310) or serious mental

illness (ICD-9 290 – 299, psychoses) were excluded because these diagnoses might impair their self-care abilities. Persons with affective disorders, such as depression, were not excluded. Persons over age 65 were excluded because their health services use might not be recorded within the data sets used. For the Medicaid data set, we further excluded those individuals having an episode of care in the nursing home during 1997 to 1999, because their level of illness and self-care might not be representative of an ambulatory population. Because the private insurance plan studied does not cover nursing home care, we were unable to identify and exclude anyone requiring such care from that data set.

Medicaid

In the Medicaid group, 6,652 persons remained after the exclusion criteria were applied, of whom 2,916 (43.8%) resided in rural counties (Table B-1.). The rural-urban distribution was similar across all diagnoses except asthma. A greater proportion of persons with asthma lived in urban areas (63.4%). A majority of the Medicaid group identified their race as African American (54.8%).

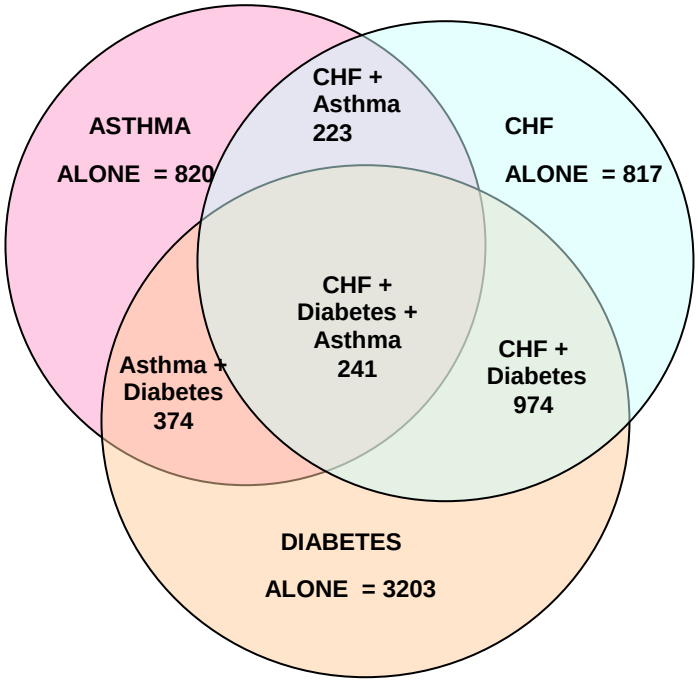
Privately Insured

In the privately insured group, 3,494 persons remained after exclusions, of whom 1,087 (31.1%) resided in rural counties and 68.9% in urban counties (Table B-1). Asthma tended to be more prevalent among urban residents (77.5%), while CHF was slightly less prevalent among urban members (60.7%). Two thirds of the privately insured group were white (67.7%)

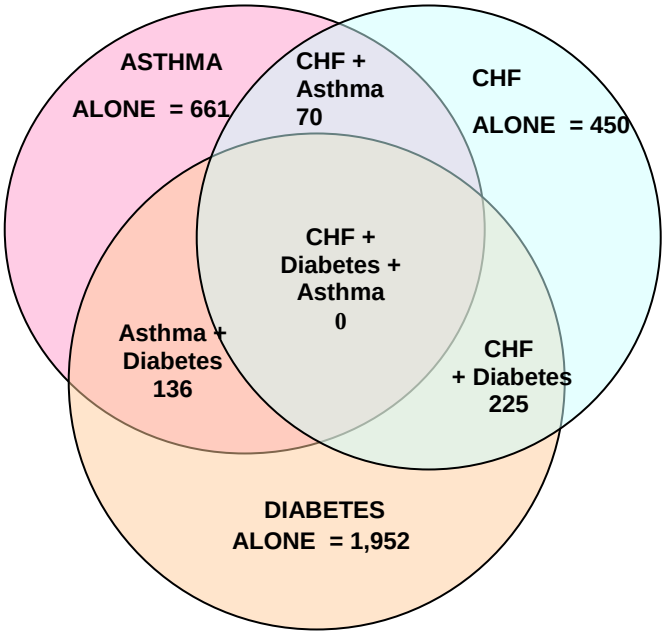
Diagnostic classifications

The three principal diagnoses of interest were asthma, diabetes and CHF. We did not obtain information on other potential co-morbidities, a limitation that we hope to correct in future research. Even limiting data collection to the three study diagnoses, however, a subgroup of patients had more than one condition. Each patient was assigned to a principal diagnosis group for study based on assumptions made about the seriousness of the disease and the degree to which its presence would complicate the analysis of a different disorder. CHF was assigned the "most serious" status; any patient with CHF was assigned to that group. Diabetes was assigned the next priority; any patient with diabetes but without CHF was assigned "diabetes" as a principal disorder. Finally, based on the above rules, a patient with asthma was assigned to the "asthma" group only if neither of the other two disorders were present. This yielded the distribution of disorders shown on the next page.

Disease distribution among Medicaid patients (n=6,652)



Disease distribution among privately insured patients (n=3,494)



Variables:

The key outcome was hospitalization. Covariates used in the study included:

• *Patient demographic characteristics* (age, race, gender, county of residence).

Location of residence (urban or rural) was defined as metropolitan statistical area (MSA) or non-MSA. For the Medicaid data, race was defined as white, African American, and other/unknown. Race was defined as white or non-white for the privately insured analysis.

• *Patient comorbidities* (limited to the 3 diagnoses studied),

• *Usual source of care*. Because many patients received ambulatory care in both office-based settings (private physician office, community health center, hospital outpatient department) and emergency departments, we used an algorithm to define usual source care. Usual source of care was assessed over the entire period of observation. Four categories were created based on the sources of outpatient care received:

- Patients whose ED visits exceeded their number of office visits (ED>MD),
- Patients whose ED visits were the same as their number of office visits (E=MD, where neither was zero; see next category),
- Patients with no ED or office based visits (ED=MD=0), and
- Patients whose ED visits were less than their number of office visits (MD>ED). This category includes persons who had no ED visits, but received all of their outpatient care in an office based setting.

• *Any ED visit*. The preceding variable, usual source of care, does not necessarily indicate whether or not an ED visit had been made. The majority of all patients fell into the final category, persons who visited an office based setting more often than an ED. This category includes persons with no ED visits. To capture those who did visit an ED, a dichotomous variable for ED visit was used.

• *Office visit frequency*. This was a time-dependent variable. Physician visits were categorized into three levels: high (top quartile for the diagnosis), moderate (bottom three quartiles), and none within the past 6 months relative to hospitalization. Diagnosis-specific cut-points are shown in Table B-2.

Table B-2. Usual number of visits in a six-month period, by quartile

	Asthma	CHF	Diabetes
Upper quartile	≥ 3	≥ 4	≥ 4
Lower 3 quartiles	1-2	1-3	1-3
None	0	0	0

Analytic approach:

Medicaid and privately insured members were analyzed separately. Because persons aged 50 – 64 would only be eligible for Medicaid under restricted circumstances such as extreme poverty or diminished health, this population was not believed to be sufficiently similar to employees and their families as to allow both groups to be pooled for analysis. Two analytic approaches were used. Visit rates were calculated over the entire period and were used for

descriptive analysis. However, more complex methods were needed to assess risk of hospitalization.

Visit rates

Visit rates for doctor visits, outpatient visits, emergency department, and inpatient visits were calculated using the total number of each type of visit divided by the total amount of time for which the person was tracked, in years. Track time was measured from the first visit the person made after January 1, 1997 through the end of the observation period, December 31, 1999. Visit rates were compared by gender, race, and location of residence.

Hospitalization rates were calculated on all hospitalizations, even if a hospitalization was the first incident of care for an individual. Hospitalizations per person year is the best measure of hospitalization rates within racial and residence-based sub-populations. As will be discussed below, multivariate analysis used time from patient identification to hospitalization. Thus, if a hospitalization was the first incident of care provided for a patient and thus marked the beginning of the observation period, it could not be included.

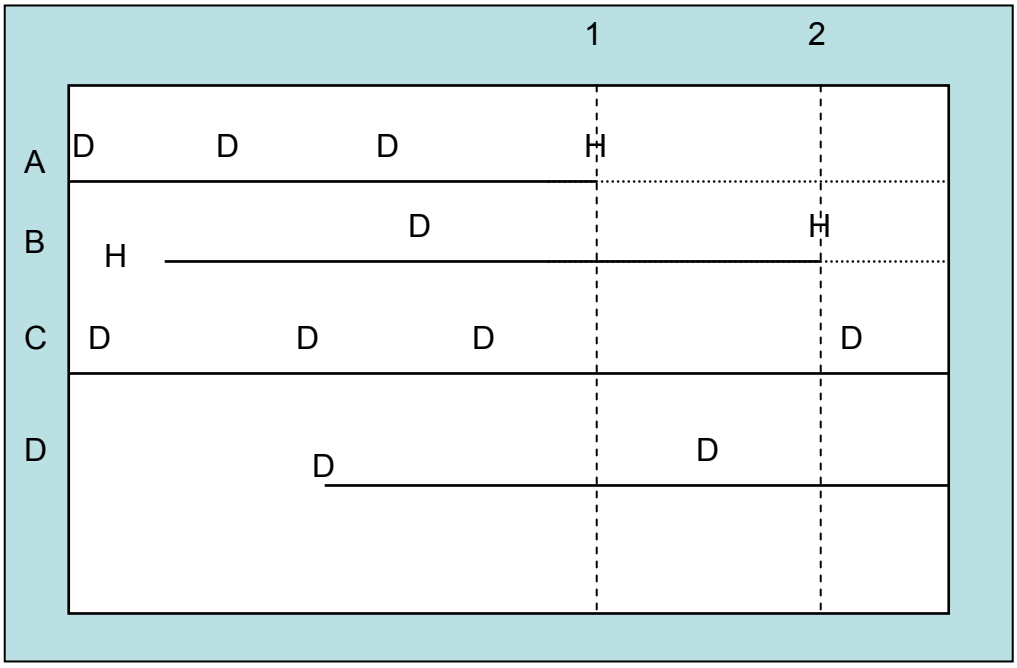
Multivariate analysis of factors affecting the likelihood of hospitalization

Multivariate analysis of the risk of hospitalization was studied in a time dependent model, to take into consideration both differing times that patients were observed and the hypothesized six-month window during which ambulatory care is believed to act to prevent hospitalization.

Patients could enter the data base at any time between January 1997 and June 1999. Thus, the observation period for each patient could differ, although the minimum period was six months. The analysis takes in consideration differences in follow-up time. We used the Cox proportional hazards model to determine whether rural nonwhite enrollees were at increased risk of hospitalization, after holding personal characteristics and county characteristics equal. For the analysis, we followed patients from the point at which they were first identified until either their first hospitalization or, if none occurred, completion of the study period.

We used time to first hospitalization following identification as the outcome, measuring doctor visits in the last six months as a time dependent variable in the survival analysis setting. This means as a person is followed over time for a hospitalization, the state of the variable (doctors visit in 6 months high, moderate or none) changes. Using the Cox proportional hazards model allowed us to incorporate this time dependent variable when modeling hospitalizations among these recipients. Figure B-1, next page, may clarify the analytic process. Patient A enters the analysis through a doctor visit early in the observation period, and is retained until first hospitalization (Time 1). Patient C, with no hospitalizations, remains in the analytic group throughout. Patient B enters the analysis through hospitalization. That hospitalization is not analyzed because it is the event that led to entry. Patient B remains in the analytic, at-risk group until the first hospitalization after entry (Time 2), after which she is dropped. Patient D, like patient C, remains in the analysis group throughout. At each hospitalization (Time 1, Time 2), the characteristics of the person being hospitalized are compared to all other persons in the analysis group at that time. Time-dependent variables, such as physician visits, are calculated for the six months preceding the event.

Figure B-1



Modeling Approach

Within the Cox proportional hazards model, we used three different model statements to study factors affecting hospitalization among privately insured enrollees. In the first model, we used the personal characteristics: race, sex, age, residence, and, within the limitations of our data, co-morbidity. Because patients were assigned a principal diagnosis in a hierarchical fashion, asthma patients had no co-morbidities included; persons with diabetes could also have asthma, and persons with CHF could also have diabetes and/or asthma.

The second model used both personal characteristics and county level infrastructure characteristics: physicians per 1,000 population, presence of an ED in the county, and presence of a CHC in the county. In the third model, we combined personal characteristics with two measures of medical care use defined above, visit frequency, and whether an ED had been visited. Usual source of care was not included in the model for privately insured enrollees because so many of these persons, 90% and above depending on the race/residence group, received most of their care from an office-based setting.

For Medicaid enrollees, analysis was performed using four models. The first three models paralleled those used for privately insured enrollees, looking first at personal characteristics, then personal characteristics plus county characteristics, then personal characteristics plus visit rate. In the fourth model, we looked at personal characteristics plus usual source of care and whether the person had visited an ED.

Appendix C

Summary of previous ACSC research and References

Cite	Data Source	Sample Size	Methods-Unit of analysis	ACSC conditions	Urban/Rural	Racial
Asch et al., 2000	Medicare claims data (1994-1996)	345,253	Proportion of beneficiaries receiving care	Acute myocardial infarction, anemia, angina, cholelithiasis, COPD, CHF, depression, diabetes, gastrointestinal bleeding, hip fracture, hypertension, pneumonia, transient ischemic attack	HPSA/ non-HPSA	
Basu and Cooper, 2000	All hospital discharge records for NY in 1994	248,656 cases w/ ACSC conditions	Person is unit of analysis. Studies travel for care: admission outside county and distance traveled	Billings definition	Not studied (analyses within groups)	
Billings et al 1993	NYC 1988	Age < 65	Population based rates		Not Studied	Not Studied
Billings et al 1996	Selected Canadian and US cities, 1990	Zip (US) FSA (Canada)	Population based rates	Billings	Urban only	Not studied.
Bindman et al., 1995	Statewide hospital discharge data (1990) and census data (1990) from CA	All adults aged 18-64 at a zip code cluster level	Comparison of population based rates	Asthma, COPD, CHF, diabetes mellitus, hypertension	Urban only	Rates higher in areas with high proportion of Afr Amers
Blustein et al 1998	Medicare Current Beneficiary Survey	MCBS 1991 & 1992	Person level analysis	Billings excluding pneumonia	Not studied	No significant difference
Culler et al., 1998	Medicare Current Beneficiary Survey (1991)	8,598 beneficiaries	Person level analysis. Multinomial logit model (DV: no hospitalization, hospitalization but none for ACSC, at least one ACSC hospitalization)	Criteria used by Weissman, Billings, and IOM	Higher OR in Rural	Higher OR among Afr Amer Higher OR among pts w/ diabetes
Epstein, 2001	VA hospital discharge data, population characteristics, medical	435 small area zip code clusters	Comparison of preventable hospitalization rates	Angina, asthma, cellulites, copd, chf, dehydration,	MUAs	

	provider characteristics (1995-1997)			diabetes, gastroenteritis, grand mal seizures and epileptic convulsions, hypertensions, hypoglycemia, kidney and urinary tract infections, pneumonia, severe ear, nose and throat infections		
Falik et al., 2001	1992 State Medicaid Research files: KY, ME, MO, PA, WA	48,738 Medicaid beneficiaries	Person is unit of analysis. Likelihood of hospitalization and likelihood of ER visit for ACSC; FQHC vs. not	20 commonly used conditions based on the literature and used as a group	Odds of ACSC admit higher among rural residents	No significant difference
Gill and Mainous, 1998	Paid Medicaid claims in Delaware among 0-64 yr olds (1993-1995)	13,495	Person level Logistic regression (DV: acute hospital admission during second year of study)	IOM definition	Not studied	
Gill, 1997	DE Medicaid claims, ages 0-64 (1992-1993)	22,862	Person level Comparison of hospitalization rates among those with regular source of care and those without	All ages: bacterial pneumonia; cellulites; dehydration; gastroenteritis; UTI; severe ear, nose and throat infections; hypoglycemia; skin grafts with cellulites; angina; asthma; COPD; CHF; diabetes mellitus; hypertension Adults only: asthma, COPD, CHF, diabetes, hypertension	Not studied	

Komaromy et al., 1996	Physician surveys and hospital discharge data among 18-64 yr olds in CA (1993-1994)	835 MDs; 394 zip code clusters	Small area analysis of zip code clusters; correlations of the MD "admission score" and combined hospitalization rate	Diabetes, asthma, CHF	Not studied	
Kozak, Hall, and Owings, 2001	National Hospital Discharge Survey (1988-1998)	Avg. of 242,000 discharges a year	Age specific rates for avoidable hospitalization annually	Weissman definition	Not studied	
Krakauer et al 1996	Medicare 5% sample 1992	Medicare national	Rates across health care service areas			
Laditka and Laditka, 1999	Statewide Planning and Research Cooperative System, NY; Hospital use data from upstate NY in 1993	Population of 65 and older in specified areas	Compared ratio of observed to expected among groups of interest (gender and income)	Billings definition; used as a group	Not studied	
Pappas et al 1997	NHDS 1990	National; excluded psychiatric and birth	Population based rates, age adjusted	Weissman et al 12 diagnoses	Not studied	Afr Amer higher than whites
Parchman and Culler, 1994	UB claims from PA (1989)		Population based rates across health service areas	Angina, CHF, hypertension, pneumonia, asthma, diabetes mellitus	Not studied	Not studied
Parchman and Culler, 1999	Medicare Current Beneficiary Survey (1991)	2,763 beneficiaries	Logistic regression (DV: preventable hospitalization)	14 acute and chronic conditions based on definitions of Weissman, Billings, and IOM	HPSAs (no urban/rural)	
Parker and Schoendorf, 2000	National Hospital Discharge Surveys (1990-1995)	15,000 medical records for children	Estimates of national hospitalization rates; hospitalization rates among income groups	Asthma, pneumonia, other upper airway conditions, gastroenteritis and dehydration, cellulites, seizures	Not studied	
Philbin et al., 2001	All patients discharged w/ principal diagnosis of heart failure from nonfederal NY	41,776 (limited to WH & AA)	Use of a prediction rule to account for baseline differences that are relevant to the risk of	Heart failure as principal diagnosis. (Including ICD-9 codes: 428.0,	Urban/rural	

	hospitals in 1995		hospital readmission	402.91, 404.93, 428.1, 402.11, 398.91, 404.91, 404.13, 402.01, 404.03, 404.11, 404.01, 428.9.)		
Porell, 2001	MA Medicaid discharges	Age < 65	Population based rates adjusted for age & gender	IOM 1993	Not studied	Afr Amer > white in HMO but not Medicaid population (Table 3)
Ricketts et al., 2001	All inpatient discharges from NC hospitals for the period 10/1/94-9/30/94	696,839 discharges (117,444 for ACSC conditions)	Comparison of ACSC hospitalization rates in different primary care target areas	ACSC proposed by the Institute of Medicine	Urban/rural	
Sanderson and Dixon, 2000						
Schreiber and Zielinski, 1997	Zip code based analysis of NY ACSC hospitalizations	1,461 Zip Codes	3-year averages for each Zip	Same as Billings et al. 1993	Rates negatively correlated to population density but positively correlated to MD/pop ratio and nearness to hospital	% Afr Amer linked to hosp. Rate in some analyses but not others
Shi and Lu, 2000	1994 National Hospital Discharge Survey	478 hospitals (children 0-15 discharged from a short stay hospital in 1994)	Logistic regression (DV: ACSC hospitalization vs. not)	Billings definition	Not studied	
Shi et al., 1999	Patients hospitalized in SC in 1995	Population	Person level logistic regression with ACSC condition vs. no ACSC condition as DV	Same as Billings et al. 1993	MSA/Non-MSA; non-MSA residents more likely to have ACSC hospitalization	Non-whites more likely to have ACSC hospitalization
Silver, Babitz and Magill, 1997	Hospitalizations in Utah, 1990-1994	27,611 admissions	County level age / gender standardized admission rates	Anemia; asthma; cellulites and abscess; congestive heart failure; diabetic complications;	Rural counties generally higher than urban reference group	Not studied

				gastric bleeding and perforated ulcer; hypertensive complications; pneumonia, bronchitis, and upper respiratory infections		
Weissman, Gatsonis & Epstein, 1992	MA and MD 1987 discharge data	Population under 65; psychiatric and OB excluded	Population based rates, adjusted for insurance; also patient based	12 conditions (Table 1)	Not studied	Not studied

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