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Healthcare Quality and Expenditure Benchmarks along the Continuum of Care: The Role of Primary Care Use and Community Healthcare Resources

Tricia Lee Wilkins
West Virginia University

Healthcare Quality and Expenditure Benchmarks along the Continuum of Care: The Role of Primary Care Use and Community Healthcare Resources.

Tricia Lee Wilkins, Pharm D., MS.

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Usha Sambamoorthi, PhD, Chair
Cindy Tworek, PhD, MPH
Joel Halverson, PhD
Xiaoyun Pan, PhD
Michael Hendryx, PhD
Leonard Pogach, MD, MBA

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Department of Pharmaceutical Systems and Policy

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ABSTRACT

Healthcare Quality and Expenditure Benchmarks along the Continuum of Care: The Role of Primary Care Use and Community Healthcare Resources.

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Objective:

The current studies examined the relationship between lapses in quality (ambulatory care sensitive hospitalizations and all cause 30-day readmissions) and patient-level, provider-level, and county-level healthcare resources. Specific attention is paid to the association between patient-level primary care use and provider-level care coordination. One of the studies also evaluated the association between chronic complex illness and lapses in quality after adjusting for individual-level, provider-level, and county-level characteristics within a longitudinal and unified framework. Yet another study evaluated whether avoiding poor quality outcomes can be achieved below an expected expenditure benchmark.

Study Design:

The study used a retrospective cross-sectional as well as longitudinal design using observational data in real-world settings.

Data Source:

Medicaid administrative claims files from four states, California, Illinois, New York and Texas, for 2008 were used. These states were chosen for their low managed care penetration rates relative to other states, as well as their diverse patient populations. The Medicaid files consisted of personal summary, outpatient, inpatient, skilled nursing home, prescription drugs, and long-term care. Personal Summary file included information on FFS beneficiary

demographics (gender, age, race/ethnicity, county of residence), Medicaid enrollment and eligibility status. The Outpatient and Inpatient files included claims for services provided in ambulatory and inpatient settings and contained International Classification of Diseases 9th edition Clinical Modification (ICD-9-CM) codes. Medicaid claims were linked with 2008 Area Resource File through county identifiers to obtain county-level information on socio-economic status, healthcare resources, facilities, providers and utilization.

Study Population:

The Study population consisted of fee-for-service Medicaid beneficiaries, aged 18-64 years, with full-year continuous enrollment and not dually enrolled in Medicare.

Statistical Techniques:

Chi square tests of independence were used to determine significance between individual, provider and community level characteristics and ACSH or readmissions. Multilevel logistic regression models on likelihood of ACSH and 30-day readmissions were conducted. . Due to the large numbers, logistic regressions were conducted on a 10% random sample of our study population. In these models, county was specified as a random intercept using GLIMMIX procedure in Statistical Analysis Software version 9.3 (SAS Inc., Cary, North Carolina USA).

Findings

In cross-sectional analyses of all Medicaid fee-for-service beneficiaries included in study 1 (N = 2.95 million across all four states), we observed that11% had any ACSH, 9.2% had all cause 30-day readmission, and 2% had combined ACSH+Readmisison. In longitudinal analyses (study 2), among fee-for-service Medicaid beneficiaries with diabetes, 14% (N = 43,753) had co-occurring diabetes and depression. Across three states included in study 3 analyses,

approximately 5.5 million beneficiaries did not have any ACSH or 30-day readmission. In all studies, patient complexity in terms of chronic conditions increased the risk of any ACSH and readmissions. Chronic complex illness was associated with increased risk of ACSH and decrease risk of readmissions. County-level variables were generally not associated with ACSH or readmissions. However, some county-level healthcare resources such as access to primary care at the county-level reduced the risk of very poor quality outcomes. However, greater availability of other types of healthcare resource increased the risk of poor quality outcomes (example; presence of mental health centers and greater availability of OBGYNs).

Discussion/Conclusion:

Our findings suggest that chronic diseases need to be better managed perhaps within an integrated system. Access to primary alone may not be enough to reduce risk of preventable hospitalizations. There is a need for innovative strategies such as comprehensive primary care for our nation's vulnerable and indigent populations. In the absence of system level restructuring of Medicaid programs, states will need to prioritize interventions for targeted groups of beneficiaries. We propose that cost containment may be maximized by aiming to reduce racial disparities and serve those with mental illness. If programs provide comprehensive primary care services to beneficiaries (especially racial ethnic minorities) and those with severe mental illness or substance abuse we expect to see reductions in poor outcomes and improved expenditure profiles. While county-level variables were generally not associated with ACSH or readmissions, some features such as access to primary care at the county-level may reduce the risk of very poor outcomes such as combined ACSH and hospital readmissions. However, greater availability of other types of healthcare resources may indeed increase the risk of poor quality outcomes. These findings taken together suggest that problems in healthcare quality

cannot be solved by investments in more resources alone, but by investing in the value of the care provided. State Medicaid programs should explore models of delivery that support value based provision of care over volume based care.

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Contents

CHAPTER 1

BACKGROUND

In recent years, hospitalizations have reemerged as a priority for the United States healthcare system, policy makers, and research communities, due to their large share of total expenditures and morbidity and mortality burden on patient populations. Estimates of the proportion of total healthcare expenditures due to hospitalizations vary from 30-38% (CMS, 2010; KFF, 2004). Between 1993 and 2009, nation-wide, the number of hospital discharges increased from 34.3 million to 39.4 million (HCUPnet National Statistics on All Stays, publicly available data). In 2009, the average hospital charges were $30,655; indeed, in 2009 the largest component of Medicare expenditures was on inpatient care and totaled $132.6 billion (MedPac, 2010). The disproportionate burden of hospitalizations is also observed for potentially preventable hospitalizations. It has been estimated that one-fifth of Medicare admissions are preventable, accounting for 67% of total cost for all preventable hospitalizations (Jiang, 2009). This is remarkable since, all preventable hospitalizations were estimated to cost $30.8 billion in 2006 (Jiang, 2009).

Preventable hospitalizations also known as Ambulatory Care Sensitive Hospitalizations (ACSH) are "hospitalizations that may be preventable with high quality primary and preventive care. These hospitalizations may be avoided if clinicians effectively diagnose, treat, and educate patients, and if patients actively participate in their care and adopt healthy lifestyle behaviors."(Kruzikas, 2000). ACSH are accepted measures of health system quality assessment by organizations such as the National Committee for Quality Assurance (NCQA), and the Agency for Healthcare Quality and Research (AHRQ) (NQF, 2012; AHRQ 2010).

Ambulatory Care Sensitive Hospitalizations

The AHRQ uses ACSH to "flag potential problems, follow trends, and identify disparities across regions, communities and providers" (AHRQ, 2010). Hospitalizations for uncontrolled diabetes, short-term diabetes complications, long-term diabetes complications, diabetes-related lower extremity amputations, congestive heart failure, hypertension, angina without procedure, adult asthma, chronic obstructive pulmonary disease, dehydration, urinary tract infections and perforated appendix are considered as preventable. The final set of ambulatory care sensitive conditions for the prevention quality indicator, underwent a rigorous process of selection and evaluation, and was determined by researchers from the University of California San Francisco-Stanford University Evidence-based Practice Center and AHRQ (AHRQ 2001) as preventable. The selection process involved literature review, expert interviews, evaluation and risk adjustment, as well as empirical testing. Currently, the PQI and ACSH indices are in wide use as measures of quality assessment.

Readmissions

Hospital readmissions are also considered potentially preventable and are widely regarded as indicators of healthcare quality for myocardial infarction, heart failure and pneumonia (AHA, 2011). As quality measures, readmissions are intended to indicate instances of poor transitional care / poor coordination between inpatient and outpatient providers within a specified time frame following discharge (Minnott, 2008). As readmissions may be planned and/or unrelated to the original admitting diagnoses, debate exists as to whether readmissions are truly preventable. (AHA, 2011). The strength of the relationship between readmissions and preceding processes of discharge planning or care coordination has also been called into question (Jha 2009) and the role of patient characteristics as determinants of readmissions has been

highlighted (Friedman, 2008). For example, the likelihood of readmission has been shown to increase with number of chronic conditions (i.e. patient complexity) (Friedman, 2008). Additionally, there is some evidence linking high regional rates of readmissions with lower regional rates of mortality (Bernheim, 2010). Despite continuing debate, healthcare payors and policy makers such as the Centers for Medicare & Medicaid Services, and National Committee for Quality Assurance (NCQA) , and American Hospital Association have adopted readmissions as markers of poor healthcare quality emphasizing the role of care coordination in patient care (ACA, 2010; CMS, 2011;AHA, 2011; NCQA 2011).

To date, research has focused on ACSH and readmissions separately. Outpatient providers have been responsible for preventing ACSH, while inpatient providers have been held responsible for preventing readmissions. However, prior research has not analyzed both ACSH and readmissions together in a longitudinal framework. This is especially relevant because current models of healthcare delivery are being organized to transition from fragmented care to coordinated care within an integrated system. For example, medical home models are designed to consolidate services and decrease fragmentation by offering team-base patient centered care. Findings from a four year intervention that implemented the ProvenHealth Navigator medical home model, estimated cumulative reductions in hospital admissions and readmissions by 18% and 36% respectively (Gilfillan, 2010) after implementation.

At the same time, healthcare delivery reforms are targeted to contain the escalating costs while providing high quality care. The Accountable Care Organization (ACO) Medicare Shared Savings Program is an example. The hallmark of the ACO program is coordination of ambulatory and inpatient care of at least 5000 Medicare beneficiaries with accompanying

standards of high quality, including reducing preventable hospitalizations (CMS, 2011a) and lower cost by placing primary care physicians as the locus of patient care and accountability.

Whereas the CMS ACO model focuses on quality outcomes at lower expenditures, we also acknowledge the impact of healthcare *structure* and resources on quality *outcomes*. For example, associations have been found between quality outcomes and community-level characteristics such as physician supply, HMO penetration, and hospital teaching status (Baiker and Chandra, 2004; Cooper, 2009; Escarce, 2006; and Mukamel, 2001). Therefore, quality outcomes assessment along the continuum of care need to take into account the role of community healthcare resources that facilitate or hinder quality achievement at lower expenditures.

Therefore the primary objective of the current study is to examine the role of primary care, care coordination, and community-level healthcare resources on ACSH and hospital readmissions. We analyze this relationship within longitudinal conceptual framework of quality assessment and expenditures. Unique contributions of the current study include a multivariate framework to account for the complex interactions between patients, providers and communities. Additionally, we seek to understand the potential for cost savings in avoiding poor quality outcomes. To do so we establish a three year risk adjusted expenditure benchmark modeled after those proposed for current ACO models of care. Benchmark attainment as an indication of cost containment will be current beneficiary expenditures at or below what would have been expected based on the previous three years of receipt of care.

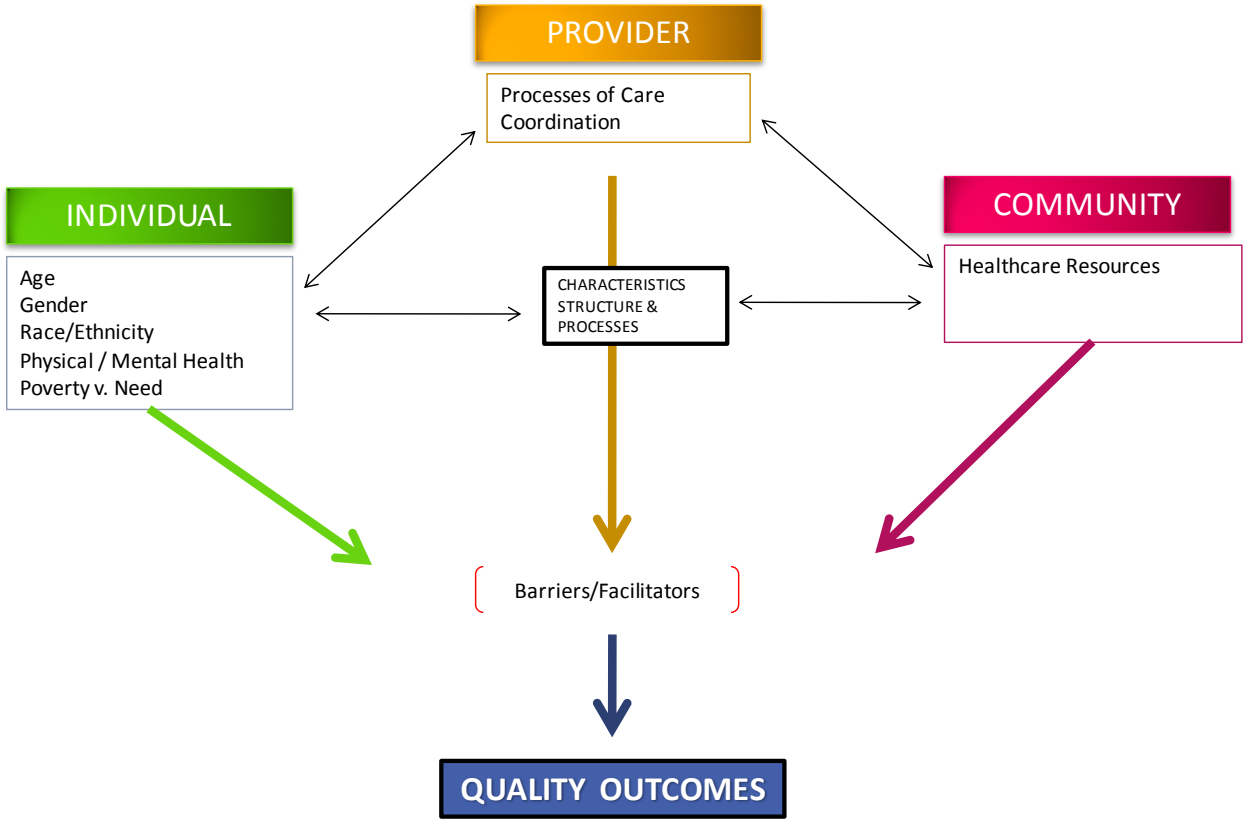
Specifically, we aim to:

- Specific Aim 1: Examine the relationship between lapses in quality (ACSH and hospital readmissions), primary care use and care coordination.
- Specific Aim 2: Using a longitudinal approach evaluate the individual-level, provider-level, and county-level characteristics that contribute to any lapse in quality along the continuum of patient care for individuals with chronic complex illness defined as co-occurring diabetes and depression.
- Specific Aim 3: Assess the relationship between expected expenditures and quality (i.e. avoiding any ACSH or readmissions).

CONCEPTUAL FRAMEWORK

Current models of quality assessment begin with Donabedian's Structure-Process-Outcome Model, in which structure denotes the attributes of settings in which care is provided, process denotes what is done in giving and receiving care, and outcomes denote the effects of care on patients and populations (Donabedian, 1988). Regarding the structure of quality healthcare, both public and private payers are inventing and reinventing models of delivery with promises of improved quality. For example, process measures for quality assessment of diabetes care may include those outlined by the 2011 Diabetes Guidelines of the American Diabetes Association (ADA). ADA process of care measures such as receipt of annual foot exam or regular HbA1c testing provide little information about the actual end results of care received (ADA 2010). Outcome quality measures, such as HbA1c < 7%, inform us of the end results of diabetes care received as reflected by the patient's state of health at a point in time following receipt of care.

FIGURE 1: CONCEPTUAL MODEL OF QUALITY ASSESSMENT



The conceptual framework of quality assessment used here is based on the Structure-Process-Outcomes Model levels as well as the Donabedian levels of quality assessment (Donabedian, 1988). According to Donabedian, quality should be assessed at levels that are pertinent and successively inclusive of responsibility, attention and control. The figure below presents the *individual*, *provider* and *community* levels of quality assessment. Within each colored box, are listed aspects that lie within the control, attention or responsibility of each level. For example, when assessing quality of care, activities of care coordination are the responsibility of health care *providers.* The presence of comorbid conditions will require additional attention from *individuals* when seeking care. Likewise, community healthcare resources are within the control of *community* policy makers. Two-way arrows between levels indicate that no level

exists in isolation, but that dynamic relationships exist between levels. As shown, aspects of each level can work as barriers or facilitators of quality care. According to the proposed conceptual framework, a comprehensive model of quality assessment will consider aspects at all levels: *individual*, *provider* and *community*. This study evaluates the relationships between primary care use and quality outcomes while adjusting for individual, provider, and community-level healthcare resources within a multivariate framework. The multivariate analyses account for patients nested within counties and the variations in healthcare resources in those counties.

Primary Care Use and Continuity

Many definitions of continuity of care exist. In the broadest case, there are three types of continuity: Informational, Relational and Management continuity (Reid et al, 2002). Informational continuity refers to the transfer of accurate patient information and documentation between providers and episodes of care. Management continuity refers broadly to delivery of care and includes disease state management programs, and some aspects of care coordination. Relational continuity broadly measures the strength and length of the patient-provider relationship. It includes having a usual and consistent source of care. Continuity of primary care is relational continuity that refers to consistency across episodes of care with a primary care provider.

Relational continuity may be measured by the strength or duration (chronology) of the physician-patient relationship. Relational strength is best measured by questionnaire or other qualitative methods. Relational chronology is commonly measured by quantitative analyses of claims data. In fact, 85% of primary care use measures are chronological and are obtained from utilization or administrative records (Reid et al, 2002). Although use of administrative claim records brings ease and convenience, this source is limited. To circumvent potential limitations,

researchers have developed a host of measures to operationalize continuity of primary care using claims data.

Duration of the patient-provider relationship is a simple measure defined as the length of time from an initial to final health care encounter (Harrington 1993; McWhinney 1988; Dorwart 1994). It is easily obtained from both administrative and survey data however, it does not account for the strength or other qualitative aspects of the relationship. Most importantly, it ignores patterns of utilization which may reveal lengthy gaps in receipt of care.

As an improvement over duration measures, intensity of the patient-provider relationship assesses both the number of, as well as total number of visits to a provider over a specified time interval (Smith 1998; Ansel 1997; Shaw, 1990; Tessler 1987; Horan 1980; O'Shea 1982). Intensity measures are also easy to calculate using administrative data, and may be used to determine gaps in continuity. The major limitation of this measure is that it does not account for cases in which a patient visits multiple providers.

Measuring the number of providers seen during an episode of care is one attempt to be inclusive of multiple providers of care. (Hall 1994; Veale 1995; Brown 1996; Meyer 1996) However, this measure is arguably better defined as a proxy for care coordination since it is based on the assumption that greater concentration of care will result in comprehensive care plans and transitional care. (Reid et al, 2002). This assumption cannot truly be evaluated by this measure since it does not capture the content or flow of information between providers. Additionally, increasing numbers of physician encounters does not necessarily result in better care.

To account for both the number of visits made as well as dispersion between providers continuity measures such as the Usual Provider Continuity (Breslau, 1975), Continuity of Care Index (COC) (Bice, 1977), Likelihood of Continuity (Steinwachs, 1979), Known Provider Continuity Index (Ejlertsson, 1985), Modified Continuity Index(Godkin 1984), and Modified Modified Continuity Index (MMCI) (Magill 1987) were developed. Briefly, each measures continuity ranging between 0 (no continuity) and 1(perfect continuity), where continuity is determined by the number of visits to a specified provider or different providers divided by the total number of visits to all providers. The LICON measure is a special case since it determines the probability that the number of providers seen by a patient is less than what would randomly be expected given the number of available providers and patient visits. The current studies presented here, adapts the Continuity of Care (COC) index.

The COC measures the number of visits to an individual provider as a ratio of all visits made: $COC = \frac{\sum_{i=1}^{j} n^2_i - N}{N - (N-1)}$, where n_i is number of visits to provider *i* and N is total number of visits. Its major advantage is that the measure is sensitive to variation in number of providers seen. In its original specification, the COC identifies visits to individual primary care providers as a ratio to all ambulatory outpatient visits. Due to the inability to consistently distinguish between claims billed under an individual provider or that of a facility, this measure has been specified to identify the ratio of any primary care visit to all ambulatory visits. Examples of ambulatory care settings are: federally qualified health centers, community mental health center, state or local public health clinics and rural health clinics. Care settings excluded were urgent care facilities, inpatient hospitals, outpatient hospitals, emergency room – hospitals, ambulatory surgery centers, birthing centers, hospice , ambulance – land, ambulance - air or

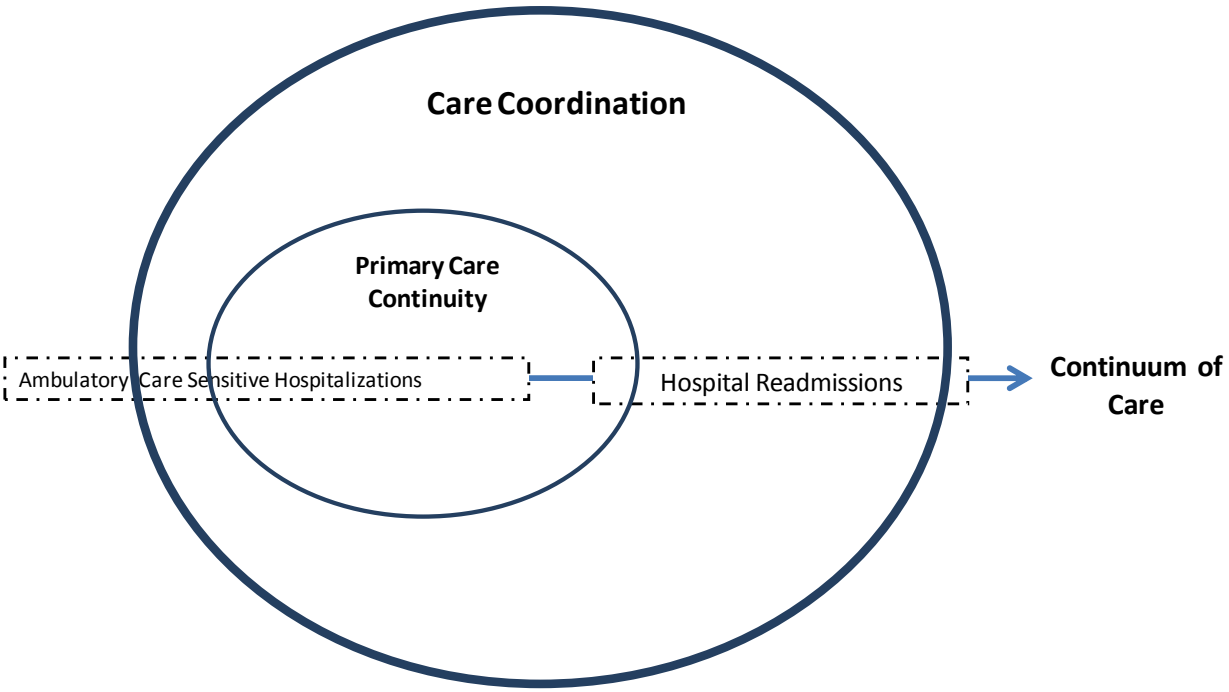
water, inpatient psychiatric facility, psychiatric facility partial hospitalization, comprehensive inpatient rehabilitation facility , independent laboratory, or unknown.

Primary care visits were identified using Current Procedural Terminology codes (CPT -4) and provider specialty codes. For the purposes of the current studies, internal medicine, general practice, family practice, preventative medicine, obstetrics/gynecology and nurse practitioners were considered as primary care providers. It has to be noted that our measure of continuity more closely approximates primary care use rather than relational continuity with a particular provider.

Care Coordination

AHRQ defines care coordination as "the deliberate organization of patient care activities between two or more participants (including the patient) involved in a patient's care to facilitate the appropriate delivery of health care services. Organizing care involves the marshalling of personnel and other resources needed to carry out all required patient care activities, and is often managed by the exchange of information among participants responsible for different aspects of care."(McDonald 2007). Care coordination includes aspects of care continuity, but the two should not be confused, since continuity most generally refers to consistency across episodes of care. **Figure 2** depicts the relationship between care coordination, continuity of care, ACSH and readmissions. In this diagram, care coordination holds predominant influence over both ACSH and hospital readmissions. ACSH are influenced by both continuity of primary care and care coordination. Hospital readmissions are influenced predominantly by care coordination, with some influence from primary care use. ACSH and readmissions are influenced by factors outside the realm of continuity or coordination, as indicated by the extension of these rectangles beyond the spheres of care coordination and continuity of primary care. Possible external influences can include individual, provider or community level factors.

FIGURE 2



In describing the mechanisms and theoretical framework for evaluating care coordination AHRQ compiled a list of components common to care coordination interventions, namely: 1) essential care tasks, 2) patient assessment, 3) care plan development, 4) identifying coordination role responsibility, 5) communication with patients and all other participants, 6) care plan execution, 6) monitoring and adjusting care, and 7) identifying coordination problems that impact health outcomes (McDonald 2007). Prospectively, these activities may be measured directly however, this is not the case with retrospective analyses such as use of administrative records. In these cases, proxy measures for care coordination activities and outcomes are heavily relied on. A commonly used proxy measure for successful care coordination is readmission rates. Post discharge readmission rates are themselves health outcomes or health utilization measures that are related to components of the care coordination process, especially, points 4, 5,

6 and 7 above. The relationship between this proxy measure and care coordination activities, is widely accepted for hospitalizations due to heart failure, pneumonia and acute myocardial infarction (Holland 2005, Mc Alister 2004, Roccoforte 2005, and Yu, 2006). In practice, use of readmissions as a measure of care coordination differs by condition (all-cause v. specific condition) and timeframe (7- day – 1 year). For the purpose of this study both continuity of primary care and care coordination will be evaluated along the continuum of patient care using a window of 14 days.

Relationship of Primary Care Use and Care Coordination with ACSH and Readmissions

The basis to view ACSH and readmissions as indicators of quality lies in the role of continuity of care and care coordination (AHRQ, 2010; Minott, 2008). Activities of care coordination whether performed in the clinic or in the community have been shown to reduce patient morbidity, such as hospitalizations as well as mortality. A meta-analysis of multidisciplinary clinic based heart failure care coordination (n=7 studies) involving primary care physicians and nurse educators, resulted in reductions in readmission and mortality rates by 24% and 34% respectively. Non-clinic based interventions (n=8 studies) that included nurse educators, home visits and telephone follow-up reduced heart failure readmissions by 26%, all-cause readmissions by 19%, and mortality rates by 25% (Mc Alister 2004).

Studies evaluating the relationship between continuity of primary care and hospitalizations have reported mixed results. In one observational study, Gill et al found a significant association between continuity of primary care and ACSH (Gill, 1998). Continuity of primary care was measured using the MMCI. When persons with the highest continuity scores were compared to those with the lowest, the risk of ACSH for a chronic condition was 46%

lower [Odds Ratio 0.54, 95% CI 0.34-0.88]. No association was found between continuity of primary care and the risk of acute ACSH. Another study in a Taiwanese population measured continuity of care using the COC and found that the risk for avoidable hospitalizations with higher continuity scores (0.34-1), was 59% lower persons ages 19-64 and 61% lower for those ages 65 and older($p < 0.001$ respectively). (Chen 2010).

Differences in findings for the relationship between continuity of care and preventable hospitalizations could result from differences in the measures themselves or even in the study design. For example Gill et al, included conditions, which are not considered ACSH, namely: cellulitis, gastroenteritis, ear, nose and throat infections and dental conditions. (Gill, 1998). Chen et al, included hospitalizations for the following conditions as preventable: asthma, angina, convulsions, cellulitis, dehydration, hypertension, bacterial pneumonia, congestive heart failure, hypoglycemia, gastroenteritis, congenital syphilis, diabetes mellitus, immunization-related and preventable conditions, grand mal status and other epileptic convulsions, chronic obstructive pulmonary disease, skin grafts with cellulitis, kidney or urinary tract infection, and severe ear, nose, and throat infections. This list goes beyond what is currently considered as ACSH.

Medicaid and Chronic Complex Illness

Primary care and care coordination are especially important for groups with multiple chronic conditions, such as Medicaid beneficiaries with diabetes and depression. Sixty-one percent of adult Medicaid beneficiaries have chronic or disabling conditions(Allen, 2000). Additionally, disabled adults are more likely to have three or more chronic conditions than their non-disabled counterparts (35% v. 10%)(Kronick, 2007). An appraisal of the most prevalent conditions by type of Medicaid beneficiary, found cardiovascular, psychiatric, and diabetes-

related conditions to be common among all beneficiaries (i.e, aged, disables, dually eligible)(Kronick, 2007). The prevalence of diabetes among Medicaid enrollees is high (14%), furthermore, the condition occurs on its own less than 1% of the time, which highlights the extent of multimorbidity within this population (CDC, 2011; Boyd, 2010). Among those with diabetes, 68% have a cardiovascular condition, and 31% have a psychiatric condition (Kronick, 2007).

Co-occurring chronic conditions can be considered complex illness, when the co-occurring conditions are discordant (i.e. have conflicting outcomes or exacerbating effects on one another) (Pentakota et al., 2012). For example, diabetes and depression can be considered discordant because treatment for one condition may conflict with outcomes of the other condition. In the case of diabetes and depression, treatment for depression with antidepressants may increase blood glucose levels, considered as poor outcomes for diabetes care. Additionally, patients with diabetes and depression may face challenges in healthcare management due to concurrent pathologies that can interact to worsen health outcomes. Furthermore, individuals with diabetes and depression may face care coordination and continuity problems because they may seek care from psychiatrists and endocrinologist providers.

PURPOSE

The purpose of the current study is to adopt a unified longitudinal framework to evaluate ACSH and readmissions among all Medicaid beneficiaries, with specific focus on a subpopulation of beneficiaries with chronic complex illness (i.e. diabetes and depression). The study is set within a multivariate framework that examines the role of primary care use, care coordination, community-level healthcare resources and patient-complexity on ACSH and

readmissions. In addition, the study evaluates whether avoiding poor quality outcome scan be achieved at lower expected expenditures.

SPECIFIC AIMS

Specific Aim 1

Examine the relationship between lapses in quality (ACSHs and hospital readmissions), primary care use and care coordination.

Objective 1.1 Examine the relationship between ACSH and primary care use, after controlling for individual-level and county-level characteristics.

Hypothesis 1.1: Individuals with lower levels of primary care use will be significantly more likely to have ACSH compared to individuals with higher levels of primary care use.

Objective 1.2: Assess the relationship between readmission and care coordination, after adjusting for individual-level and county-level characteristics.

Hypothesis 1.2: Individuals with coordinated care will be significantly less likely to have readmissions compared to individuals without coordinated care.

Specific Aim 2

Using a unified approach evaluate the individual-level, provider-level, and county-level characteristics that contribute to any lapse in quality along the continuum of patient care for a Medicaid beneficiaries with chronic complex illness, defined as co-occurring diabetes and depression.

Objective 2.1: Using a unified longitudinal approach, examine the relationship between lapses in quality and primary care use among individuals with chronic complex illness in diabetes.

Hypothesis 2.1: Individuals with lower levels of primary care use will be significantly more likely to have both ACSH and readmissions compared to individuals with higher levels of primary care use.

Objective 2.2: Using a unified longitudinal approach, examine the relationship between lapses in quality and chronic complex illness in diabetes.

Hypothesis 2.2: Likelihood of poor quality outcomes will be greater for those with chronic complex illness compared to those without chronic complex illness.

Specific Aim 3

Assess the relationship between expenditure benchmarks and quality in Medicaid beneficiaries.

Objective 3.1: Determine the relationship between expenditures and quality outcomes using a three-year expenditure benchmark.

Hypothesis 3.1: After controlling for individual, provider and county-level characteristics, lower levels of primary care use will be associated with increased likelihood of achieving expenditure benchmark compared to higher levels of primary care use.

Objective 3.2: Evaluate the role of county-level resources in the relationship between expenditure benchmarks and quality.

Hypothesis 3.2: Lower availability of health care resources within counties will be associated with lower likelihood of achieving expenditure benchmarks.

SIGNIFICANCE OF THE STUDY

The unique contributions of the current studies include a unified approach to analyze both ACSH and readmissions along the continuum of care, use of longitudinal data, focus on low-income non-elderly adult population, chronic complex illness, defined as co-occurring diabetes and depression, inclusion of a comprehensive list of variables including county-level health care resources, and policy relevance for current healthcare delivery reform efforts. Details are provided in the summary section of Chapter 5, "Discussion and Conclusions".

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CHAPTER 2

Title: A Multi-level Model Assessing Ambulatory Care Sensitive Hospitalizations and 30-Day Readmissions among Medicaid Beneficiaries: The Role of Primary Care Use, and County-Level Healthcare Resources

INTRODUCTION

Ambulatory care sensitive conditions (ACSH) are those for which hospitalization could have been prevented by timely and appropriate outpatient care. Hospitalizations that have been identified as preventable are uncontrolled diabetes, short-term diabetes complications, long-term diabetes complications, diabetes-related lower extremity amputations, congestive heart failure, hypertension, angina without procedure, adult asthma, chronic obstructive pulmonary disease, dehydration, urinary tract infections and perforated appendix. Between 1997 and 2004, the rate of ACSH has remained relatively stable (3% increase)(Russo, 2007). Based on a national review of potentially preventable hospitalizations, between 2004 and 2007 the rates of ACSH declined from 1,617 to 1,510 per 100,000 adults (Moy, 2011). Despite the decrease in ACSH between 2004 and 2007, ACSH still accounted for 10% of all hospitalizations in 2008, and 5.8 % of all Medicaid inpatient stays (Stranges, 2010).

Hospital readmissions are viewed as an indication of poor care coordination; and for some conditions (i.e. heart failure), are considered preventable. According to a report of the Healthcare Cost and Utilization Project, the rate of 30-day all cause readmissions among adult Medicaid enrollees was 10.7 % in 2007 (Jiang, 2010). Another report estimated the rate of 30-day readmissions among Medicaid enrollees to be 16.3% (Gilman and Hamblin, 2010). With increasing healthcare costs and demands for improved quality of care, ACSH and readmissions

have become accountability measures by which to lower healthcare costs and improve quality by avoiding preventable hospitalizations.

Although most of the literature focuses on Medicare beneficiaries, we may still draw conclusions applicable to Medicaid enrollees, since both programs have large numbers of persons with functional limitations or chronic disease. According to a Dartmouth Atlas Report on Post-Acute Care for Medicare Beneficiaries, almost one in five Medicare beneficiaries discharged from the hospital return within 30 days. This costs an estimated $17 billion for Medicare beneficiaries. According to the same report, the national rates of 30-day readmissions remained unchanged between 2004 and 2009 (Goodman, 2011). Excluding new enrollees, the rate of readmission increased with increasing number of chronic diseases. Both studies found poor rates of post discharge follow-up. The Dartmouth atlas reports 44.2% of Medicare beneficiaries saw a primary care or specialty clinician within 14 days of discharge. Gilmer and Hamblin report 49.7% of Medicaid enrollees with readmissions went without physician visits 30 days after discharge.

ACSH and readmissions are influenced by interactions between individual, provider and community-level factors. For example, individuals' age, gender, socio economic status, co-occurring chronic conditions and severity of illness are associated with quality endpoints (Feller, 2011; Jiang, 2007; O'Connor, 2008). Provider-level processes of care for AMI, CHF and pneumonia, and characteristics such as case volume and years of experience have been tied to reduced readmissions and mortality (Joynt, 2011; O'Malley, 2007). Although findings relating community-level characteristics to quality differ, there is some evidence that HMO penetration is a predictor of quality for certain geographic regions (Escarce, 2006), or for certain groups (Mukamel, 2001). In one comprehensive review of both ACSH and readmissions,

Muenchberger and Kendall compiled the number of studies reporting significant associations between specific factors and preventable hospitalizations (Muenchberger and Kendall, 2010). Muenchberger and Kendall identified nearly 20 factors that were significantly associated with occurrence of preventable hospitalizations. Indeed, integrated care was found predictive of lower likelihood of preventable hospitalizations across all the studies that included integrated care as one of the predictors.

One observational study of the Delaware Medicaid program, found continuity of primary care to be significantly associated with both hospitalizations and ACSH (Gill, 1998). Continuity of primary care was measured as the number of visits to the same provider, accounting for the number of total visits to different providers. When persons with the highest continuity scores were compared to those with the lowest, the risk of hospitalization was found to be 44% lower [Odds Ratio 0.56, 95% CI 0.46-0.69]. The risk of hospitalization due to a chronic ACSH was 46% lower [Odds Ratio 0.54, 95% CI 0.34-0.88]. No association was found between continuity of primary care and the risk of acute ACSH (Gill, 1998). It should be noted, this study included conditions that are not currently considered to be acute ACSH, namely cellulitis, gastroenteritis, ear, nose and throat infections and dental conditions.

Considerable debate exists as to whether a readmission can be deemed preventable, and whether or not discharge planning is a true predictor of readmission rates (Jha, 2009). Although, debatable, hospital readmissions are highly suggestive of poor care coordination and post discharge planning. In an attempt to lower costs and improve quality associated with hospital admissions, the Centers for Medicare and Medicaid Services will penalize hospitals for readmissions: 1% of total Medicare bill beginning in 2013, 2% in 2014 and 3% in 2015. Patient complexity inherent with multiple chronic diseases also casts doubt on whether a readmission

can truly be avoided. Currently, much of this concern is accounted for by case mix and risk adjustment. Even with adjustment, the findings of the Dartmouth atlas and others hold, showing readmissions to be an area of quality improvement. The Patient Protection and Affordable Care Act (ACA) considers "excess" readmissions that are above what would be expected based on facility case mix as a poor quality indicator. Therefore, in this study, readmissions are considered to reflect poor quality of care.

Most of the research on ACSH and readmissions have focused on the Medicare beneficiaries, perhaps due to the national scope of the program and increased morbidity among the elderly. However, due attention should also be given to state Medicaid programs, which incur an estimated $374 billion in healthcare expenditures and provide healthcare services to the vulnerable, indigent and disabled. Indeed, nearly one- fifth of enrollees are disabled (Allen, 2000; KFF, 2008). It has been estimated that 61% of adult Medicaid beneficiaries have chronic or disabling conditions which place them at increased risk of hospitalization (Allen, 2000).

The purpose of this study is to examine the relationship between ACSH, readmissions and county-level healthcare characteristics after adjusting for primary care use, care coordination, and patient characteristics among Medicaid fee for service (FFS) beneficiaries.

METHODS

Study Design:

The study used a retrospective cross-sectional design using observational data in real-world settings.

Data Source:

Medicaid administrative claims files from four states, California, Illinois, New York and Texas, for 2008 were used. These states were chosen for their low managed care penetration rates relative to other states, as well as their diverse patient populations. This will allow more fee-for-service (FFS) claims for analysis. For example, the state of Alaska is entirely FFS, However with enrollment at approximately 115,000 beneficiaries; a sufficient cell sizes would likely not be available for evaluation after applying study exclusions. As another example, the state of West Virginia has a penetration rate of 47%, however state Medicaid enrolment is also comparatively low at approximately 340,000. Moreover, to aid evaluation of demographic variables, states with beneficiaries of diverse racial/ethnic background were chosen. Medicaid managed care penetration ranged from 55%- 69% for the selected states, California, Illinois, New York and Texas. However, with enrollment in the millions, a large number of beneficiaries were available for analyses even after exclusions were applied.

The Medicaid files consisted of personal summary, outpatient, inpatient, skilled nursing home, prescription drugs, and long-term care. Personal Summary file included information on FFS beneficiary demographics (gender, age, race/ethnicity, county of residence), Medicaid enrollment and eligibility status. The Outpatient and Inpatient files included claims for services provided in ambulatory and inpatient settings and contained International Classification of Diseases 9th edition Clinical Modification (ICD-9-CM) codes.

The 2008 Area Resource File (ARF) provided county-level information on socio-economic status, healthcare resources, facilities, providers and utilization.

Study Population:

The Study population consisted of fee-for-service Medicaid beneficiaries, aged 18-64 years, with full-year continuous enrollment and not dually enrolled in Medicare and utilized inpatient services during 2008.

Dependent Variables:

ACSH: These were defined based on the following 13 ambulatory care sensitive conditions for: 1) diabetes short-term complications; 2) diabetes long-term complications; 3) perforated appendicitis; 4) chronic obstructive pulmonary disease (COPD); 5) hypertension; 6) congestive heart failure; 7) dehydration; 8) bacterial pneumonia; 9) urinary infections; 10) angina without a procedure; 11) uncontrolled diabetes; 12) adult asthma; and 13) lower extremity amputations. Medicaid beneficiaries with a hospitalization for any of the above-mentioned conditions in the observed calendar year were considered to have an ACSH. ACSH will be identified using the Prevention Quality Indicators (PQI) software developed by AHRQ (publicly available at http://www.qualityindicators.ahrq.gov/Software/Default.aspx).

All Cause 30-day Readmissions; These were defined as hospitalizations within 30 days following first observed hospitalization (index hospitalization) in 2008. Patient transfers were not considered readmissions.

ACSH and All Cause 30-day readmissions: We also combined ACSH and all cause 30-day readmissions to construct the following categories: 1) Any ACSH and any 30-day readmission; 2) ACSH or 30-day readmission; and 3) other hospitalizations. Other hospitalizations may include non ACSH admissions, readmissions after 30 days or single inpatient stays.

Key Independent Variables:

Primary Care Use Index: This variable was derived from ambulatory care visits to primary care providers. Primary care visits were identified from physician specialty codes and current procedural terminology (CPT-4) codes for services rendered. We defined primary care use as an index and calculated it as the proportion of ambulatory visits to primary care practitioners divided by all ambulatory visits. This index ranged from 0 indicating no primary care visits and 1.0 indicating all visits were to primary care providers. Primary care use was divided into quartiles, specific to each state. Higher quartiles indicate greater use of primary care visits in relation to all ambulatory setting visits. Individuals who did not have any ambulatory care visit were considered in a separate category. It is likely that an individual who had only one visit to primary care may be classified as having higher levels of primary care if they had only one visit in the entire year. For this reason primary care use was measured only for individuals with greater than two ambulatory care visits.

Care Coordination: This variable was defined as a visit to a primary care provider within 14 days of any hospital discharge during 2008. This can also be considered as a provider-level variable.

Other Patient-Level Independent Variables:

Patient-level variables, obtained from the Medicaid personal summary claim files, include demographic variables: age (18-24, 25-34, 35-44, 45-54, 55-64 years), gender (female, male), race/ethnicity (African American, Caucasian, Hispanic, Asian, American Indian, Pacific Islander), Medicaid eligibility (poverty, medical need), health status measured by presence of chronic physical and mental health conditions and substance abuse. Chronic physical conditions consisted of: asthma, chronic obstructive pulmonary disease (COPD), cardio vascular disease

(CVD), diabetes, hypertension, joint disorders (arthritis, osteoarthritis, rheumatoid arthritis), thyroid disease, and cancer; Mental health conditions included depression and severe mental illness (schizophrenia, bipolar disorder, psychosis) and substance use disorders. All conditions were identified using ICD-9-CM codes from inpatient and outpatient files.

Other County-Level Independent Variables:

These were obtained from Area Resource file and included educational attainment (at least high school diploma), median household income, metropolitan statistical area, primary care shortage, mental health shortage area, presence of federally qualified health center (FQHC), community mental health clinic, rural health clinic, total number of hospitals, office based general physicians, OBGYN physicians, preventative medicine physicians. For variables on a continuous numeric scale, quartiles were constructed by calculating per capita density and then distributing into quartile rages, specific to each state.

Statistical Techniques

Chi square tests of independence were used to determine significance between individual, provider and community level characteristics and ACSH or readmissions. Multilevel logistic regression models on likelihood of ACSH and 30-day readmissions were conducted. In these models, county was specified as a random intercept using GLIMMIX procedure. In logistic regressions, we included all the variables mentioned in the measure section. Due to the large numbers, logistic regressions were conducted on a 10% random sample of our study population. All analyses were conducted using Statistical Analysis Software version 9.3 (SAS Inc., Cary, North Carolina USA).

RESULTS

Demographics

Across all four states, there were 2,954,360 Medicaid FFS beneficiaries with full year enrollment. Of these, 371,648 had at least one inpatient encounter. Inpatient users were mostly female (76.4%), and more were between 25-34 years of age (25.6%). There was a near even split between Caucasian, Hispanic and African American racial/ethnic groups (33%, 30%, 26%). A majority of individuals lived in a metropolitan area (93.3%) and in counties with primary care shortage (80.5%).

Among those with inpatient utilization, 11.5% had an ACSH, and 9.2% experienced 30-day readmission. The rate of experiencing both ACSH and 30-day readmission was just 2%. Additionally, 56% of beneficiaries had a primary care visit within 14 days of discharge. Primary care use was distributed as follows: Quartile 1 (20.9%), quartile 2 (24.7%), quartile 3 (21.9%) and quartile 4 (19.9%).

Bivariate Analysis

The bivariate analysis on differences between ACSH and readmission combinations revealed significant differences for all independent variables tested (Table 2).

ACSH

All patient level variables were significantly associated with risk of any ACSH. A greater proportion of African Americans (14.1%) compared to Caucasians (10.9%) experienced this event. Lower levels of primary care use were associated with greater risk of any ACSH. Any ACSH for the 1st quartile of primary care use was 14.1% compared to the lowest rate, 9.1% for the 4th quartile.

Regarding county-level variables, all were significant in bivariate analyses. For example, beneficiaries residing in counties with primary care shortage had the highest rates of ACSH (11.6%) compared to 10.7% for those living in no shortage areas.

Readmission

Similar findings were observed for 30-day readmissions. All patient-level variables were significantly associated with risk of readmission. Readmissions were more likely among African Americans (10.4%), those with lower levels of primary care use (1st quartile10.8%) compared to Caucasians (9.3%) and the 4th quartile of primary care use (7.7%).

Regarding county-level variables, all were significant in bivariate analyses. For example, beneficiaries residing in counties with primary care shortage had the highest rates of 30-day readmission (9.4%) compared to 8.7% for those living in no shortage areas.

ACSH and Readmission

From column percentage summaries (not presented), those who experienced both ACSH and readmission were more likely to be female (59.8%), have CVD (67.0%), diabetes (54.7%) or hypertension (74.9 %). Additionally, more individuals with both ACSH and readmission had higher levels of primary care use (Q1 and Q2 combined, 56.2%). Among the community-level variables, majority of individuals with both ACSH and readmissions lived in metropolitan areas and a higher percent of Medicaid beneficiaries lived in areas with the lowest household income as represented by the first quartile of median household income. The majority of this group lived in areas where the entire county was designated as a primary or mental health shortage area (82.8%, and 73.7%, respectively).

Multilevel Logistic Regressions

Multilevel logistic regressions which accounted for patients nested within counties were conducted for any ACSH and any 30-day readmissions separately because only 2% of Medicaid beneficiaries had both ACSH and 30-day all-cause readmissions. Table 3 summarizes the Adjusted Odds Ratios (AOR) and 95% Confidence Intervals (CI) from these regressions.

Patient Level:

Across both models, African Americans had a higher likelihood of both ACSH [AOR = 1.31, 95% CI 1.18, 1.45] and Readmission [AOR = 1.20, 95% CI 1.08, 1.33] as compared to Caucasians. The converse was true for Asian, American Indian and Pacific Islanders, who had a lower likelihood of ACSH [AOR = 0.62, 95% CI 0.51, 0.75]. While younger age adults (18-44 years) experienced a lower likelihood of any ACSH, the likelihood of any readmission was elevated for this group as compared to those 55-64 years of age.

There was a greater likelihood of readmission for those with chronic physical or mental health conditions with the exception of depression. There was no relationship between any 30-day readmission and depression. Those with asthma, COPD, CVD, diabetes and hypertension had greater likelihood of any ACSH compared to beneficiaries without these conditions. A lower likelihood of any ACSH was observed for those with severe mental illness (OR= 0.64, 95%CI 0.56, 0.74) and substance abuse (OR= 0.84, 95%CI 0.76, 0.94).

Beneficiaries with lower levels of primary care use (2nd Quartile, 3rd Quartile, no primary care use) had lower likelihood of any ACSH compared to those with 4th quartile primary care use.

County Level:

Compared to individuals living in counties with no designation, those in metropolitan areas were 41% more likely to experience any ACSH. We observed that beneficiaries residing in counties with lowest quartiles of hospitals had higher likelihood of readmission compared to those with more hospitals.

DISCUSSION

In 2008, the rate of ACSH or readmission was 27.5% among inpatient users from four diverse states. The rate of combined ACSH or readmission was 2%, representing approximately 7503 Medicaid beneficiaries.

When logistic regressions were controlled for county-level variation in ACSH or readmission, certain demographic factors remained significant predictors of hospitalization including African American race, chronic disease and age.

Racial disparities in hospitalization have been previously reported (Biello et al, 2010; O'Neil et al. 2010). That racial disparities persist after controlling for socio-economic and geographic factors underscores the need for comprehensive primary care services for minority groups and tangible ways to reduce barriers to care such as limited health literacy. In fact early studies of California Medi-Cal Medicaid managed care have demonstrated significant reductions in the rate of ACSH between FFS and managed care beneficiaries (Bindman et al. 2005). When evaluating the effect on hospitalizations, including readmissions, the greatest reductions in hospitalization were seen among minority groups. For example, African Americans voluntarily enrolled in Medi-Cal had hospitalization rates that were 42.7% lower than their FFS counterparts. The difference was just 27.1% for Caucasian beneficiaries.

Presence of chronic disease among Medicaid beneficiaries increases the likelihood of hospitalization, as has been established in the literature. It is interesting to note that our findings showed a lower likelihood of ACSH for beneficiaries with severe mental illness or substance abuse, however with an increased likelihood of readmission. Our findings are consistent with readmission rates reported by the New York State Medicaid program for 2007 (Lindsey, et al 2007). According to NYS DOH, the rate of potentially preventable readmissions was 3.5 times greater among beneficiaries with severe mental illness or substance abuse disorders compared to those without these conditions.

Our findings that younger aged adults were more likely to experience readmissions are inconsistent with previous reports. This finding may be the result of underlying differences in health seeking behaviors among younger age groups or could be a result of rates of substance abuse among this Medicaid sample (13.3%) that would differentially drive readmission rates instead of ACSH.

When adjusted for variation between counties, co-occurring chronic conditions remained a strong predictor of any ACSH and any 30-day readmissions. As these patient-level factors are not easily modified, Medicaid programs may need to provide structural and system level interventions to increase access to comprehensive care to those with chronic conditions.

Although any ACSH risk was reduced for beneficiaries with serious mental illness and substance use disorders, this group had greater likelihood of any 30-day readmissions compared to those without severe mental illness or substance use disorders. There may be several plausible reasons for this finding. Readmission risk may be increased due to lack of coordination between inpatient facilities and outpatient mental health/safety net providers typically observed in FFS

system. It is also possible that we have captured the results of county-level patient case mix complexity.

Contrary to our hypothesis, we found that lower levels of primary care use were associated with a lower likelihood of ACSH. While this finding may sound puzzling, it is possible that individuals seek primary care due to sickness and our findings may reflect underlying patient complexity, case mix or variations in severity of illness rather than primary care use. It is well documented that patients with increasing disease complexity utilize a greater volume of healthcare services including primary care. As the number of co-occurring conditions increases, so does the use of healthcare services, including physician, outpatient and inpatient services (Schneider 2009). It has been estimated that Medicaid beneficiaries with chronic or disabling conditions make an average of 19 outpatient visits per year (Allen, 2000). Thus, our measure of primary care use may have served as a proxy for patient complexity. These findings may also highlight the limitations of our primary care measure. For example, our measure of primary care use did not capture continuity of care with the same physician over the year. Our primary care use variable did not measure the quality of visits or the nature of these encounters, which may better explain risk for any ACSH or readmissions..

LIMITATIONS

Our study findings need to be interpreted in the light of its limitations. As our study was based only on beneficiaries from four states it is not generalizable to the entire Medicaid population. We also excluded individuals who are not enrolled in Medicaid health maintenance organizations. Given that less than one-third of the population receives fee-for-service care in Medicaid, our study suffers from selection bias. Our study design was cross-sectional and cannot

be used to establish causal relationships. Although we had a comprehensive list of variables including county-level healthcare resources, we did not have measures of health status, which may better explain risk of ACSH or any 30-day readmissions. As our study used observational data, one cannot rule out the selection bias because inpatient users may have a different profile in unobserved variables compared to individuals without inpatient use.

Despite these limitations, our study findings add to the nascent literature on ACSH and readmissions among Medicaid beneficiaries. Our study findings highlight the continued presence of racial disparities in quality in Medicaid population. Patient complexity in terms of chronic conditions increased the risk of any ACSH and readmissions, suggesting that chronic diseases need to be managed within an integrated system. This is especially needful for beneficiaries with severe mental illness, who represented one-fourth of beneficiaries in 2008. While county-level variables were generally not associated with ACSH or readmissions, some features such as access to primary care at the county-level may reduce the risk of very poor outcomes such as combined ACSH and hospital readmissions. Access to primary alone may not be enough to reduce risk of preventable hospitalizations. There is a need for innovative strategies such as comprehensive primary care for our nation's vulnerable and indigent populations. Future research needs to distinguish between preventive primary care and primary care due to illness complexity to better explain the link between primary care and any ACSH or any 30-day readmissions.

TABLES

Table 1: Description of Population Characteristics 2008 Medicaid Fee for Service Beneficiaries Inpatient Users

	N	%
TOTAL	371,648	100
State		
California	159,205	42.8
Illinois	64,887	17.5
New York	116,258	31.3
Texas	31,298	8.4
Gender		
Female	283,786	76.4
Male	87,862	23.6
Race/Ethnicity		
Caucasian	122,571	33
African American	96,749	26
Hispanic	111,859	30.1
Asian/AI/PI	23,694	6.4
Other	16,775	4.5
Age		
18-24 years	83,815	22.6
25-34 years	95,241	25.6
35-44 years	61,674	16.6
45-54 years	68,124	18.3
55-64 years	62,794	16.9
Poverty Based Eligibility		
Yes	277,399	74.6
No	94,249	25.4
Medical Eligibility		
Yes	128,744	34.6
No	242,904	65.4
Primary Care Use		
Q1	77,697	20.9
Q2	91,823	24.7
Q3	81,432	21.9
Q4	73,806	19.9
No Primary Care Visits	46,890	12.6

(Continued)

Table 1: Description of Population Characteristics 2008 Medicaid Fee for Service Beneficiaries Inpatient Users

	N	%
Asthma		
Yes	55,214	14.9
No	316,434	85.1
COPD		
Yes	47,431	12.8
No	324,217	87.2
CVD		
Yes	79,974	21.5
No	291,674	78.5
Diabetes		
Yes	64,365	17.3
No	307,283	82.7
Lipid Disorder		
Yes	65,180	17.5
No	306,468	82.5
Hypertension		
Yes	118,534	31.9
No	253,114	68.1
Joint		
Yes	91,689	24.7
No	279,959	75.3
Thyroid		
Yes	29,530	7.9
No	342,118	92.1
Cancer		
Yes	22,587	6.1
No	349,061	93.9
Depression		
Yes	63,684	17.1
No	307,964	82.9
Severe Mental Illness		
Yes	93,024	25
No	278,624	75
Substance Abuse		
Yes	49,525	13.3
No	322,123	86.7

Table 1: Description of Population Characteristics 2008 Medicaid Fee for Service Beneficiaries Inpatient Users

	N	%
County Education at least High School		
Q1	156,795	42.2
Q2	75,589	20.3
Q3	49,242	13.3
Q4	49,758	13.4
Q5	40,211	10.8
County Median Household Income		
Q1	17,426	4.7
Q2	33,356	9
Q3	79,549	21.4
Q4	62,708	16.9
Q5	178,556	48.1
County Metropolitan Status		
Not Statistical	8,482	2.3
Metro	346,630	93.3
Micro	16,483	4.4
Primary Care Shortage Area		
No shortage	14,520	3.9
Whole county	299,269	80.5
Part county	57,806	15.6
Mental Health Care Shortage Area		
No shortage	20,196	5.4
Whole county	265,200	71.4
Part county	86,199	23.2
Ambulatory Care Sensitive Hospitalization		
Yes	42,557	11.5
No	329,091	88.5
Readmissions 30-90 Days		
30day Readmission	34,247	9.2
31- 90 day Readmission	54,840	14.8
None	282,561	76
ACSH- 30 day Readmission		
ACSH + Readmission	7,503	2.0
ACSH or Readmission	102,124	27.5
No ACSH- No Readmission	262,021	70.5

Note: Based on 371,648 adult Medicaid fee for service beneficiaries, aged between 18 and 64 years and who were enrolled for all 12 months during 2008, used inpatient services, alive, and not enrolled in Medicare in 2008. Primary care use index was calculated only for those with primary care visits. County-level variables were from Area Resource File for 2008. AI = American Indian; PI = Pacific Islander ;
Primary care use quartiles varied by state; where 4th quartile values ranged from 0.67-1.0.

Table 2: Select Characteristics by Any ACSH and Readmissions 2008 Medicaid Fee for Service Beneficiaries

	Any ACSH				30-day Readmission		31-90 day Readmission			
	N	%	chisqval	sig	N	%	N	%	chisqval	sig
Total	42,557	11.0			34,247	9.2	54,840	14.8		
Gender			3471	***					7133	***
Female	27,637	9.7			22,733	8.0	35,959	12.7		
Male	14,920	17.0			11,514	13.1	18,881	21.5		
Race/Ethnicity			1178	***					1715	***
Caucasian	13,416	10.9			11,430	9.3	18,355	15.0		
African American	13,669	14.1			10,014	10.4	16,839	17.4		
Hispanic	11,296	10.1			9,350	8.4	14,432	12.9		
Asian/AI /PI	1,988	8.4			1,810	7.6	2,518	10.6		
Other	2,188	13.0			1,643	9.8	2,696	16.1		
Age			25306	***					14750	***
18-24 years	2,594	3.1			5,404	6.4	6,845	8.2		
25-34 years	4,231	4.4			6,951	7.3	9,238	9.7		
35-44 years	6,997	11.3			5,920	9.6	9,857	16.0		
45-54 years	13,440	19.7			8,040	11.8	14,831	21.8		
55-64 years	15,295	24.4			7,932	12.6	14,069	22.4		
Poverty Based Eligibility			901	***					1563	***
Yes	34,300	12.4			27,255	9.8	43,716	15.8		
No	8,257	8.8			6,992	7.4	11,124	11.8		
Medical Eligibility			2394	***	34,247		54,840		1856	***
Yes	10,223	7.9			10,013	7.8	15,524	12.1		
No	32,334	13.3			24,234	10.0	39,316	16.2		

(Continued)

Table 2: Select Characteristics by Any ACSH and Readmissions 2008 Medicaid Fee for Service Beneficiaries

	Any ACSH				30-day Readmission		31-90 day Readmission			
	N	%	chisqval	sig	N	%	N	%	chisqval	sig
Primary Care Use			1083	***					2350	***
Q1	10,966	14.1			8,369	10.8	13,926	17.9		
Q2	10,991	12.0			9,131	9.9	14,359	15.6		
Q3	9,256	11.4			7,534	9.3	12,066	14.8		
Q4	6,740	9.1			5,693	7.7	8,661	11.7		
No Ambulatory Visits	4,604	9.8			3,520	7.5	5,828	12.4		
County Level Variables Education at Least High School			158	***					135	***
Q1	18,646	11.9			14,447	9.2	22,824	14.6		
Q2	8,416	11.1			7,441	9.8	11,191	14.8		
Q3	5,231	10.6			4,545	9.2	7,298	14.8		
Q4	6,116	12.3			4,493	9.0	7,797	15.7		
Q5	4,143	10.3			3,318	8.3	5,725	14.2		
Median Household Income			189	***					501	***
Q1	1,828	10.5			1,465	8.4	2,299	13.2		
Q2	3,328	10.0			2,718	8.1	3,992	12.0		
Q3	10,003	12.6			8,101	10.2	12,339	15.5		
Q4	7,133	11.4			5,872	9.4	9,324	14.9		
Q5	20,260	11.3			16,088	9.0	26,881	15.1		
Metropolitan Status			45	***					87	***
Not Statistical	1,088	12.8			784	9.2	1,192	14.1		
Metro	39,797	11.5			32,094	9.3	51,541	14.9		
Micro	1,667	10.1			1,366	8.3	2,102	12.8		

(Continued)

Table 2: Select Characteristics by Any ACSH and Readmissions 2008 Medicaid Fee for Service Beneficiaries

	Any ACSH				30-day Readmission		31-90 day Readmission			
	N	%	chisqval	sig	N	%	N	%	chisqval	sig
Primary Care Shortage Area			58	***					123	***
No shortage	1,555	10.7			1,262	8.7	2,273	15.7		
Whole county	34,854	11.6			28,067	9.4	44,608	14.9		
Part county	6,143	10.6			4,915	8.5	7,954	13.8		
Mental Health Care Shortage Area			61	***					37	***
No shortage	2,178	10.8			1,763	8.7	2,981	14.8		
Whole county	31,056	11.7			24,904	9.4	39,223	14.8		
Part county	9,318	10.8			7,577	8.8	12,631	14.7		

Note: Based on 371,648 adult Medicaid fee for service beneficiaries, aged between 18 and 64 years and who were enrolled for all 12 months during 2008, used inpatient services, alive, and not enrolled in Medicare in 2008. Primary care use index was calculated only for those with primary care visits. County-level variables were from Area Resource File for 2008. AI = American Indian; PI = Pacific Islander ;
Primary care use quartiles varied by state; where 4th quartile values ranged from 0.67-1.0.
*** $p < 0.001$; ** $0.001 < p < 0.01$; * $0.01 < p < 0.05$

Table 3: Adjusted Odds Ratios and 95% Confidence Intervals from Separate Multilevel Logistic Regressions on any ACSH and 30-Day Readmission 2008 Medicaid Fee for Service Beneficiaries

		ACSH			30-Day Readmission		
		AOR	95% CI	Sig	AOR	95% CI	Sig
State							
	Illinois	0.81	[0.65,1.01]		1.17	[0.94,1.45]	
	New York	0.83	[0.64,1.07]		0.85	[0.65,1.11]	
	Texas	1.09	[0.88,1.35]		1.1	[0.88,1.37]	
	California	Reference					
Gender							
	Female	0.79	[0.73,0.86]	***	0.76	[0.70,0.83]	***
	Male	Reference					
Race/Ethnicity							
	African American	1.31	[1.18,1.45]	***	1.2	[1.08,1.33]	***
	Hispanic	1.01	[0.91,1.12]		0.97	[0.88,1.08]	
	Asian/AI /PI	0.62	[0.51,0.75]	***	1.07	[0.91,1.27]	
	Other	1	[0.84,1.19]		0.91	[0.76,1.10]	
	Caucasian	Reference					
Age							
	18-24 years	0.37	[0.32,0.44]	***	1.47	[1.27,1.71]	***
	25-34 years	0.53	[0.46,0.61]	***	1.5	[1.31,1.72]	***
	35-44 years	0.89	[0.79,1.00]	*	1.34	[1.18,1.52]	***
	45-54 years	1.01	[0.92,1.11]		1.03	[0.92,1.15]	
	55-64 years	Reference					
Cash Eligibility							
	Cash	0.93	[0.81,1.07]		1.22	[1.08,1.38]	**
	No Cash	Reference					
Medical Eligibility							
	Medical	0.79	[0.69,0.90]	***	1.11	[0.99,1.25]	
	No Medical	Reference					
Primary Care Use							
	Q1	0.96	[0.84,1.09]		1.11	[0.97,1.27]	
	Q2	0.76	[0.67,0.87]	***	1.11	[0.97,1.28]	
	Q3	0.72	[0.63,0.82]	***	1.11	[0.97,1.28]	
	No PCP Visits	0.85	[0.74,0.98]	*	1.03	[0.89,1.19]	
	Q4	Reference					
Asthma							
	Yes	3.31	[3.04,3.60]	***	1.25	[1.14,1.37]	***
	No	Reference					

(Continued)

Table 3: Adjusted Odds Ratios and 95% Confidence Intervals from Separate Multilevel Logistic Regressions on any ACSH and 30-Day Readmission 2008 Medicaid Fee for Service Beneficiaries

		ACSH			30-Day Readmission		
		AOR	95% CI	Sig	AOR	95% CI	Sig
COPD							
	Yes	2.6	[2.38,2.84]	***	1.44	[1.3,1.59]	***
	No	Reference					
CVD							
	Yes	1.68	[1.55,1.83]	***	1.71	[1.56,1.87]	***
	No	Reference					
Diabetes							
	Yes	2.91	[2.68,3.16]	***	1.37	[1.25,1.51]	***
	No	Reference					
Hypertension							
	Yes	1.32	[1.2,1.44]	***	1.3	[1.18,1.43]	***
	No	Reference					
Joint							
	Yes	0.99	[0.91,1.07]		1.28	[1.18,1.39]	***
	No	Reference					
Thyroid							
	Yes	1.03	[0.91,1.16]		1.15	[1.01,1.30]	*
	No	Reference					
Cancer							
	Yes	0.91	[0.79,1.04]		1.91	[1.69,2.16]	***
	No	Reference					
Depression							
	Yes	1.1	[0.95,1.28]		1.11	[0.97,1.27]	
	No	Reference					
Severe Mental Illness							
	Yes	0.64	[0.56,0.74]	***	1.28	[1.13,1.45]	***
	No	Reference					
Substance Abuse							
	Yes	0.84	[0.76,0.94]	**	1.87	[1.70,2.06]	***
	No	Reference					

(Continued)

Table 3: Adjusted Odds Ratios and 95% Confidence Intervals from Separate Multilevel Logistic Regressions on any ACSH and 30-Day Readmission 2008 Medicaid Fee for Service Beneficiaries

	ACSH			30-Day Readmission		
	AOR	**95% CI**	**Sig**	**AOR**	**95% CI**	**Sig**
County Education at Least High School						
Q1	1.11	[0.85,1.46]		1.16	[0.88,1.53]	
Q2	1.26	[0.99,1.60]		1.14	[0.89,1.45]	
Q3	1.13	[0.92,1.40]		1.08	[0.87,1.33]	
Q4	1.07	[0.86,1.31]		1.04	[0.84,1.29]	
Q5	Reference					
County Median Household Income						
Q1	1	[0.74,1.36]		0.95	[0.69,1.29]	
Q2	1.02	[0.78,1.34]		1.02	[0.77,1.35]	
Q3	1.05	[0.83,1.33]		1.08	[0.85,1.38]	
Q4	1.08	[0.89,1.30]		1.04	[0.85,1.26]	
Q5	Reference					
County Metropolitan Status						
Metro	1.41	[1.03,1.92]	*	1.23	[0.89,1.68]	
Micro	0.88	[0.67,1.15]		1.3	[1.00,1.69]	
Not Statistical	Reference					
Primary Care Shortage Area						
Whole county	0.97	[0.71,1.32]		1.17	[0.85,1.62]	
Part county	1.04	[0.77,1.40]		1.19	[0.87,1.63]	
No shortage	Reference					
Mental Health Care Shortage Area						
Whole county	0.85	[0.66,1.09]		1	[0.77,1.3]	
Part county	0.82	[0.64,1.06]		1.04	[0.80,1.36]	
No shortage	Reference					
Rural Health Clinic						
Yes	0.89	[0.74,1.08]		1.05	[0.87,1.27]	
No	Reference					
FQHC						
Yes	1.07	[0.86,1.33]		0.97	[0.78,1.20]	
No	Reference					
Community Mental Health Clinic						
Yes	1.1	[0.90,1.35]		1.06	[0.86,1.30]	
No	Reference					

(Continued)

Table 3: Adjusted Odds Ratios and 95% Confidence Intervals from Separate Multilevel Logistic Regressions on any ACSH and 30-Day Readmission 2008 Medicaid Fee for Service Beneficiaries

	ACSH			30-Day Readmission		
	AOR	**95% CI**	**Sig**	**AOR**	**95% CI**	**Sig**
Total Hospitals						
Q1	1.06	[0.87,1.29]		1.35	[1.11,1.64]	**
Q2	1.04	[0.83,1.30]		1.25	[0.99,1.57]	
Q3	1.02	[0.73,1.43]		1.14	[0.81,1.61]	
Q4	Reference					
Office Based General Practitioners						
Q1	0.8	[0.46,1.39]		1.06	[0.61,1.83]	
Q2	0.88	[0.53,1.44]		0.95	[0.58,1.56]	
Q3	0.77	[0.49,1.22]		0.96	[0.61,1.52]	
Q4	Reference					
Office Based OBGYN						
Q1	0.97	[0.58,1.63]		0.78	[0.46,1.32]	
Q2	0.86	[0.53,1.40]		0.89	[0.54,1.46]	
Q3	0.89	[0.56,1.41]		0.86	[0.54,1.37]	
Q4	Reference					
Office Based Preventative Medicine						
Q1	0.93	[0.74,1.19]		0.82	[0.64,1.04]	
Q2	1.07	[0.84,1.35]		0.88	[0.69,1.12]	
Q3	1.06	[0.82,1.38]		1	[0.77,1.31]	
Q4	Reference					

Note: Based on 371,648 adult Medicaid fee for service beneficiaries, aged between 18 and 64 years and who were enrolled for all 12 months during 2008, used inpatient services, alive, and not enrolled in Medicare in 2008. Primary care use index was calculated only for those with primary care visits. County-level variables were from Area Resource File for 2008. AI = American Indian; PI = Pacific Islander ;
Primary care use quartiles varied by state; where 4th quartile values ranged from 0.67-1.0.
*** $p < 0.001$; ** $0.001 < p < 0.01$; * $0.01 < p < 0.05$

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CHAPTER 3

Title: Longitudinal Assessment of Ambulatory Care Sensitive Hospitalizations and Readmissions: A Case of Chronic Complex Illness in Diabetes.

INTRODUCTION

Medicaid and Chronic Complex Illness

The need for primary care services is especially important for individuals with co-occurring chronic conditions. Sixty-one percent of adult Medicaid beneficiaries have chronic or disabling conditions (Allen, 2000). Additionally, disabled adults are more likely to have three or more co-occurring chronic conditions than their non-disabled counterparts (35% v. 10%) (Kronick, 2007). An appraisal of the most prevalent conditions among Medicaid beneficiaries found cardiovascular, psychiatric, and diabetes-related conditions to be common among all eligibility groups (i.e, aged, disables, dually eligible)(Kronick, 2007).

It has been estimated that Medicaid beneficiaries with chronic or disabling conditions make an average of 19 outpatient visits per year (Allen, 2000). It should be noted that greater number of co-occurring conditions increases the use of healthcare services, including physician, outpatient and inpatient services (Schneider 2009). Accordingly, 25% of Medicaid enrollees, many of whom are disabled or have chronic diseases, require 70% of program resources (Kronick, 2007). Individuals with co-occurring chronic conditions may be considered to suffer from chronic complex illness. The Agency for Healthcare Research and Quality defines "a complex patient is one with two or more chronic conditions where each condition may influence the care of the other condition(s) through limitations of life expectancy, interactions between drug therapies, difficulties in establishing adequate care coordination, and/or direct

contraindications to therapy for one condition by other conditions themselves" (AHRQ 2009b). Within this context, we focus on co-occurring diabetes and depression.

Chronic Complex Illness: Diabetes and Depression

For the purposes of this study, we consider co-occurring diabetes and depression as chronic complex illness. Diabetes and depression can be considered discordant conditions because treatment for one condition may conflict with outcomes of the other condition. In the case of diabetes and depression, treatment for depression with antidepressants may increase blood glucose levels, considered as poor outcomes for diabetes care. Additionally, patients with diabetes and depression may face challenges in healthcare management due to concurrent pathologies that can interact to worsen health outcomes. Furthermore, individuals with diabetes and depression may face care coordination and continuity problems because they may seek care from psychiatrists and endocrinologist providers.

We selected diabetes and depression because of many reasons. The prevalence of diabetes among Medicaid enrollees is high (14%), furthermore, the condition occurs on its own less than 1% of the time, which highlights the extent of chronic complex illness within this population (CDC, 2011; Boyd, 2010). Among those with diabetes, 68% have a cardiovascular condition, and 31% have a psychiatric condition (Kronick, 2007). Specifically, co-occurring depression is highly prevalent among individuals with diabetes. A meta-analysis and systematic review of studies published between 1980 and 2005, revealed the likelihood of depression among those with diabetes to be significantly more likely, than for individuals without diabetes (Ali, 2006). Across studies included in the meta-analysis, the likelihood of co-occurring depression was 60% greater among those with diabetes **[OR= 1.6, 95%CI 1.2- 2.0]**. Furthermore, co-

occurring diabetes and depression is associated with mortality, morbidity and economic burden (Egede, 2010).

Ambulatory Care Sensitive Hospitalizations (ACSH) and Readmissions

With increasing healthcare costs and demands for improved quality of care, preventable hospitalizations, such as ambulatory care sensitive hospitalizations (ACSH) and readmissions, attract special attention especially for at risk groups such those with diabetes. Currently, of the 14 ambulatory care sensitive hospitalizations identified by the Agency for Healthcare Research and Quality, four are diabetes related complications. This underscores the important role of primary care in managing this condition. Indeed, among persons with diabetes, higher continuity of primary care has been associated with decreased risk of hospitalization (Chen, 2011; Knight, 2009; Worrall, 2011).

According to one cross-sectional study, diabetes-related ACSHs account for 36% of hospitalizations for type II diabetes, with the risk of ACSH increased by the presence of and types of present comorbid conditions (Ahern and Hendrix, 2007). One observational study that analyzed medical claims for patients with a diagnosis of diabetes between 1994 and 2001 found the overall rate of 30-day non-elective readmissions to be 20% (Robbins and Webb, 2006). We are also aware of instances where these events co-occur. One article estimates that 19% of individuals who experienced an ACSH also had a preventable readmission within 6 months (Friedman, 2004). Integrated models of care such as those proposed by CMS, AHRQ, and outlined in Patient Protection and Affordable Care Act (ACA) highlight the importance of evaluating quality outcomes along a continuum of care. Additionally, we the role primary care and care coordination need to be considered within a longitudinal framework.

Therefore, the primary objective of the current study is to use a unified approach to evaluate the individual-level, provider-level, and county-level characteristics that contribute to any lapse in quality along the continuum of patient care for a Medicaid beneficiaries with chronic complex illness, defined as co-occurring diabetes and depression. We evaluated the association between chronic complex illness and the likelihood of any ACSH and all cause 30-day readmissions within a longitudinal and multivariate framework. In addition, we examine the role of primary care and care coordination on the likelihood of ACSH and all cause 30-day among Medicaid beneficiaries with diabetes, after controlling for the complexity of illness. Where previous studies have evaluated ACSH and readmissions within a cross-sectional framework, a longitudinal assessment will more closely approximate a unified view of the continuum of patient care. We hypothesize that the likelihood of ACSH+Readmissions will be greater for those with chronic complex illness (i.e. diabetes and depression) compared to those without chronic complex illness (diabetes without depression). Among all adult Medicaid beneficiaries with diabetes, Individuals with lower levels of primary care use will be significantly more likely to have both ACSH+Readmissions compared to individuals with higher levels of primary care use.

METHODS

Conceptual Framework

The conceptual framework of quality assessment used here is based on the Structure-Process-Outcomes Model levels as well as the Donabedian levels of quality assessment (Donabedian, 1988). According to Donabedian, quality should be assessed at levels that are pertinent and successively inclusive of responsibility, attention and control. The figure below presents the individual, provider and community levels of quality assessment. Within each

colored box, are listed aspects that lie within the control, attention or responsibility of each level. For example, when assessing quality of care, activities of care coordination are the responsibility of health care providers. The presence of co-occurring conditions will require additional attention from individuals when seeking care.

Historically, primary care physicians in outpatient settings have been held responsible for ACSH, while inpatient facilities have been held responsible for post- discharge readmissions. The current model of integrated care sets forth an all inclusive approach to analyze lapses in quality, realizing that they may occur alone or in tandem. The following scenarios are proposed: 1) ACSH only, 2) Readmission only, 3) ACSH and Readmission, and 4) Neither ACSH or Readmission.

Study Design:

The study used a retrospective longitudinal design using observational data in real-world settings. Longitudinal analysis were restricted to those enrollees who had claims in three years (i.e. 2005 through 2007 – Panel 1; and 2006 through 2008 – Panel 2). The time frame for our longitudinal analysis was a total of 270 days for individuals who were enrolled in all three years. In this time frame, we distinguished between a baseline and follow up period. Ninety days prior to index hospitalization formed the baseline period and 180 days following discharge from index hospitalization were used to evaluate readmission and preventable hospitalizations. Index hospitalization is defined as the first observed hospitalization between 2005 and 2007 for Panel 1 and between 2006 and 2008 for Panel 2.

Data:

Medicaid administrative claims files from four states, California, Illinois, New York and Texas, between the years of 2005-2008 were used. These states were chosen for their low

managed care penetration rates relative to other states, as well as their diverse patient populations. This will allow more fee-for-service claims for analysis. For example, the state of Alaska is entirely FFS, However with enrollment at approximately 115,000 beneficiaries, a sufficient sample would likely not be available for evaluation after applying study exclusions. As another example, the state of West Virginia has a penetration rate of 47%, however state Medicaid enrolment is also comparatively low at approximately 340,000. Moreover, to aid evaluation of demographic variables, states with beneficiaries of diverse racial/ethnic background were chosen. Medicaid managed care penetration ranged from 55%- 69% for the select states, California, Illinois, New York and Texas. However, with enrollment in the millions, a sufficient number of beneficiary claims were available for analyses after exclusions were applied.

Medicaid data consisted of the Personal Summary file which included information on beneficiary demographics (gender, age, race/ethnicity, county of residence), Medicaid enrollment and eligibility status. The Outpatient and Inpatient files included claims for services provided in ambulatory and inpatient settings and contained International Classification of Diseases 9th edition Clinical Modification (ICD-9-CM) codes.

The 2008 Area Resource File (ARF) provided county- level information on socio-economic status, healthcare resources, facilities, providers and utilization. The longitudinal model pooled three years of claims data across two panels (2005-2007; and 2006- 2008).

Study Population:

Individuals with Diabetes

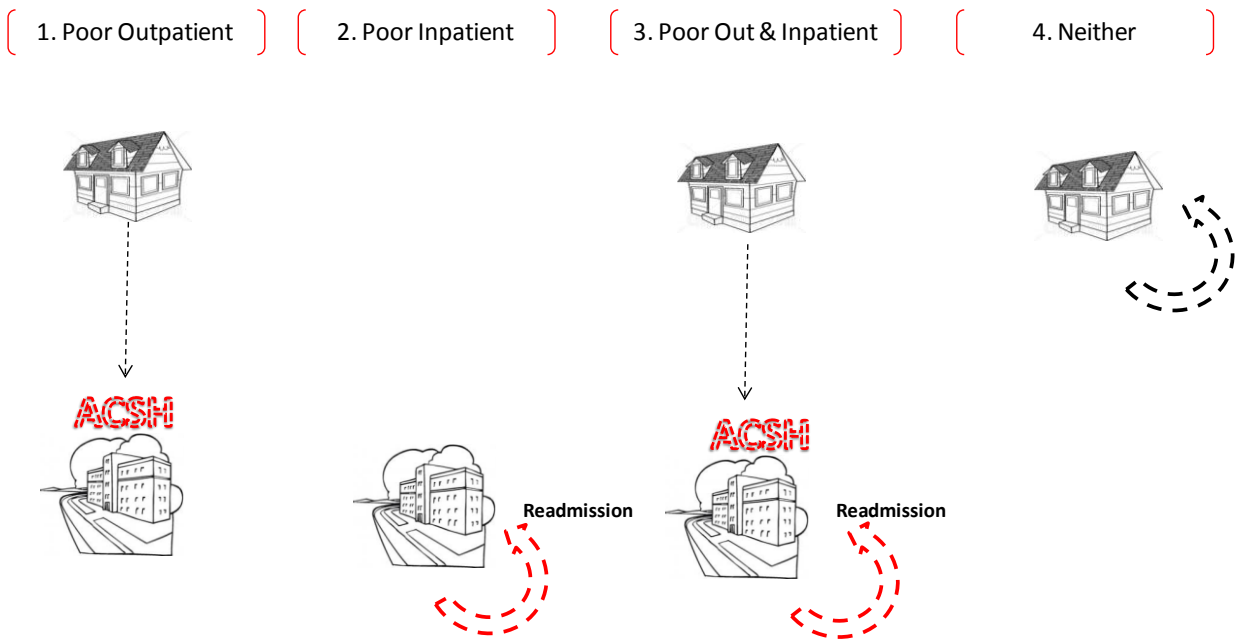
The study population consisted of fee-for-service (FFS) Medicaid beneficiaries, aged 18-64 years, with full-year continuous enrollment and not dually enrolled in Medicare and utilized inpatient services during 2005-2008. Persons with diabetes were identified as such by either 2 outpatient claims, or 1 inpatient claim with ICD-9 codes: 250.00-03, 250.10-13, 250.20-23, 250.30-33, 250.40-43, 250.50-53, 250.60-63, 250.70-73, 250.80-83, and 250.90-93.

Individuals with Diabetes and Depression:

For individuals with diabetes, depression was identified by ICD9-codes: 293.83, 296.20-26, 296.30-36,300.40, and 311. Those with diabetes and depression were considered to have chronic complex illness.

Dependent Variable:

Figure1: Four Possible Scenarios of ACSH and Readmission



ACSH were based on any of the following 13 ambulatory care sensitive conditions identified by ICD-9 codes for: 1) diabetes short-term complications; 2) diabetes long-term complications; 3) perforated appendicitis; 4) chronic obstructive pulmonary disease (COPD); 5) hypertension; 6) congestive heart failure; 7) dehydration; 8) bacterial pneumonia; 9) urinary infections; 10) angina without a procedure; 11) uncontrolled diabetes; 12) adult asthma; and 13) lower extremity amputations. Medicaid beneficiaries with a hospitalization for any of the above-mentioned conditions in the observation period were considered to have an ACSH. ACSH was calculated by using the Prevention Quality Indicators (PQI) software developed by AHRQ (publicly available at http://www.qualityindicators.ahrq.gov/Software/Default.aspx). Readmissions: Readmissions were identified as all-cause 30-day readmissions following an index hospitalization discharge during the observation period. Patient transfers were not considered as readmissions.

Quality Scenarios: We combined any ACSH and all cause 30-day readmission during the observation period to evaluate four possible scenarios for lapses in quality: 1) ACSH only, 2) Readmission only, 3) ACSH+Readmission, and 4) Neither ACSH or Readmission. Figure 1 is a visual representation of these four possible quality outcomes in Medicaid benefiicaires with diabetes.

Key Independent Variables:

Chronic Complex Illness:

Individuals with co-occurring diabetes and depression were considered to have chronic complex illness.

Primary care use:

Primary care use was identified during 90 days prior to index hospitalization observed between 2005 and 2007 for Panel 1 and 2006 and 2008 for panel 2. This variable was derived from ambulatory care visits to primary care providers. Primary care visits were identified from physician specialty codes and current procedural terminology (CPT-4) codes for services rendered. We defined the primary care use as an index and calculated it as the proportion of ambulatory visits to primary care practitioners divided by all ambulatory visits. This index ranged from 0 indicating no primary care visits and 1.0 indicating all visits were to primary care providers. The distribution of primary care use was divided into quartiles, specific to each state. Higher quartiles indicate greater use of primary care visits in relation to all ambulatory setting visits. Individuals who did not have any ambulatory care visit were considered in a separate category. It is likely that an individual who had only one visit to primary care may be classified as having higher levels of primary care if they had only one visit in the entire year. For this reason primary care use was measured only for individuals with greater than two ambulatory care visits. Primary care providers were identified as general practice physicians, internal medicine, family practice, obstetrics & gynecology, preventive medicine physicians and nurse practitioners, since they also provide primary care services.

Care Coordination:

Care coordination was defined as a visit to a primary care practitioner within 14 days of index hospitalization discharge.

Other Independent Variables:

Patient-level variables, obtained from the Medicaid personal summary claim files, include demographic variables: age (18-24, 25-34, 35-44, 45-54, 55-64 years), gender (female, male), race/ethnicity (African American, Caucasian, Hispanic, Asian, American Indian, Pacific Islander), Medicaid eligibility (poverty, medical need), health status measured by presence of chronic physical and mental health conditions and substance abuse. Chronic physical conditions consisted of: asthma, chronic obstructive pulmonary disease (COPD), cardio vascular disease (CVD), hypertension, joint disorders (arthritis, osteoarthritis, rheumatoid arthritis), thyroid disease, and cancer; Mental health conditions included severe mental illness (schizophrenia, bipolar disorder, psychosis) and substance use disorders. All conditions were identified using ICD-9-CM codes from inpatient and outpatient files.

Index hospitalization characteristics:

Length of hospitalization and season of index hospitalization (fall, winter, spring, and summer) were also included as independent variables.

County-Level Independent Variables:

These were obtained from Area Resource file and included educational attainment (at least high school diploma), median household income, metropolitan statistical area, primary care shortage, mental health shortage area, presence of federally qualified health center (FQHC), community mental health clinic, rural health clinic, total number of hospitals, office based general physicians, and preventative medicine physicians. For variables on a continuous numeric scale, quartiles were constructed by calculating per capita density and then distributing into quartile rages, specific to each state.

Statistical Techniques

Chi square tests of independence were used to determine the significant association between chronic complex illness and quality scenarios. Multinomial logistic regressions which accounted patients nested within counties were conducted. In these regressions, we evaluated the association between chronic complex illness and likelihood of ACSH+Readmissions. In logistic regressions, we included all other independent variables mentioned in the measure section. Due to the large numbers, logistic regressions were conducted on a 10% random sample of our study population. All analyses were conducted using Statistical Analysis Software version 9.3 (SAS Inc., Cary, North Carolina USA).

RESULTS

Demographics

The full three- year longitudinal samples (2005-2007 and 2006-2008) represented 3,793,520 FFS Medical beneficiaries. The majority of FFS beneficiaries continuously enrolled all three years were from the state of California. Beneficiaries from Illinois comprised just 1% of the study population. Most beneficiaries were female and a third were of Hispanic ethnicity. At baseline, the majority of beneficiaries met poverty- based eligibility requirements (74.2%) and a third were enrolled due to medical need (31.5%). The majority of beneficiaries did not have the medial conditions evaluated. For those experiencing disease, the five conditions with the highest prevalence were hypertension (17%), joint disorders (16%), severe mental illness (14%), and lipid disorder (13%).

To test the hypothesis that likelihood of ACSH+Readmission would be greater for those with chronic complex illness we restricted our study population to FFS Medicaid beneficiaries with diabetes (N=305, 569). In our study population of FFS Medicaid beneficiaries with

diabetes 14% (N = 43,753) were diagnosed with chronic complex illness defined as co-occurring diabetes and depression. The majority of beneficiaries (89%) experienced the lowest levels of primary care use (Index = 0.0-0.25). Of those hospitalized a third had length of stays in the highest quartile (5 + days), and more than half were admitted during the winter or spring months (54%). Finally, most beneficiaries resided in metropolitan areas where the entire county was designated as a primary care or mental health shortage area (**Table 1**).

Subgroup Differences for ACSH+Readmission

The bivariate analysis on differences between ACSH/Readmission combinations revealed significant differences for all independent variables tested (**Table 2**). Of the entire population, just 1% experienced the poor outcome of ACSH+Readmission, representing 26,193 beneficiaries. From column percentage summaries (shaded column of Table 2), we observe more individuals that experienced ACSH+Readmission were of Caucasian and African American races (34% and 31%, respectively) and were aged 45 years and older (69%). For those with ACSH+Readmission, the five conditions with the highest prevalence were hypertension (59.5%), CVD (48.9%), joint disorders (39.3%) and COPD (35.5%). For comparison, the rate of comorbid diabetes and depression among those with ACSH+Readmission was (20%).

Most beneficiaries with ACSH+Readmission received no care coordination post discharge (69.9%) and belonged to the lowest quartile (65%) of primary care use (index = 0.0-0.25). Just over half of these beneficiaries had lengths of hospitalization ≥ 5 days (52.4%). Most beneficiaries experiencing ACSH+Readmission beneficiaries resided in metropolitan areas where the entire county was designated as a primary care or mental health shortage area.

Multinomial Logistic Regression Model

As mentioned before, to test the hypothesis that complex illness, defined as co-occurring diabetes and depression increased the likelihood of poor quality outcomes (i.e. ACSH+Readmission) among FFS beneficiaries, our study population was restricted to those beneficiaries with diabetes. Multinomial logistic regressions included all independent variables mentioned in the measures section. However, the key independent variable was "chronic complex illness indicator (i.e. those with co-occurring diabetes and depression). The multinomial logistic regression accounted for patients nested within counties. For the dependent variable the reference group was "Neither ACSH or Readmission" (**Table 3**).

Chronic Complex Illness and Quality Scenarios:

Medicaid beneficiaries with chronic complex illness (i.e. those with co-occurring diabetes and depression) were more likely to have any ACSH compared to those with diabetes and no depression. The adjusted odds ratio (AOR) was 1.31 with 95% Confidence Interval [1.17, 1.46]. Similarly, chronic complex illness lowered the likelihood of readmission by 31%. The AOR was 0.69 and 95% CI = 0.57, 0.83. Compared to those experiencing neither event, the likelihood of combined ACSH+Readmission was not statistically significant for those with complex illness (diabetes and depression) compared to those with diabetes and no depression.

Other Patient-level Variables; Asthma, COPD, CVD, hypertension, joint and lipid disorders and substance abuse all increased the likelihood of combined ACSH+Readmission. Compared to those experiencing neither event, the likelihood of combined ACSH+Readmission was not significant for racial ethnic minorities compared to Caucasians. Young adults (18-34 years) had a higher likelihood of combined ACSH+Readmission compared to those 55 years and

older. Beneficiaries with no primary care use were more likely to experience combined ACSH+Readmission.

ACSH+Readmission were less likely among individuals with lower levels of primary care use compared to those with higher levels of primary care use. Compared to the 4th quartile of primary care use (Index > 0.75), The AOR for the 2nd quartile (Index 0.26-0.50) of primary care use was 0.69 and 95% CI = 0.51, 0.93. The AOR for the 3rd quartile (Index 0.51-0.75) of primary care use was 0.68 and 95% CI = 0.53, 0.87.

Beneficiaries with coordinated care, defined as a primary care visit within 14 days of hospital discharge, were significantly less likely to experience readmission **[AOR= 0.86, 95%CI 0.76, 0.96]**.

County-level Independent Variables:

Compared to those experiencing neither event, the likelihood of combined ACSH+Readmission was significantly increased for beneficiaries residing in counties with a community mental health center **[AOR = 1.44, 95%CI 1.19, 1.74]**. The combined outcome (ACSH+Readmission) was less likely for beneficiaries residing in counties designated as primary health shortage area **[AOR = 0.59, 95%CI 0.36, 0.98]** or for those with metropolitan status **[AOR = 0.48, 95%CI 0.28, 0.81]**. Compared to the highest quartile, the combined outcome (ACSH+Readmission) was also less likely at all lower levels of office based preventive medicine physicians. For example the AOR for the lowest quartile of preventative medicine physicians was 0.52 and 95%CI was 0.37, 0.73.

Discussion

We sought to analyze the relationship between poor quality outcomes (ACSH+Readmission) and primary care use in the presence of chronic complex illness, defined as comorbid diabetes and depression. Over a three year period, 305, 569 beneficiaries had diabetes, and of this 43,753 (14%) had comorbid depression. Among those experiencing ACSH+Readmission, 20% were beneficiaries with complex illness. However, when adjusted for differences in health care sources between counties, multinomial regressions revealed no significant increase in the likelihood of ACSH+Readmission for those with chronic complex illness.

Co-occurring conditions can be considered complex illness, when the conditions are discordant, have conflicting outcomes or exacerbating effects on one another. For example, care for diabetes and depression may be discordant if sought from a psychiatrist and endocrinologist separately. From our analyses of Medicaid FFS beneficiaries, co-occurring diabetes and depression did not produce worse outcomes in terms of ACSH+Readmission. It has however been reported elsewhere, that in the presence of comorbid physical and mental illness a tradeoff occurs in receipt of care (Laiteerapong et al , 2011). Those conditions with overt symptomology (hyperglycemia) often receive priority treatment over less overt symptoms (feeling down) which are of no less importance.

An interesting finding was the relationship between the presence of community mental health clinics and ACSH+Readmission. FFS Beneficiaries with diabetes residing in counties with community mental clinics had an increased likelihood of experiencing a poor outcome event. Consistent with prior reports, this suggests a lack of appropriate care coordination between mental health and primary care providers during transitions of care or outpatient settings

(Koenig et al, 2013). Our findings could also be a result of differences in patient case mix. The presence of mental health clinics could indicate an area of greater medical need. In which case, we would expect to observe a higher likelihood of readmissions if demand for mental health services was due to presence of more individuals with disease (Curtis et al 2009).

In our analysis we observed a greater likelihood of ACSH+Readmission among those with no primary care compared to those with higher use of primary care. Similarly, readmission rates were higher for those with no primary care use. These findings highlight the importance of access to primary care rather than intensity of primary care on reducing poor quality outcomes.

Our findings also reinforce the role of primary care and care coordination on reducing the likelihood of all cause 30-day readmissions. As expected we found that those visiting primary care providers within 14-days of discharge experienced reduction in likelihood of all cause 30-day readmissions. Extrapolating our findings, one can speculate that he current healthcare delivery reform including the Accountable care organization which place emphasis on primary care provider as the locus of care may reduce the likelihood of readmissions and reduce economic burden of the payors and patients alike.

At the same time, we also observed lower likelihood of combined poor outcomes (ACSH+Readmission) for those with lower levels of primary care sue (the third and fourth quartiles of primary care use index 0.26-0.75), compared with those in the highest quartile (0.75 -1.0). This finding suggests that primary care use alone may not be sufficient to reduce poor quality outcomes among those with chronic illness. It is plausible that those with diabetes seek care from multiple providers and placing the responsibility on only primary care providers may not reduce the risk of ACSH. Further research needs to analyze the association between other aspects of continuity (such as management continuity) and risk of ACSH.

Nevertheless, our findings for the combined outcome are consistent with those reported elsewhere, that less interaction with the health care system worsens poor outcomes and more interaction with the health care system attenuates likelihood of poor outcomes for persons with diabetes or chronic complex illness (Pentakota et al., 2012). Similarly, where counties were designated as whole primary care shortage areas, beneficiaries with diabetes were less likely to experience combined poor outcomes that in counties with no primary care shortage. Taken together these findings suggest in this population of FFS beneficiaries with diabetes, counties with primary care shortages may indirectly support improved continuity with the same provider, and thus reduce occurrence of combined ACSH and readmission (Adair, 2005; Green et al 2008). Green et all demonstrated how relational continuity helped improved recovery and reported quality of life among patients with severe mental illness (Green et al, 2008). Despite these possible explanations for our findings, we continue to highlight the importance of access to primary care services as foundational to provision of healthcare at the population level.

Even within a FFS structure, Laiteerapong et al., suggest a clinical algorithm for caring for patients with diabetes and complex illness that focuses on quality of life and functional assessments rather than on diabetes care alone. The patient-centric approach includes shared treatment goals and understanding patient preferences. By being attentive to patient centered outcomes, clinicians will have more opportunity to distinguish between nuanced manifestations of disease especially for symptomatic versus asymptomatic chronic disease. The provision of care must be tailored to meet the needs of the patient, since as observed here, presence of service providers alone cannot compensate for the increased likelihood of poor outcomes among those with chronic complex illness (Jortberg et al, 2012). Models of care that provide comprehensive primary care will be key in managing panels of patients with complex illness in a way that

improves provision of quality care and maintains costs within a reasonable threshold. Already, one state evaluated here is currently developing models of care that provide behavioral and primary care services to Medicaid patients in a patient centric way (http://innovation.cms.gov/initiatives/MIPCD/). Future evaluations will be needed to determine the impact of comprehensive care pilots such as this on healthcare costs and patient health outcomes.

LIMITATIONS

The major limitation of this study is one that can influence the interpretation of our findings. Our measure of primary care use does not make distinction for patient severity of illness as a reason for greater primary care use. As such, our findings that lower levels of primary care use were associated with lower likelihood of ACSH+Readmissions may not be due to decreased continuity of care, but instead to demand induced use of primary care services among a sicker subgroup of beneficiaries in the highest quartile. Because primary care use measured prior to and not concurrently during the outcome period, it could not directly account for severity of illness during the entire measurement period. We did, however, attempt to adjust for this in our regression by including length of hospital stay as a proxy measure for disease severity.

Despite these limitations, our study made unique contribution to the literature by evaluating healthcare quality scenarios using a longitudinal design with multilevel modeling. We have demonstrated the continued importance of primary care use as well as care coordination with primary care providers in reducing combined poor quality outcomes especially for high risk patients, such as those with chronic illness (i.e. diabetes).

TABLES

Table 1: Description of Population Characteristics Medicaid Fee for Service 2005-2007, 2006-2008

		N	%
TOTAL		**3,793,520**	**100.0**
State			
	California	2,215,421	58.4
	Illinois	39,096	1.0
	New York	1,364,394	36.0
	Texas	174,609	4.6
Gender			
	Female	2,525,433	66.6
	Male	1,268,087	33.4
Race/Ethnicity			
	Caucasian	1,114,164	29.4
	African American	780,846	20.6
	Hispanic	1,222,247	32.2
	Asian/AI/PI	484,966	12.8
	Other	191,297	5.0
Age			
	18-24 years	724,405	19.1
	25-34 years	814,450	21.5
	35-44 years	889,874	23.5
	45-54 years	798,933	21.1
	55-64 years	565,858	14.9
Poverty Based Eligibility			
	Yes	2,815,579	74.2
	No	977,941	25.8
Medical Eligibility			
	Yes	1,195,372	31.5
	No	2,598,148	68.5
Care Coordination			
	Yes	236,540	6.2
	No	3,556,980	93.8
Primary Care Use			
	Q1	3,383,427	89.2
	Q2	30,632	0.8
	Q3	90,317	2.4
	Q4	69,921	1.8
	No PCP Visits	219,223	5.8
Asthma			
	Yes	247,409	6.5
	No	3,546,111	93.5
COPD			
	Yes	212,523	5.6
	No	3,580,997	94.4
CVD			
	Yes	249,243	6.6
	No	3,544,277	93.4

(Continued)

Table 1: Description of Population Characteristics Medicaid Fee for Service 2005-2007, 2006-2008

	N	%
TOTAL	**3,793,520**	**100.0**
Diabetes		
Yes	305,569	8.1
No	3,487,951	91.9
Lipid Disorder		
Yes	503,837	13.3
No	3,289,683	86.7
Hypertension		
Yes	656,628	17.3
No	3,136,892	82.7
Joint		
Yes	628,053	16.6
No	3,165,467	83.4
Thyroid		
Yes	189,629	5.0
No	3,603,891	95.0
Cancer		
Yes	112,958	3.0
No	3,680,562	97.0
Depression		
Yes	351,952	9.3
No	3,441,568	90.7
Severe Mental Illness		
Yes	532,213	14.0
No	3,261,307	86.0
Substance Abuse		
Yes	175,797	4.6
No	3,617,723	95.4
County Education at least High School		
Q1	2,104,451	55.5
Q2	442,362	11.7
Q3	479,280	12.6
Q4	489,336	12.9
Q5	277,828	7.3
County Median Household Income		
Q1	143,335	3.8
Q2	331,127	8.7
Q3	1,065,911	28.1
Q4	561,719	14.8
Q5	1,691,165	44.6
County Metropolitan Status		
Not Statistical	37,315	1.0
Metro	3,662,578	96.6
Micro	93,364	2.5

(Continued)

Table 1: Description of Population Characteristics Medicaid Fee for Service 2005-2007, 2006-2008

	N	%
TOTAL	**3,793,520**	**100.0**
Primary Care Shortage Area		
No shortage	95,112	2.5
Whole county	3,237,169	85.3
Part county	460,976	12.2
Mental Health Care Shortage Area		
No shortage	140,622	3.7
Whole county	2,782,530	73.4
Part county	870,105	22.9
Length of Stay		
Q1 (≤ 2 days)	227,265	23.1
Q2 (3 days)	253,498	25.7
Q3 (4 days)	176,277	17.9
Q4 (≥ 5 days)	328,560	33.3
Season of Hospitalization		
Spring	265,466	26.9
Summer	239,167	24.3
Fall	211,148	21.4
Winter	269,819	27.4
Diabetes + Depression		
Diabetes + Depression	43,753	14.3
Diabetes Only	261,816	85.7

Note: Based on 3,793,520 adult Medicaid fee for service beneficiaries with diabetes aged between 18 and 64 years and who were enrolled for all months between 2005- 2007 and 2006-2008, used inpatient services, alive, and not enrolled in Medicare in 2008. Care coordination was measured as primary care visit within 14 days post hospital discharge. Primary care use index was calculated only for those with primary care visits. County-level variables were from Area Resource File for 2008.
AI = American Indian; PI = Pacific Islander; ACSH = Ambulatory Care Sensitive Hospitalizations; PCP = Primary Care Provider

Table 2: Characteristics by ACSH and Readmission Medicaid Fee For Service Beneficiaries with Diabetes 2005-2007, 2006-2008

	ACSH +Readmission			ACSH Only		Readmission Only		None			
	N	ROW%	Column %	N	%	N	%	N	%	chisqval	sig
TOTAL	26,193	1.0		82,112	2.0	90,937	2.00	3,594,278	95.0		
State										9296.1	***
California	16,818	0.8	64.2	47,290	2.1	52,734	2.4	2,098,579	94.7		
Illinois	120	0.3	0.5	661	1.7	1,025	2.6	37,290	95.4		
New York	6,560	0.5	25.0	26,124	1.9	31,324	2.3	1,300,386	95.3		
Texas	2,695	1.5	10.3	8,037	4.6	5,854	3.4	158,023	90.5		
Gender										511.6	***
Female	15,765	0.6	60.2	54,054	2.1	60,913	2.4	2,394,701	94.8		
Male	10,428	0.8	39.8	28,058	2.2	30,024	2.4	1,199,577	94.6		
Race/Ethnicity										14942.5	***
Caucasian	8,984	0.8	34.3	25,985	2.3	30,395	2.7	1,048,800	94.1		
African American	8,168	1.0	31.2	23,060	3.0	24,637	3.2	724,981	92.8		
Hispanic	5,999	0.5	22.9	22,873	1.9	24,945	2.0	1,168,430	95.6		
Asian/AI/PI	1,482	0.3	5.7	5,539	1.1	6,302	1.3	471,643	97.3		
Other	1,560	0.8	6.0	4,655	2.4	4,658	2.4	180,424	94.3		
Age										54673.5	***
18-24 years	1,238	0.2	4.7	5,036	0.7	16,738	2.3	701,393	96.8		
25-34 years	2,327	0.3	8.9	8,463	1.0	19,556	2.4	784,104	96.3		
35-44 years	4,544	0.5	17.3	15,220	1.7	18,965	2.1	851,145	95.6		
45-54 years	8,261	1.0	31.5	25,517	3.2	20,027	2.5	745,128	93.3		
55-64 years	9,823	1.7	37.5	27,876	4.9	15,651	2.8	512,508	90.6		
Poverty Based Eligibility										5229.5	***
Yes	22,406	0.8	85.5	66,305	2.4	72,413	2.6	2,654,455	94.3		
No	3,787	0.4	14.5	15,807	1.6	18,524	1.9	939,823	96.1		

(Continued)

Table 2: Characteristics by ACSH and Readmission Medicaid Fee For Service Beneficiaries with Diabetes 2005-2007, 2006-2008

	ACSH +Readmission			ACSH Only		Readmission Only		None			
	N	ROW%	Column %	N	%	N	%	N	%	chisqval	sig
TOTAL	26,193	1.0		82,112	2.0	90,937	2.00	3,594,278	95.0		
Medical Eligibility										5501.8	***
Yes	4,962	0.4	18.9	19,135	1.6	24,762	2.1	1,146,513	95.9		
No	21,231	0.8	81.1	62,977	2.4	66,175	2.5	2,447,765	94.2		
Care Coordination										164286.3	***
Yes	7,889	3.3	30.1	23,960	10.1	22,963	9.7	181,728	76.8		
No	18,304	0.5	69.9	58,152	1.6	67,974	1.9	3,412,550	95.9		
Primary Care Use										165355.4	***
Q1	17,046	0.5	65.1	51,102	1.5	55,246	1.6	3,260,033	96.4		
Q2	953	3.1	3.6	2,794	9.1	3,027	9.9	23,858	77.9		
Q3	2,253	2.5	8.6	7,678	8.5	8,045	8.9	72,341	80.1		
Q4	1,759	2.5	6.7	5,642	8.1	6,561	9.4	55,959	80.0		
No Primary Care Visits	4,182	1.9	16.0	14,896	6.8	18,058	8.2	182,087	83.1		
Asthma										76851.8	***
Yes	7,262	2.9	27.7	20,907	8.5	11,667	4.7	207,573	83.9		
No	18,931	0.5	72.3	61,205	1.7	79,270	2.2	3,386,705	95.5		
COPD										112483.4	***
Yes	9,293	4.4	35.5	19,576	9.2	12,623	5.9	171,031	80.5		
No	16,900	0.5	64.5	62,536	1.7	78,314	2.2	3,423,247	95.6		
CVD										179878.6	***
Yes	12,805	5.1	48.9	23,853	9.6	18,449	7.4	194,136	77.9		
No	13,388	0.4	51.1	58,259	1.6	72,488	2.0	3,400,142	95.9		
Diabetes										127035.8	***
Yes	11,284	3.7	43.1	27,721	9.1	13,375	4.4	253,189	82.9		
No	14,909	0.4	56.9	54,391	1.6	77,562	2.2	3,341,089	95.8		

Table 2: Characteristics by ACSH and Readmission Medicaid Fee For Service Beneficiaries with Diabetes 2005-2007, 2006-2008

	ACSH +Readmission			ACSH Only		Readmission Only		None			
	N	ROW%	Column %	N	%	N	%	N	%	chisqval	sig
TOTAL	26,193	1.0		82,112	2.0	90,937	2.00	3,594,278	95.0		
Lipid Disorder										10478.8	***
Yes	6,666	1.3	25.4	18,408	3.7	14,831	2.9	463,932	92.1		
No	19,527	0.6	74.6	63,704	1.9	76,106	2.3	3,130,346	95.2		
Hypertension										91810.3	***
Yes	15,595	2.4	59.5	36,628	5.6	28,388	4.3	576,017	87.7		
No	10,598	0.3	40.5	45,484	1.4	62,549	2.0	3,018,261	96.2		
Joint										28476.3	***
Yes	10,283	1.6	39.3	24,359	3.9	24,507	3.9	568,904	90.6		
No	15,910	0.5	60.7	57,753	1.8	66,430	2.1	3,025,374	95.6		
Thyroid										4762.0	***
Yes	2,667	1.4	10.2	6,621	3.5	7,022	3.7	173,319	91.4		
No	23,526	0.7	89.8	75,491	2.1	83,915	2.3	3,420,959	94.9		
Cancer										13680.3	***
Yes	2,100	1.9	8.0	4,147	3.7	7,713	6.8	98,998	87.6		
No	24,093	0.7	92.0	77,965	2.1	83,224	2.3	3,495,280	95.0		
Depression										24413.2	***
Yes	5,344	1.5	20.4	10,944	3.1	20,141	5.7	315,523	89.6		
No	20,849	0.6	79.6	71,168	2.1	70,796	2.1	3,278,755	95.3		
Severe Mental Illness										38546.4	***
Yes	7,773	1.5	29.7	16,476	3.1	30,617	5.8	477,347	89.7		
No	18,420	0.6	70.3	65,636	2.0	60,320	1.8	3,116,931	95.6		
Substance Abuse										74570.2	***
Yes	5,412	3.1	20.7	7,633	4.3	18,687	10.6	144,065	81.9		
No	20,781	0.6	79.3	74,479	2.1	72,250	2.0	3,450,213	95.4		

Table 2: Characteristics by ACSH and Readmission Medicaid Fee For Service Beneficiaries with Diabetes 2005-2007, 2006-2008

	ACSH +Readmission			ACSH Only		Readmission Only		None			
	N	ROW%	Column %	N	%	N	%	N	%	chisqval	sig
TOTAL	26,193	1.0		82,112	2.0	90,937	2.00	3,594,278	95.0		
County Education at least High School										2731.9	***
Q1	12,939	0.6	49.4	41,166	2.0	45,523	2.2	2,004,823	95.3		
Q2	3,398	0.8	13.0	10,919	2.5	11,428	2.6	416,617	94.2		
Q3	3,943	0.8	15.1	11,063	2.3	13,679	2.9	450,595	94.0		
Q4	3,919	0.8	15.0	12,328	2.5	13,151	2.7	459,938	94.0		
Q5	1,991	0.7	7.6	6,618	2.4	7,148	2.6	262,071	94.3		
County Median Household Income										1635.9	***
Q1	950	0.7	3.6	3,498	2.4	3,233	2.3	135,654	94.6		
Q2	2,260	0.7	8.6	7,446	2.2	7,315	2.2	314,106	94.9		
Q3	8,977	0.8	34.3	22,728	2.1	26,838	2.5	1,007,368	94.5		
Q4	4,384	0.8	16.7	13,937	2.5	14,829	2.6	528,569	94.1		
Q5	9,619	0.6	36.7	34,485	2.0	38,714	2.3	1,608,347	95.1		
County Metropolitan Status										464.9	***
Not Statistical	370	1.0	1.4	1,285	3.4	889	2.4	34,771	93.2		
Metro	25,168	0.7	96.1	78,342	2.1	87,658	2.4	3,471,410	94.8		
Micro	652	0.7	2.5	2,467	2.6	2,382	2.6	87,863	94.1		
Primary Care Shortage Area										170.1	***
No shortage	685	0.7	2.6	2,390	2.5	2,554	2.7	89,483	94.1		
Whole county	22,082	0.7	84.3	69,333	2.1	76,831	2.4	3,068,923	94.8		
Part county	3,423	0.7	13.1	10,371	2.2	11,544	2.5	435,638	94.5		
Mental Health Care Shortage Area										866.6	***
No shortage	1,180	0.8	4.5	3,671	2.6	4,480	3.2	131,291	93.4		
Whole county	18,751	0.7	71.6	59,429	2.1	63,904	2.3	2,640,446	94.9		
Part county	6,259	0.7	23.9	18,994	2.2	22,545	2.6	822,307	94.5		

Table 2: Characteristics by ACSH and Readmission Medicaid Fee For Service Beneficiaries with Diabetes 2005-2007, 2006-2008

	ACSH +Readmission			ACSH Only		Readmission Only		None			
	N	ROW%	Column %	N	%	N	%	N	%	chisqval	sig
TOTAL	26,193	1.0		82,112	2.0	90,937	2.00	3,594,278	95.0		
Length of Stay										19682.4	***
Q1	4,914	2.2	18.8	17,496	7.7	21,519	9.5	183,336	80.7		
Q2	3,984	1.6	15.2	16,921	6.7	14,849	5.9	217,744	85.9		
Q3	3,568	2.0	13.6	14,152	8.0	11,928	6.8	146,629	83.2		
Q4	13,727	4.2	52.4	33,543	10.2	42,641	13.0	238,649	72.6		
Season of Hospitalization										5042.4	***
Spring	6,977	2.6	26.6	22,930	8.6	24,818	9.3	210,741	79.4		
Summer	4,574	1.9	17.5	17,194	7.2	21,047	8.8	196,352	82.1		
Fall	4,133	2.0	15.8	16,303	7.7	16,851	8.0	173,861	82.3		
Winter	10,509	3.9	40.1	25,685	9.5	28,221	10.5	205,404	76.1		
Diabetes + Depression										2054.9	***
Diabetes + Depression	2,359	5.4	20.9	3,924	9.0	3,479	8.0	33,991	77.7		
Diabetes Only	8,925	3.4	79.1	23,797	9.1	9,896	3.8	219,198	83.7		

Note: Based on 3,793,520 adult Medicaid fee for service beneficiaries with diabetes aged between 18 and 64 years and who were enrolled for all months between 2005- 2007 and 2006-2008, used inpatient services, alive, and not enrolled in Medicare in 2008
ACSH = Ambulatory Care Sensitive Hospitalizations,
PCP = Primary Care Provider
Care coordination = primary care visit within 14 days post hospital discharge.
Primary care use index was calculated only for those with primary care visits. County-level variables were from Area Resource File for 2008. AI = American Indian; PI = Pacific Islander
Beneficiaries in the "None" category have experienced non ACSH admission without a hospitalization within 30 days post discharge.
*** $p < 0.001$; ** $0.001 < p < 0.01$; * $0.01 < p < 0.05$

Table 3: Multinomial Logistic Regression on ACSH +Readmission Medicaid FFS Beneficiaries 2005-2007, 2006-2008 (10% Random Sample)

	ACSH + Readmission			ACSH ONLY			Readmission ONLY		
	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig
Diabetes + Depression									
Diabetes + Depression	1.02	[0.88, 1.19]		1.31	[1.17, 1.46]	***	0.69	[0.57, 0.83]	***
Diabetes Only	Reference								
State									
Illinois	1.82	[0.77, 4.33]		0.77	[0.44, 1.34]		0.38	[0.07, 1.99]	
New York	0.87	[0.61, 1.23]		1.33	[1.06, 1.68]	*	1.59	[1.11, 2.28]	*
Texas	0.92	[0.67, 1.25]		1.32	[1.07, 1.63]	**	1.05	[0.78, 1.41]	
California	Reference								
Gender									
Female	0.80	[0.70, 0.91]	***	0.88	[0.81, 0.95]	**	0.75	[0.65, 0.88]	***
Male	Reference								
Race/Ethnicity									
African American	1.20	[0.99, 1.44]		1.21	[1.03, 1.43]	*	1.04	[0.81, 1.33]	
Hispanic	0.87	[0.75, 1.02]		1.03	[0.90, 1.19]		0.87	[0.69, 1.11]	
Asian/AI/PI	0.90	[0.67, 1.22]		0.77	[0.61, 0.96]	*	0.94	[0.79, 1.11]	
Other	1.05	[0.73, 1.50]		0.94	[0.74, 1.20]		0.79	[0.60, 1.05]	
Caucasian	Reference								
Age									
18-24 years	2.53	[1.58, 4.06]	***	1.38	[0.95, 2.02]		2.05	[1.36, 3.09]	***
25-34 years	1.82	[1.38, 2.41]	***	0.93	[0.77, 1.12]		2.18	[1.68, 2.83]	***
35-44 years	1.18	[0.98, 1.42]		0.80	[0.70, 0.92]	***	1.41	[1.22, 1.63]	***
45-54 years	1.03	[0.91, 1.16]		0.94	[0.81, 1.09]		1.36	[1.16, 1.61]	***
55-64 years	Reference								

(Continued)

Table 3: Multinomial Logistic Regression on ACSH +Readmission Medicaid FFS Beneficiaries 2005-2007, 2006-2008 (10% Random Sample)

	ACSH + Readmission			ACSH ONLY			Readmission ONLY		
	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig
Length of Stay									
Q1 (≤ 2 days)	0.56	[0.47, 0.66]	***	0.81	[0.68, 0.96]	*	0.60	[0.51, 0.71]	***
Q2 (3 days)	0.67	[0.58, 0.77]	***	0.99	[0.89, 1.10]		0.65	[0.56, 0.76]	***
Q3 (4 days)	0.90	[0.79, 1.02]		1.06	[0.94, 1.20]		0.60	[0.51, 0.71]	***
Q4 (≥ 5 days)	Reference								
Season of Hospitalization									
Spring	1.24	[0.99, 1.54]		1.10	[0.95, 1.28]		1.12	[0.96, 1.31]	
Fall	1.07	[0.86, 1.34]		0.97	[0.81, 1.17]		0.93	[0.79, 1.10]	
Winter	1.77	[1.39, 2.26]	***	1.17	[1.00, 1.37]		1.21	[1.03, 1.43]	*
Summer	Reference								
Poverty Based Eligibility									
Yes	1.55	[1.14, 2.10]	**	1.04	[0.86, 1.25]		1.46	[1.18, 1.81]	***
No	Reference								
Medical Eligibility									
Yes	1.33	[1.07, 1.65]	*	0.92	[0.76, 1.11]		1.33	[1.11, 1.59]	**
No	Reference								
Care Coordination									
Yes	0.96	[0.82, 1.13]		1.09	[0.97, 1.22]		0.86	[0.76, 0.96]	**
No	Reference								
Primary Care Use									
0.0	1.20	[1.004, 1.43]	*	1.36	[1.11, 1.66]	**	1.15	[1.01, 1.32]	*
0.1-0.25	1.01	[0.70, 1.45]		1.05	[0.77, 1.41]		0.85	[0.65, 1.10]	
0.26-0.50	0.69	[0.51, 0.93]	*	0.97	[0.81, 1.17]		1.19	[1.01, 1.40]	*
0.51-0.75	0.68	[0.53, 0.87]	**	0.78	[0.63, 0.96]	*	1.02	[0.81, 1.27]	
> 0.75	Reference								

(Continued)

Table 3: Multinomial Logistic Regression on ACSH +Readmission Medicaid FFS Beneficiaries 2005-2007, 2006-2008 (10% Random Sample)

	ACSH + Readmission			ACSH ONLY			Readmission ONLY		
	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig
Asthma									
Yes	1.79	[1.51, 2.13]	***	1.78	[1.44, 2.20]	***	1.43	[1.17, 1.74]	***
No	Reference								
COPD									
Yes	1.95	[1.67, 2.27]	***	1.40	[1.27, 1.55]	***	1.21	[1.03, 1.42]	*
No	Reference								
CVD									
Yes	2.44	[2.07, 2.89]	***	1.13	[0.96, 1.34]		1.42	[1.25, 1.62]	***
No	Reference								
Lipid Disorder									
Yes	0.79	[0.63, 0.99]	*	0.84	[0.68, 1.05]		0.89	[0.77, 1.02]	
No	Reference								
Hypertension									
Yes	1.24	[1.01, 1.53]	*	0.95	[0.86, 1.05]		1.09	[0.97, 1.23]	
No	Reference								
Joint									
Yes	1.19	[1.08, 1.32]	***	0.96	[0.85, 1.08]		1.04	[0.93, 1.17]	
No	Reference								
Thyroid									
Yes	1.10	[0.94, 1.28]		0.90	[0.79, 1.02]		1.14	[0.93, 1.39]	
No	Reference								
Cancer									
Yes	1.00	[0.81, 1.23]		0.69	[0.58, 0.81]	***	1.71	[1.38, 2.12]	***
No	Reference								

(Continued)

Table 3: Multinomial Logistic Regression on ACSH +Readmission Medicaid FFS Beneficiaries 2005-2007, 2006-2008 (10% Random Sample)

	ACSH + Readmission			ACSH ONLY			Readmission ONLY		
	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig
Substance Abuse									
Yes	1.79	[1.51, 2.12]	***	0.85	[0.72, 1.01]		2.35	[2.00, 2.76]	***
No	Reference								
County Education at least High School									
Q1	1.82	[1.27, 2.62]	***	1.15	[0.87, 1.53]		2.66	[1.78, 3.98]	***
Q2	1.53	[1.04, 2.25]	*	1.11	[0.84, 1.48]		2.70	[1.85, 3.93]	***
Q3	0.86	[0.62, 1.20]		0.92	[0.75, 1.11]		1.33	[0.94, 1.88]	
Q4	1.40	[1.05, 1.86]	*	1.12	[0.92, 1.36]		1.76	[1.31, 2.37]	***
Q5	Reference								
County Median Household Income									
Q1	0.63	[0.39, 1.02]		0.78	[0.56, 1.10]		0.78	[0.48, 1.27]	
Q2	0.72	[0.46, 1.12]		0.93	[0.66, 1.31]		0.57	[0.34, 0.96]	*
Q3	0.98	[0.73, 1.32]		0.88	[0.68, 1.13]		0.71	[0.50, 0.99]	*
Q4	0.86	[0.69, 1.08]		1.00	[0.85, 1.17]		0.73	[0.58, 0.91]	**
Q5	Reference								
County Metropolitan Status									
Metro	0.48	[0.28, 0.81]	**	0.69	[0.43, 1.11]		1.23	[0.58, 2.64]	
Micro	0.57	[0.30, 1.10]		0.92	[0.57, 1.48]		1.33	[0.58, 3.06]	
Not Statistical	Reference								
Primary Care Shortage Area									
Whole county	0.59	[0.36, 0.98]	*	1.60	[1.07, 2.40]	*	1.51	[0.77, 2.97]	
Part county	0.66	[0.40, 1.09]		1.60	[1.07, 2.39]	*	1.85	[0.97, 3.53]	
No shortage	Reference								

(Continued)

Table 3: Multinomial Logistic Regression on ACSH +Readmission Medicaid FFS Beneficiaries 2005-2007, 2006-2008 (10% Random Sample)

	ACSH + Readmission			ACSH ONLY			Readmission ONLY		
	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig	Odds Ratio	95% CI	Sig
Mental Health Care Shortage Area									
Whole county	0.72	[0.50, 1.02]		0.78	[0.59, 1.04]		1.01	[0.67, 1.52]	
Part county	0.82	[0.58, 1.16]		0.76	[0.57, 1.01]		0.88	[0.57, 1.36]	
No shortage	Reference								
Rural Health Clinic									
Yes	1.01	[0.78, 1.31]		0.99	[0.80, 1.22]		0.99	[0.74, 1.33]	
No	Reference								
FQHC									
Yes	0.95	[0.63, 1.42]		1.07	[0.79, 1.43]		0.85	[0.54, 1.32]	
No	Reference								
Community Mental Health Clinic									
Yes	1.44	[1.19, 1.74]	***	0.93	[0.81, 1.08]		1.37	[1.15, 1.64]	***
No	Reference								
Total Hospitals									
Q1	0.85	[0.61, 1.18]		1.13	[0.91, 1.41]		0.98	[0.71, 1.34]	
Q2	0.77	[0.56, 1.04]		1.25	[0.98, 1.60]		0.83	[0.58, 1.20]	
Q3	0.96	[0.70, 1.32]		0.96	[0.76, 1.21]		0.68	[0.49, 0.94]	*
Q4	Reference								
Office Based General Practitioners									
Q1	0.58	[0.10, 3.45]		1.61	[0.65, 3.95]		1.70	[0.42, 6.87]	
Q2	1.55	[0.83, 2.87]		1.70	[1.11, 2.62]	*	1.34	[0.67, 2.67]	
Q3	1.70	[0.94, 3.07]		1.38	[0.89, 2.16]		1.99	[0.97, 4.06]	
Q4	Reference								

(Continued)

Table 3: Multinomial Logistic Regression on ACSH +Readmission Medicaid FFS Beneficiaries 2005-2007, 2006-2008 (10% Random Sample)

	ACSH + Readmission			ACSH ONLY			Readmission ONLY		
	Odds Ratio	**95% CI**	**Sig**	**Odds Ratio**	**95% CI**	**Sig**	**Odds Ratio**	**95% CI**	**Sig**
Office Based Preventative Medicine									
Q1	0.52	[0.37, 0.73]	***	0.67	[0.54, 0.82]	***	0.87	[0.61, 1.24]	
Q2	0.73	[0.61, 0.88]	***	0.80	[0.70, 0.92]	***	1.03	[0.84, 1.27]	
Q3	0.56	[0.41, 0.76]	***	0.92	[0.74, 1.14]		0.86	[0.64, 1.17]	
Q4	Reference								

Note: Based on 10% random sample of adult Medicaid fee for service beneficiaries with diabetes aged between 18 and 64 years and who were enrolled for all months between 2005- 2007 and 2006-2008, used inpatient services, alive, and not enrolled in Medicare in 2008
ACSH = Ambulatory Care Sensitive Hospitalizations,
PCP = Primary Care Provider
Care coordination = primary care visit within 14 days post hospital discharge.
Primary care use index was calculated only for those with primary care visits. County-level variables were from Area Resource File for 2008. AI = American Indian; PI = Pacific Islander
Multinomial reference group is "None": Beneficiaries in the "None" category experienced non-ACSH admission without a hospitalization within 30 days post discharge.
*** $p < 0.001$; ** $0.001 < p < 0.01$; * $0.01 < p < 0.05$

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CHAPTER 4

Title: Expenditure Benchmark Attainment in Absence of Poor Quality Outcomes: Role of Primary Care and County-Level Healthcare Resources in a Medicaid Population

INTRODUCTION

Expenditures, ACSH and Readmissions:

Estimates of the proportion of total healthcare expenditures due to hospitalizations vary from 30-38% (CMS, 2010; KFF, 2004). Between 1997 and 2008, the number of hospitalizations covered by Medicaid increased by 30%, at an estimated total expenditures of $51.1 billion. Due to its large share of total healthcare expenditures, hospitalizations, specifically preventable hospitalizations continue to be a target of cost containment strategies (Stranges, 2008). In 2006, expenditures for adult ambulatory care sensitive hospitalizations (ACSH) were estimated at $30 billion (Moy, 2011). Despite the decrease in rates of ACSH, these hospitalizations still accounted for 10% of all hospitalizations in 2008, and 5.8% of all Medicaid inpatient stays (Stranges, 2010). In 2008, the all cause 30-day readmission rate among Medicaid beneficiaries, was 21% for persons aged between 18-64 years and 24% for persons aged between 45-64 years (Wier, 2011). With increasing healthcare expenditures and demands for improved quality of care, ACSH and readmissions have become an accountability measure by which to lower healthcare expenditures and improve quality.

Some individuals may experience poor quality outcomes in terms of ACSH and all cause 30-day readmissions. Indeed, one study estimates that among Medicaid beneficiaries, 19% of individuals who experienced an ACSH also had a preventable readmission within 6 months (Friedman, 2004). These findings emphasize the need for preventing both ACSH and all cause

30-day readmissions for some individuals. In order to achieve both quality and cost containment, the Centers for Medicare and Medicaid, have established the Accountable Care Organization (ACO) Medicare Shared Savings Program.

Accountable Care Organizations, Expenditures and Quality:

Accountable Care Organizations (ACOs) and the Medicare Shared Savings Program are two ways that CMS is addressing quality improvement and skyrocketing healthcare costs. Although the ACO models are currently implemented for Medicare beneficiaries, Medicaid policy makers in many states are also embracing the concept. For example, currently ACO models are being used as demonstration projects in Colorado, New Jersey, Oklahoma, Oregon, and Utah. Medicaid ACO Demonstration Projects will be utilized to establish the usefulness of the ACO delivery model in for state Medicaid programs. In general, ACOs have the goal of providing coordinated care for beneficiaries with the aim of improving quality of care with costs at or below the ACO expenditure benchmark.

As Medicaid ACOs are still in their infancy, we describe the concept using examples from Medicare ACOs. As considered by CMS, Medicare ACOs will be accountable for both financial losses and lapses in quality. In a broad sense the purpose of an ACO is to improve efficiency in provision of healthcare services with improved quality outcomes. The Medicare Shared Savings Program is rolled out among Medicare beneficiaries beginning January 1, 2012,

As per the current guidelines, ACO expenditure benchmark will be set based on the previous three- year average of cost per fee-for-service (FFS) beneficiaries that would have been cared for by an ACO. This average expenditures will be risk adjusted using the CMS Hierarchical Condition Category (CMS-HSS) prospective risk score, with separate estimates for end stage renal disease, disabled, aged dually eligible and aged non-dually eligible persons. The

quality benchmark is at least 70% compliance in each of 4 domains namely, Patient/caregiver experience, Care coordination/Patient safety, Preventative health, and at risk populations. The amount eligible for cost sharing will be the difference between actual costs per beneficiary and the risk adjusted 3-year average. The percentage to be shared will be determined by the degree of quality compliance.

The second domain of ACO quality care, Care Coordination/Patient Safety, includes measures for ACS COPD hospitalizations, ACS heart failure hospitalizations and all cause readmissions. Given the burden of both ACSH and readmissions among Medicaid beneficiaries, these hospitalizations serve as a justifiable starting point for quality outcome standards.

Regional Variations in Quality and Healthcare Expenditures

Regional variations in both healthcare expenditures and quality in the United States had been demonstrated. According to the 2003-2007 Dartmouth Atlas of Health Care, per-person Medicare expenditures varied by greater than threefold across geographical regions; the highest estimated at $17,000 and lowest estimated to be $5,200 (Dartmouth, 2008). These variations in healthcare expenditures by regions are not associated with healthcare quality measured in terms of processes of care, outcomes or satisfaction, and thus suggest system-level inefficiencies in provision of care (Fisher, 2003a ; Fisher, 2003b). There is considerable debate as to what role community and market characteristics play in regional differences in quality and costs. Despite dissension, evidence exists, that community-level characteristics impact variation in both quality and efficiency.

A national analysis of state level quality of care found a significant relationship between per capita physicians and quality. Quality was determined using the Commonwealth Fund

quality score card that includes mainly process of care measures and preventative care/screenings. Results showed that per capita physicians and specialist were significantly associated with better quality rankings (Cooper, 2009). In a prior analysis, Baiker and Chandra reported per capita physicians to be significantly associated with both higher quality and lower costs. In contrast to Copper, they report higher numbers of per capital specialists to be associated with lower quality and higher costs (Baiker and Chandra, 2004). Although the direction of the relationship is debated, we may still conclude that a relationship does exist, albeit more research is warranted. Therefore, the current study will also examine the role of county-level health resources as a facilitator/barrier to attaining expenditure benchmark.

As previously described in Manuscripts 1 and 2, poor quality outcomes have been defined by combinations of ACSH and/or readmissions. In the current study, we defined good quality as absence of ACSH or all cause 30-day readmissions. Within the context of Medicare ACO expenditure benchmarking, and Medicaid ACO demonstration projects, we explore cost containment as presence of outcome avoidance at or below a three-year expenditure benchmark. Because high quality attainment is the goal, the expenditure benchmark will only be applied to cases with quality scenario 1 (No ACSH AND No Readmission). Please see description of Quality Scenarios in Chapter 3.

METHODS

Conceptual Framework:

Current models of quality assessment begin with Donabedian's structure, process and outcome model, in which structure denotes the attributes of settings in which care is provided, process denotes what is done in giving and receiving care, and outcomes denote the effects of care on patients and populations (Donabedian, 1988). Here, the framework is adapted to

describe the influence of community healthcare resources, provider and individual characteristics on quality outcomes. To explore geographic variation in expenditure benchmarks, this framework also incorporates the Donabedian definition of distributional efficiency. Since healthcare resources should be distributed in such a way as to provide health benefits for those in need (i.e. Medicaid beneficiaries), quality outcomes may be compared across counties using risk adjustment to evaluate the impact of community-level resources. With this basis, we seek to explain county-level variation in quality outcomes and expenditures by primary care use and available healthcare resources.

Data:

Medicaid administrative claims files from four states, California, Illinois, New York and Texas, for 2008 were used. These states were chosen for their low managed care penetration rates relative to other states, as well as their diverse patient populations. This allowed more fee-for-service claims for analysis. For example, the state of Alaska is entirely FFS, However with enrollment at approximately 115,000 beneficiaries, a sufficient sample would likely not be available for evaluation after applying study exclusions. As another example, the state of West Virginia has a penetration rate of 47%, however state Medicaid enrolment is also comparatively low at approximately 340,000. Moreover, to aid evaluation of demographic variables, states with beneficiaries of diverse racial/ethnic background were chosen. Medicaid managed care penetration ranged from 55%- 69% for the select states, California, New York and Texas. However, with enrollment in the millions, a sufficient number of beneficiary claims were available for analyses after exclusions were applied.

Medicaid files included the personal Summary file with information on beneficiary demographics (gender, age, race/ethnicity, county of residence), Medicaid enrollment and

eligibility status. The Outpatient and Inpatient files included claims for services provided in ambulatory and inpatient settings and contained International Classification of Diseases 9th edition Clinical Modification (ICD-9-CM) codes.

The 2008 Area Resource File (ARF) provided county- level information on socio-economic status, healthcare resources, facilities, providers and utilization. Files from each state were obtained for the following years (2005-2008). Note, the state of Illinois was excluded due to lack of sufficient sample size of continuously enrolled beneficiaries across all four years.

Study Population:

The study population consisted of FFS Medicaid beneficiaries, aged 18-64 years, with full-year continuous enrollment and not dually enrolled in Medicare. Additionally the population was restricted to those beneficiaries NOT experiencing poor quality outcomes (ACSH or all cause 30-day readmissions). See description of both events below. Due to the large initial population, analyses were further restricted to a random 10% sample of beneficiaries. ACSH was defined as presence or absence of any of the following 13 ambulatory care sensitive conditions identified by ICD-9 codes: 1) diabetes short-term complications; 2) diabetes long-term complications; 3) perforated appendicitis; 4) chronic obstructive pulmonary disease (COPD); 5) hypertension; 6) congestive heart failure; 7) dehydration; 8) bacterial pneumonia; 9) urinary infections; 10) angina without a procedure; 11) uncontrolled diabetes; 12) adult asthma; and 13) lower extremity amputations. Medicaid beneficiaries with a hospitalization for any of the above-mentioned conditions in the observed calendar year were considered to have an ACSH. ACSH was identified using the Prevention Quality Indicators (PQI) software developed by AHRQ (publicly available at http://www.qualityindicators.ahrq.gov/Software/Default.aspx).

Readmissions were identified as all cause 30-day readmission following an index hospitalization observed within the study period. Patient transfers were not considered new admissions.

Dependent Variable:

Expenditure Benchmark: The expenditure benchmark was established by risk adjustment based on age and gender using annual per-capita expenditures averaged over the previous three years (2005-2007). Individuals were considered to attain expenditure benchmark if 2008 annual per-capita expenditures were less than or equal to the risk-adjusted average per-capita expenditures averaged over the previous three years. For the purposes of the current study, this variable is dichotomized to indicate 1) expenditures less than or equal to the benchmark and 2) expenditures greater than the expenditure benchmark. As stated previously, this was defined only for individuals who did not have ACSH or all cause 30-day readmissions.

Key Independent Variables:

Primary care use: This variable was derived from ambulatory care visits to primary care providers. Primary care visits were identified from physician specialty codes and current procedural terminology (CPT-4) codes for services rendered. We defined primary care use as an index and calculated it as the proportion of ambulatory visits to primary care practitioners divided by all ambulatory visits. This index ranged from 0 indicating no primary care visits and 1.0 indicating all visits were to primary care providers. The distribution of primary care use was divided into quartiles, specific to each state. Higher quartiles indicate greater use of primary care visits in relation to all ambulatory setting visits. Individuals who did not have any ambulatory care visit were considered in a separate category. It is likely that an individual who had only one visit to primary care may be classified as having higher levels of primary care if they had only

one visit in the entire year. For this reason primary care use was measured only for individuals with greater than two ambulatory care visits.

Other Patient-Level Variables:

Patient-level variables, obtained from the Medicaid personal summary claim files, include demographic variables: age (18-24, 25-34, 35-44, 45-54, 55-64 years), gender (female, male), race/ethnicity (African American, Caucasian, Hispanic, Asian, American Indian, Pacific Islander), Medicaid eligibility (poverty, medical need), health status measured by presence of chronic physical and mental health conditions and substance abuse. Chronic physical conditions consisted of: asthma, chronic obstructive pulmonary disease (COPD), cardio vascular disease (CVD), diabetes, hypertension, joint disorders (arthritis, osteoarthritis, rheumatoid arthritis), thyroid disease, and cancer; Mental health conditions included depression and severe mental illness (schizophrenia, bipolar disorder, psychosis) and substance use disorders. All conditions were identified using ICD-9-CM codes from inpatient and outpatient files.

Other County-Level Variables:

These were obtained from Area Resource file and included educational attainment (at least high school diploma), median household income, metropolitan statistical area, primary care shortage, mental health shortage area, presence of federally qualified health center (FQHC), community mental health clinic, rural health clinic, total number of hospitals, office based general physicians, OBGYN physicians, preventative medicine physicians. For variables on a continuous numeric scale, quartiles were constructed by calculating per capita density and then distributing into quartile rages, specific to each state.

Statistical Techniques

Chi square tests of independence were used to determine significance between individual, provider and community level characteristics and benchmark attainment. Random intercept logistic regression which accounted for patients nested within counties was conducted to determine the patient-, provider-, and community-level predictors of benchmark attainment. All analyses were conducted using Statistical Analysis Software version 9.3 (SAS Inc., Cary, North Carolina USA).

RESULTS

Demographics

The 10% random sample from 2008 represented 558, 872 beneficiaries from California, New York and Texas. Majority of the beneficiaries were female (65%) and a third were of Hispanic ethnicity (34%). The majority of beneficiaries were disease free and nearly 40% of the sample belonged to the highest quartiles of primary care use.

Subgroup Differences by Benchmark Attainment

The bivariate analysis on differences by benchmark attainment revealed significant differences for all independent variables tested (**Table 2**). Nearly a third of beneficiaries with the lowest quartile of primary care use had expenditures above the benchmark (32.6%). Nearly half of those with depression (45%) and greater than half of those with severe mental illness and substance abuse had expenditures greater that the benchmark.

Multilevel Model

Multilevel logistic regression models (patients nested in counties) were run on likelihood of expenditure benchmark attainment against all independent variables (**Table 3**).

Patient-level:

Across all states, we observe the likelihood of benchmark attainment to be significantly higher for African American and Hispanic beneficiaries as compared to Caucasians. The likelihood of benchmark attainment was significantly higher for Asian, American Indian, Pacific Islanders and other racial groups as well. Benchmark attainment was 21% less likely for beneficiaries ages 25- 34 years **[OR = 0.79, 95% CI 0.67-0.94]**. Compared to those with the highest levels of primary care use, those with the lowest were nearly 50% less likely to have expenditures below the benchmark **[Odds Ratio 0.53, 95%CI 0.46, 0.60**]. With the exception of depression, the presence of all diseases was significantly associated with lower likelihood of benchmark attainment. In fact, beneficiaries with severe mental illness were 84% less likely to achieve benchmark attainment **[Odds Ratio 0.16, 95% CI 0.13, 0.19]**. Of all diseases included in the model, benchmark attainment was more likely for those with depression **[2.01, 95%CI 1.88, 2.15]**.

County-level:

Presence of a rural health center **[OR= 1.12, 95%CI 1.004, 1.26]** and fewer hospitals [**OR= 1.16, 95%CI 1.02, 1.31]** were associated with an increase in benchmark attainment of border line significance. Whereas presence of fewer office based general practitioners, was associated with lower likelihood of benchmark attainment, fewer office based OBGYNs was associated with greater likelihood of benchmark attainment.

DISCUSSION

In 2008, approximately 5.5 million Medicaid beneficiaries from California, New York and Texas, experienced neither ACSH or 30-day Readmissions. From a 10% random sample (N= 558, 872), 80% of

per-capita annual expenditures were at or below the three year average expenditure benchmark. These findings are consistent with earlier studies in which only 25% of the population spent 70% of total Medicaid healthcare expenditures (Kronick, 2007). These findings also reinforce the need for crafting programs to effectively target these individuals to reduce Medicaid spending burden.

Prior to county-level adjustment, unadjusted logistic regressions showed racial ethnic minorities were less likely to achieve benchmark attainment (results not presented). That these racial and ethnic groups were associated with higher healthcare expenditures has been reported elsewhere (Zhang et al, 2012). Ethnic minorities have higher rates of chronic and comorbid illness as well as poor health outcomes- known drivers of higher healthcare costs. However, when adjusted for county-level variation, African American race and Hispanic ethnicity were significant predictors of expenditures below the expenditure benchmark. This suggests the important role that factors predicting access to care play in reducing racial ethnic disparities in care.

In 2008, the study sample of beneficiaries without ACSH or readmission, were mostly free of the conditions studied here. In the presence of disease, benchmark achievement was less likely, except with depression. Benchmark attainment was greater among beneficiaries with depression, however, less likely among those with severe mental illness or substance abuse. The trend for beneficiaries with depression may be partially explained by the greater presence of mental health services in counties that achieved benchmark attainment. Among counties with no mental health care shortage, 76% had benchmark attainment. The finding suggests that mental health care access may facilitate good quality care at lower expenditures.

However, beneficiaries with severe mental illness or substance abuse disorders were less likely to achieve expenditure benchmark. In 2008, these beneficiaries accounted for 15% of the study sample. It is plausible that ensuring high quality for Medicaid beneficiaries with mental illness and substance use may involve higher healthcare expenditures. These groups may require targeted efforts to effectively reduce

cost while providing high quality outcomes. Delivery models that integrate behavioral/mental health and primary care will be a necessity for Medicaid programs given the high cost associated with ensuring good quality for beneficiaries with mental illness. Although mental health/ primary care services can be integrated within communities by co-location of service providers, it remains to be seen as to whether such structures can reduce expenditures while providing good quality outcomes.

Our findings of greater benchmark attainment among beneficiaries residing in counties with rural health centers reaffirms the role of safety net providers in reducing costs at the population level (Richard et al., 2012). Fewer numbers of office based OBGYNs also significantly increased the likelihood of benchmark attainment. We know that the majority of Medicaid fee for service beneficiaries are women. We acknowledge the role of OBGYN practitioners as centers for primary women's health care since some women frequent OBGYNs as providers of primary woman's care (Henderson and Weisman, 2005; Lewis et al. 2011). However, it has been reported elsewhere that OBGYN providers are less likely than generalist to provide comprehensive care for cardiovascular disease prevention (Schmittdiel et al, 2011). Another survey of OBGYNs reported the perceived definition of comprehensive care to be comprised of screenings and referrals. (Ehrenthal et al., 2011). If the referral loop between OBGYN and primary care providers remains open, it would be expected that inefficiencies in provision of care or other clinical outcomes due to lack of follow up could drive costs, especially in a FFS structure. The literature has long supported the need for more preventative care to improve population health and lower healthcare costs(Maciejewski et al, 2007;Liu et al., 2008). Here we report lower likelihood of benchmark attainment in counties with lower levels of office based generalist providers, again highlighting the importance for primary care providers. Given the large proportion of women enrolled in state Medicaid programs, we are careful not to undermine the important role that OBGYNs and general practitioners can play in provision of primary care services. We acknowledge the difficulty coordinating care within a FFS payment scheme, but highlight the benefit that women can receive when multiple care providers are working to coordinate care appropriately (Henderson et al 2002).

Irrespective of the particular type of primary care provider, we observed that lowest levels of primary care use were associated with a 47% lower likelihood of benchmark attainment as compared to the highest. These findings support the use of primary care providers as the locus of patient care and accountability. It is plausible that ACO models that emphasize primary care may be successful in providing good quality outcomes at lower healthcare costs.

LIMITATIONS

Our findings should be interpreted in the context of this study's limitations. Whereas we evaluated the variation in benchmark attainment between counties, we did not examine differences in need between counties. It is possible that during the three year period over which the expenditure benchmark was calculated that beneficiaries could have experienced poor outcomes that would cause this average cost to be greater in any subsequent year when poor quality events were avoided. However, in line with our conceptual framework of healthcare efficiency, merely reducing the cost of care will not increase efficiency unless health improvements are unaffected or improved. As such it is appropriate to restrict analyses to those for whom poor outcomes did not occur despite outcomes that might have occurred previously. Our findings are not generalizable to all Medicaid program, because we used only four states. In addition, our findings are only relevant to fee-for-service Medicaid beneficiares.

Despite these limitations our analyses utilized Medicaid claims files, a robust source of expenditure data for FFS beneficiaries from three diverse states. Here we present poor outcome avoidance as a proxy of quality care and observed that 80% of counties provided healthcare services at or below a three year expenditure benchmark. Although there is no conclusive link between greater healthcare efficiency/ cost containment and better quality, even in the absence of poor quality events we observe room for greater efficiency, especially among ffs beneficiaries. The implications are further magnified when we consider the burden of severe mental illness among Medicaid beneficiaries and the need to provide integrated primary and mental health care. According to the National Academy for State

Health Policy, there are currently 41 states, including California, New York and Texas, considering PCMH policies/ pilots/ models for Medicaid populations (NASHP, 2013). Further research will be needed to evaluate the impact of these new models on costs of state Medicaid programs and outcomes for those with mental illness.

TABLES

Table 1: Description of Sample Characteristics 2008 Medicaid Fee for Service

		N	%
TOTAL		**558,872**	**100.0**
State			
	California	305,965	54.7
	New York	213,384	38.2
	Texas	39,523	7.1
Gender			
	Female	364,210	65.2
	Male	194,662	34.8
Race/Ethnicity			
	Caucasian	159,892	28.6
	African American	110,956	19.9
	Hispanic	189,268	33.9
	Asian/AI/PI	71,772	12.8
	Other	26,984	4.8
Age			
	18-24 years	120,876	21.6
	25-34 years	113,122	20.2
	35-44 years	113,957	20.4
	45-54 years	118,877	21.3
	55-64 years	92,040	16.5
Cash Eligibility			
	Cash	414,963	74.3
	No Cash	143,909	25.7
Medical Eligibility			
	Medical	181,990	32.6
	No Medical	376,882	67.4
Primary Care Use			
	Q1	93,824	16.8
	Q2	103,127	18.5
	Q3	109,872	19.7
	Q4	111,077	19.9
	No PCP Visits	140,972	25.2

(Continued)

Table 1: Description of Sample Characteristics 2008 Medicaid Fee for Service

	N	%
Asthma		
Yes	37,333	6.7
No	521,539	93.3
COPD		
Yes	28,832	5.2
No	530,040	94.8
CVD		
Yes	34,391	6.2
No	524,481	93.8
Diabetes		
Yes	48,012	8.6
No	510,860	91.4
Lipid Disorder		
Yes	82,629	14.8
No	476,243	85.2
Hypertension		
Yes	103,727	18.6
No	455,145	81.4
Joint		
Yes	97,936	17.5
No	460,936	82.5
Thyroid		
Yes	31,716	5.7
No	527,156	94.3
Cancer		
Yes	14,240	2.5
No	544,632	97.5
Depression		
Yes	52,711	9.4
No	506,161	90.6
Severe Mental Illness		
Yes	84,040	15.0
No	474,832	85.0
Substance Abuse		
Yes	24,673	4.4
No	534,199	95.6

(Continued)

Table 1: Description of Sample Characteristics 2008 Medicaid Fee for Service

	N	%
County Education atlatl High School		
Q1	313,423	56.1
Q2	60,854	10.9
Q3	67,521	12.1
Q4	74,690	13.4
Q5	42,384	7.6
County Median Household Income		
Q1	23,134	4.1
Q2	49,926	8.9
Q3	147,703	26.4
Q4	86,302	15.4
Q5	251,807	45.1
County Metropolitan Status		
Not Statistical	6,898	1.2
Metro	536,260	96.0
Micro	15,714	2.8
Primary Care Shortage Area		
No shortage	14,257	2.6
Whole county	474,746	84.9
Part county	69,869	12.5
Mental Health Care Shortage Area		
No shortage	21,184	3.8
Whole county	407,296	72.9
Part county	130,392	23.3

Note: Based on 10% random sample of California, New York and Texas Medicaid fee for service beneficiaries with continuous enrollment 2005-2008 and no ACSH or 30- day readmission. Aged between 18 and 64 years and who were enrolled for all 12 months during 2008, used inpatient services, alive, and not enrolled in Medicare in 2008 The state of Illinois was excluded from analyses due to lack of sufficient sample size of continuously enrolled beneficiaries across all four years. Primary care use index was calculated only for those with primary care visits. County-level variables were from Area Resource File for 2008. AI = American Indian; PI = Pacific Islander ; Primary care use quartiles varied by state; where 4^{th} quartile values ranged from 0.67-1.0.
*** $p < 0.001$; ** $0.001 < p < 0.01$; * $0.01 < p < 0.05$

Table 2: Sample Characteristics by Benchmark Attainment
2008 Medicaid Fee For Service Beneficiaries 10% Random Sample

	Less Than Equal to Benchmark		Greater Than Equal to Benchmark			
	N	%	N	%	chisqval	sig
TOTAL	**445,031**	**79.6**	**113,841**	**20.4**		
State					4241.41	***
California	244,782	80.0	61,183	20.0		
New York	173,712	81.4	39,672	18.6		
Texas	26,537	67.1	12,986	32.9		
Gender					29.63	***
Female	290,802	79.8	73,408	20.2		
Male	154,229	79.2	40,433	20.8		
Race/Ethnicity					9487.39	***
Caucasian	118,215	73.9	41,677	26.1		
African American	84,994	76.6	25,962	23.4		
Hispanic	158,359	83.7	30,909	16.3		
Asian/AI/PI	63,366	88.3	8,406	11.7		
Other	20,097	74.5	6,887	25.5		
Age					8980.16	***
18-24 years	105,116	87.0	15,760	13.0		
25-34 years	91,642	81.0	21,480	19.0		
35-44 years	91,879	80.6	22,078	19.4		
45-54 years	90,846	76.4	28,031	23.6		
55-64 years	65,548	71.2	26,492	28.8		
Cash Eligibility					15502.86	***
Cash	314,044	75.7	100,919	24.3		
No Cash	130,987	91.0	12,922	9.0		
Medical Eligibility					19040.61	***
Medical	164,388	90.3	17,602	9.7		
No Medical	280,643	74.5	96,239	25.5		
Primary Care Use					16315.39	***
Q1	63,241	67.4	30,583	32.6		
Q2	79,656	77.2	23,471	22.8		
Q3	85,005	77.4	24,867	22.6		
Q4	93,776	84.4	17,301	15.6		
No PCP Visits	123,353	87.5	17,619	12.5		
Asthma					6654.61	***
Yes	23,596	63.2	13,737	36.8		
No	421,435	80.8	100,104	19.2		

(Continued)

Table 2: Sample Characteristics by Benchmark Attainment
2008 Medicaid Fee For Service Beneficiaries 10% Random Sample

	Less Than Equal to Benchmark		Greater Than Equal to Benchmark			
	N	%	N	%	chisqval	sig
TOTAL	**445,031**	**79.6**	**113,841**	**20.4**		
COPD					8552.30	***
Yes	16,800	58.3	12,032	41.7		
No	428,231	80.8	101,809	19.2		
CVD					16747.96	***
Yes	18,022	52.4	16,369	47.6		
No	427,009	81.4	97,472	18.6		
Diabetes					13684.73	***
Yes	28,362	59.1	19,650	40.9		
No	416,669	81.6	94,191	18.4		
Lipid Disorder					5281.47	***
Yes	58,031	70.2	24,598	29.8		
No	387,000	81.3	89,243	18.7		
Hypertension					15346.33	***
Yes	68,097	65.7	35,630	34.3		
No	376,934	82.8	78,211	17.2		
Joint					9866.42	***
Yes	66,617	68.0	31,319	32.0		
No	378,414	82.1	82,522	17.9		
Thyroid					3025.33	***
Yes	21,424	67.5	10,292	32.5		
No	423,607	80.4	103,549	19.6		
Cancer					2715.52	***
Yes	8,867	62.3	5,373	37.7		
No	436,164	80.1	108,468	19.9		
Depression					22500.83	***
Yes	28,774	54.6	23,937	45.4		
No	416,257	82.2	89,904	17.8		
Severe Mental Illness					57464.83	***
Yes	41,123	48.9	42,917	51.1		
No	403,908	85.1	70,924	14.9		
Substance Abuse					14478.43	***
Yes	12,205	49.5	12,468	50.5		
No	432,826	81.0	101,373	19.0		

(Continued)

Table 2: Sample Characteristics by Benchmark Attainment
2008 Medicaid Fee For Service Beneficiaries 10% Random Sample

	Less Than Equal to Benchmark		Greater Than Equal to Benchmark			
	N	%	N	%	chisqval	sig
TOTAL	**445,031**	**79.6**	**113,841**	**20.4**		
County Education at Least High School					4001.09	***
Q1	257,491	82.2	55,932	17.8		
Q2	49,243	80.9	11,611	19.1		
Q3	51,697	76.6	15,824	23.4		
Q4	55,115	73.8	19,575	26.2		
Q5	31,485	74.3	10,899	25.7		
County Median Household Income					1310.46	***
Q1	17,404	75.2	5,730	24.8		
Q2	41,151	82.4	8,775	17.6		
Q3	119,908	81.2	27,795	18.8		
Q4	65,887	76.3	20,415	23.7		
Q5	200,681	79.7	51,126	20.3		
County Metropolitan Status					344.99	***
Not Statistical	5,243	76.0	1,655	24.0		
Metro	428,113	79.8	108,147	20.2		
Micro	11,675	74.3	4,039	25.7		
Primary Care Shortage Area					800.19	***
No shortage	11,038	77.4	3,219	22.6		
Whole county	381,049	80.3	93,697	19.7		
Part county	52,944	75.8	16,925	24.2		
Mental Health Care Shortage Area					1163.15	***
No shortage	16,088	75.9	5,096	24.1		
Whole county	328,882	80.7	78,414	19.3		
Part county	100,061	76.7	30,331	23.3		

Note: Based on California, New York and Texas Medicaid fee for service beneficiaries with continuous enrollment 2005-2008 and no ACSH or 30- day readmission. Aged between 18 and 64 years and who were enrolled for all 12 months during 2008, used inpatient services, alive, and not enrolled in Medicare in 2008
The state of Illinois was excluded from analyses due to lack of sufficient sample size of continuously enrolled beneficiaries across all four years. Primary care use index was calculated only for those with primary care visits. County-level variables were from Area Resource File for 2008. AI = American Indian; PI = Pacific Islander ;
Primary care use quartiles varied by state; where 4th quartile values ranged from 0.67-1.0.
Expenditure Benchmark= Three year (2005-2007) age-sex adjusted per member expenditures
Benchmark Attainment = 2008 expenditure less than or equal to the Expenditure Benchmark
*** $p < 0.001$; ** $0.001 < p < 0.01$; * $0.01 < p < 0.05$

Table 3: Logistic Regression on Benchmark Attainment 2008 Medicaid FFS Beneficiaries 10% Random Sample

		AOR	95% CI		Sig
State					
	New York	0.53	0.40	0.70	***
	Texas	0.77	0.66	0.90	***
	California	Reference			
Gender					
	Female	1.15	0.98	1.35	
	Male	Reference			
Race/Ethnicity					
	African American	1.20	1.11	1.29	***
	Hispanic	1.58	1.27	1.97	***
	Asian/AI/PI	1.94	1.79	2.09	***
	Other	1.20	0.93	1.56	
	White	Reference			
Age					
	18-24 yrs	0.98	0.72	1.33	
	25-34 yrs	0.79	0.67	0.94	**
	35-44 yrs	0.94	0.80	1.12	
	45-54 yrs	1.02	0.90	1.17	
	55-64 yrs	Reference			
Poverty Based Eligibility					
	Yes	0.53	0.33	0.83	**
	No	Reference			
Medical Eligibility					
	Yes	2.23	2.06	2.41	***
	No	Reference			
Primary Care Use					
	Q1	0.53	0.46	0.60	***
	Q2	0.76	0.68	0.84	***
	Q3	0.75	0.68	0.83	***
	No PCP Visits	0.94	0.88	1.01	
	Q4	Reference			
Asthma					
	Yes	0.63	0.51	0.77	***
	No	Reference			
COPD					
	Yes	0.67	0.63	0.71	***
	No	Reference			
CVD					
	Yes	0.41	0.37	0.47	***
	No	Reference			

(Continued)

Table 3: Logistic Regression on Benchmark Attainment 2008 Medicaid FFS Beneficiaries 10% Random Sample

		AOR	95% CI		Sig
Diabetes					
	Yes	0.50	0.46	0.55	***
	No	Reference			
Hypertension					
	Yes	0.71	0.68	0.74	***
	No	Reference			
Joint					
	Yes	0.73	0.68	0.78	***
	No	Reference			
Thyroid					
	Yes	0.75	0.66	0.84	***
	No	Reference			
Cancer					
	Yes	0.55	0.52	0.58	***
	No	Reference			
Depression					
	Yes	2.01	1.88	2.15	***
	No	Reference			
Severe Mental Illness					
	Yes	0.16	0.13	0.19	***
	No	Reference			
Substance Abuse					
	Yes	0.39	0.25	0.59	***
	No	Reference			
County Education at least High School					
	Q1	0.67	0.53	0.83	***
	Q2	0.79	0.64	0.96	*
	Q3	0.86	0.73	1.02	
	Q4	0.82	0.71	0.96	*
	Q5	Reference			
County Median Household Income					
	Q1	1.74	1.45	2.09	***
	Q2	1.91	1.58	2.31	***
	Q3	1.64	1.42	1.90	***
	Q4	1.17	1.03	1.32	*
	Q5	Reference			
County Metropolitan Status					
	Metro	0.96	0.80	1.14	
	Micro	0.92	0.77	1.10	
	Not Statistical	Reference			

(Continued)

Table 3: Logistic Regression on Benchmark Attainment 2008 Medicaid FFS Beneficiaries 10% Random Sample

	AOR	95% CI		Sig
Primary Care Shortage Area				
Whole county	0.87	0.75	1.02	
Part county	0.93	0.79	1.10	
No shortage	Reference			
Mental Health Care Shortage Area				
Whole county	0.99	0.86	1.13	
Part county	1.07	0.91	1.24	
No shortage	Reference			
Rural Health Clinic				
Yes	1.12	1.00	1.26	*
No	Reference			
FQHC				
Yes	0.96	0.84	1.09	
No	Reference			
Community Mental Health Clinic				
Yes	0.98	0.88	1.10	
No	Reference			
Total Hospitals				
Q1	1.16	1.02	1.31	*
Q2	1.03	0.89	1.18	
Q3	1.06	0.93	1.22	
Q4	Reference			
Office Based General Practitioners				
Q1	0.36	0.21	0.59	***
Q2	0.33	0.21	0.53	***
Q3	0.32	0.21	0.47	***
Q4	Reference			
Office Based OBGYN				
Q1	1.63	1.30	2.06	***
Q2	1.67	1.27	2.19	***
Q3	1.61	1.23	2.11	***
Q4	Reference			
Office Based Preventative Medicine				
Q1	1.00	0.84	1.19	
Q2	1.10	0.98	1.22	
Q3	0.87	0.75	1.01	
Q4	Reference			

Note: Based on California, New York and Texas Medicaid fee for service beneficiaries with continuous enrollment 2005-2008 and no ACSH or 30- day readmission. Aged between 18 and 64 years and who were enrolled for all 12 months during 2008, used inpatient services, alive, and not enrolled in Medicare in 2008 The state of Illinois was excluded from analyses due to lack of sufficient sample size of continuously enrolled beneficiaries across all four years. Primary care use index was calculated only for those with primary

care visits. County-level variables were from Area Resource File for 2008. AI = American Indian; PI = Pacific Islander ;
Primary care use quartiles varied by state; where 4th quartile values ranged from 0.67-1.0.
Expenditure Benchmark= Three year (2005-2007) age-sex adjusted per member annual expenditures
Benchmark Attainment = 2008 expenditure less than or equal to the Expenditure Benchmark
*** $p < 0.001$; ** $0.001 < p < 0.01$; * $0.01 < p < 0.05$

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CHAPTER 5

DISCUSSION & CONCLUSIONS

SUMMARY OF FINDINGS

The purpose of this dissertation was to evaluate ambulatory care sensitive (ACSH) and all cause 30-day readmissions among Medicaid beneficiaries, with a subpopulation of individuals with chronic complex illness using a longitudinal framework. Additionally, we analyzed the role of community healthcare resources on ACSH and readmissions as well as achieving quality outcomes (i.e. avoiding any ACSH and/or all cause 30-day readmissions) at or below an expected expenditure benchmark. These studies were guided by three specific aims:

Specific Aim 1: Examine the relationship between lapses in quality (ACSH and hospital readmissions), primary care use and care coordination

Specific Aim 2 : Evaluate the individual-level, provider-level, and county-level characteristics that contribute to any lapse in quality along the continuum of patient care for individuals with chronic complex illness using a longitudinal framework.

Specific Aim 3: Assess the relationship between expected expenditures and quality outcomes (i.e. avoiding any ACSH or all cause 30-day readmissions).

SPECIFIC AIM 1

In Chapter 2, "A Multi-level Model Assessing Ambulatory Care Sensitive Hospitalizations and 30-Day Readmissions among Medicaid Beneficiaries: The Role of Primary Care Use, and County-Level Healthcare Resources", cross-sectional fee-for-service Medicaid claims files linked to the 2008 Area Resource File were used to analyze the relationship between

primary care use and any ACSH and all cause 30-day readmissions after adjusting for patient-level and county-level variables.

Among 371,648 beneficiaries with inpatient use, in four states, we observed the following: any ACSH (11.5%); all cause 30-day readmission (9.2%); and both ACSH+Readmission (2%). Minority race/ethnicity and chronic physical conditions were associated with higher likelihood of any ACSH and 30-day readmission. Lower levels of primary care use were associated with lower likelihood of any ACSH. A few county variables (number of hospitals per capita, metro status, primary care shortage) were associated with poor quality outcomes. Beneficiaries residing in counties with lower number of hospitals per capita had a higher likelihood of readmission compared to those residing in counties with more hospitals**.** Compared to individuals residing in counties that were not metropolitan statistical areas those residing in metropolitan areas were 41% more likely to have any ACSH. Beneficiaries residing in counties with partial primary care shortage were more likely to experience both ACSH and all cause 30-day readmissions compared to those residing in counties designated as having no primary care shortage.

Objective 1.1 Examine the relationship between ACSH and primary care use, after controlling for individual-level and county-level characteristics.

The first hypothesis was that *individuals with lower levels of primary care use will be significantly more likely to have any ACSH compared to individuals with higher levels of primary care use.* Multilevel models revealed a significant association between primary care shortage and likelihood of experiencing both ACSH and Readmission. However, primary care use, our proxy for continuity of care revealed that the any ACSH was less likely at lower levels of primary care use as compared to those with highest levels of primary care use.

Objective 1.2: Assess the relationship between readmission and care coordination, after adjusting for individual-level and county-level characteristics.

The second hypothesis was that *individuals with coordinated care will be significantly less likely to have readmissions compared to individuals without coordinated care.*

Results from analyses using the coordination of care variable were inconclusive and were not presented here. Due to the time dependent nature of the variable (visit to a primary care provided within 14 days of discharge), the cross sectional analysis did not support our hypothesis. The relationship between care coordination and readmissions need to be evaluated using longitudinal models as described in Chapter 3.

SPECIFIC AIM 2

In Chapter 3, "Longitudinal Assessment of Ambulatory Care Sensitive Hospitalizations and Readmissions: A Case of Chronic Complex Illness in Diabetes", three years of longitudinal Medicaid claims files linked to the 2008 Area Resource File were used to assess the relationship between patient-level and community-level characteristics and any ACSH and 30-day readmissions for a subpopulation of patients with diabetes. Chronic complex illness for this group of patients was defined as having co-occurring diabetes and depression.

Of the beneficiaries with diabetes (305,569), 14% had both diabetes and co-occurring depression. After adjusting for patient-level and county-level variables using a multilevel model, complex chronic illness was associated with increased likelihood of ACSH only by 31% and decreased the likelihood of readmission by 31%. However, the likelihood of ACSH+Readmission was NOT significant for those with complex illness (diabetes and depression) compared to those experiencing neither event. Although non-significant for diabetes and depression, the presence of asthma, COPD, CVD, hypertension, joint and lipid disorders

and substance abuse all increased the likelihood of combined ACSH+Readmission in this population of individuals with diabetes. ACSH+Readmission were less likely for beneficiaries with lengths of stays ≤ 3 days, and for those with levels of primary care use between 0.26 and 0.75 compared to those with greater lengths of stays and highest levels of primary care use.

Compared to those experiencing neither ACSH or 30-day readmission, the likelihood of ACSH+Readmission was significantly increased (44%) for beneficiaries residing in counties with a community mental health center. The combined outcome (ACSH+Readmission) was less likely for beneficiaries residing in counties designated as primary health shortage area or those with metropolitan status. The combined outcome (ACSH+Readmission) was also less likely at lower levels of office based preventive medicine physicians compared to highest level of office based preventive medicine physicians.

Objective 2.1: Using a unified longitudinal approach, examine the relationship between lapses in quality and primary care use among individuals with chronic complex illness in diabetes.

The first hypothesis was that *individuals with lower levels of primary care use will be significantly more likely to have both ACSH+Readmission compared to individuals with higher levels of primary care use.*

Among beneficiaries with diabetes, after adjusting for other patient-level and county-level variables, multinomial logistic regression revealed a lower likelihood of ACSH+Readmission for beneficiaries with primary care use between 0.26 -0.75, as compared to those with primary care use > 0.75. There are two possible explanations for why lower levels of primary care use were associated with lower likelihood of ACSH+Readmission. As diabetes is typically managed in primary care settings, higher levels of primary care use may be indicative of greater severity of illness. Our measure of primary care use may be capturing severity of

illness or duration of diabetes rather than relational continuity. Although we controlled for severity of illness with a proxy measure (i.e. length of inpatient stay during index hospitalization), it may not have captured all aspects of illness severity or duration of diabetes.

Another possible explanation may be found in the relationship between primary care shortage and hospitalization. In this study we observed that beneficiaries with diabetes residing in counties with primary care shortage were less likely to experience ACSH+Readmission. Taken together with our observation for those with lower levels of primary care use, it may be that whole county primary care shortage is driving relational continuity. Or in other words, the lack of primary care providers forces beneficiaries to receive care from the same settings, thus improving the continuity of care received, even if at a lower volume of visits.

Objective 2.2: Using a unified longitudinal approach, examine the relationship between lapses in quality and chronic complex illness in diabetes.

The second hypothesis was that the l*ikelihood of poor quality outcomes will be greater for those with chronic complex illness (diabetes with depression) compared to those without chronic complex illness (diabetes without depression).*

After adjusting for other patient-level, provider-level and county-level variables, multinomial logistic regression revealed that the likelihood of ACSH was greater for those with chronic complex illness compared to those without chronic complex illness. However, readmission was less likely among those with chronic complex illness compared to those without chronic complex illness. Combined outcome (ACSH+Readmission) was not statistically significant for those with complex illness (diabetes and depression) compared to those without chronic complex illness (diabetes without depression). Closer examination of care coordination by chronic complex illness revealed that beneficiaries with diabetes and depression had higher

rates of coordinated care (17%) compared to those with diabetes and no depression (14%). It is plausible greater care coordination post-hospital discharge among those with chronic complex illness may have been protected against the risk of readmissions.

SPECIFIC AIM 3

In Chapter 4, "Expenditure Benchmark Attainment in Absence of Poor Quality Outcomes: Role of Primary Care and County-Level Healthcare Resources in a Medicaid Population", 2005-2008 Medicaid claims files linked to the 2008 Area Resource file were used to determine the likelihood of cost containment at or below a three-year expenditure benchmark for beneficiaries not experiencing poor quality outcomes (ACSH or 30-day readmission) during the year.

Of 558, 872 beneficiaries, 76.9% had average expenditures in 2008 that were at or below the three year age-sex adjusted average for their respective state. After controlling for patient and county level variables, multivariate logistic the likelihood of benchmark achievement was greater for all racial/ethnic minorities as compared to Caucasian beneficiaries. Compared to those with the highest levels of primary care use, those with the lowest level of primary care use were nearly 50% less likely to have expected expenditures below the benchmark. With the exception of depression, the presence of all chronic conditions was significantly associated with lower likelihood of benchmark attainment. For example, beneficiaries with severe mental illness were 84% less likely to achieve benchmark attainment compared to those without serious mental illness**.**

At the county-level fewer resources (number of office based general practitioners) were associated with lower likelihood of benchmark attainment compared to greater resources

(number of office based general practitioners). This finding highlights the role of access in terms of primary care resource in containing cost. However, fewer resources (number of OBGYNs) were associated with greater likelihood of benchmark attainment compared to greater resources (number of OBGYNs). As explained below, these findings may suggest missed opportunities in providing good quality care at lower expenditure thresholds.

Objective 3.1: Determine the relationship between expenditures and quality outcomes using a three-year expenditure benchmark.

This first hypothesis was *that after controlling for individual, provider and county-level characteristics, lower levels of primary care use will be associated with increased likelihood of achieving expenditure benchmark compared to higher levels of primary care use.*

Compared to the highest quartile of primary care use, all lower levels (1^{st} -3^{rd} quartiles) were associated with a lower likelihood of achieving the expenditure benchmark. In fact those in the 1^{st} quarter were 47% less likely to have annual average expenditures below the three year average.

Objective 3.2: Evaluate the role of county-level resources in the relationship between expenditure benchmarks and quality.

The second hypothesis was that *lower availability of health care resources within counties compared to greater availability of healthcare resources within counties will be associated with lower likelihood of achieving expenditure benchmarks.*

We found that lower the availability of certain type of healthcare resources (office based general practitioners within a county) the less likely beneficiaries were to have expenditures

below the benchmark. However, this was not the case with the availability of OBGYNs. With regard to OBGYNs beneficiaries living in counties with lower availability of OBGYNs were more likely to attain expenditure benchmark compared to beneficiaries living in counties with greater availability of OBGYN. As discussed below, these findings may suggest missed opportunities to provide good quality outcomes at lower expenditure thresholds.

CONSISTENT FINDINGS

Patient-level

Across all studies we observed an increased likelihood of poor quality outcomes among beneficiaries with chronic physical illness (example: COPD, CVD, hypertension and diabetes). Cross-sectional and longitudinal analyses revealed an increased risk of ACSH, 30-day readmission, or both for beneficiaries with these conditions compared to those without these conditions. Integrated care and case management interventions have been shown to reduce readmissions among those at high risk, such as patients with chronic physical conditions. One study randomized CHF patients to receive coordinated care from a team including cardiologists, specialized nurses and primary care physicians. Both hospitalizations and deaths were significantly reduced for those in the intervention group as compared to those receiving conventional care [43% v. 59%; and 7 deaths v. 13 deaths, $p<0.05$, respectively] (Kasper, 2002). Another study randomized COPD patients to integrated care or usual care following hospitalization. The intervention consisted of access to a nurse case manager post discharge. Compared to those with usual care, the 12-month readmission rates were significantly lower for those participating in the intervention [69% v. 51%, $p <0.05$ respectively] (Casas, 2006).

Compared to the 4th quartile of primary care use, quartiles 2 and 3 (0.26-0.75) were associated with lower likelihood of ACSH (cross-sectional) or ACSH+Readmission (longitudinal). In the longitudinal model, no primary care use was associated with increased risk of ACSH, readmission and ACSH+Readmission, although the combined outcome was of borderline significance.

It is plausible that our measure of primary care use was not able to distinguish between visits for prevention versus visits for sickness. Therefore, higher levels of primary care use may represent severity of chronic conditions. As such, our findings that lower levels of primary care use were associated with lower likelihood ACSH+Readmissions may not be due to decreased continuity of care, but instead to demand induced use of primary care services among a sicker subgroup of beneficiaries. Because primary care use measured prior to and not concurrently during the outcome period, it could not directly account for severity of illness during the entire measurement period. We did, however, attempt to adjust for this in our model by including length of hospital stay as a proxy measure for disease severity.

INCONSISTENT FINDINGS

Patient-level

For beneficiaries most likely to experience poor outcomes, once these events are avoided, they are more likely to achieve cost containment. For example, compared to Caucasians, being of African American race was consistently associated with increased likelihood of poor outcomes, yet in third aim analyses we observed this group of was more likely to have expenditures below the expenditure benchmark. If race or some other biological-genetic plausibility were the sole driver of disparate outcomes, we would expect to observe higher

expenditures among this group as well. Our observation of cost containment for this group suggests that processes of disease management or other system level factors in the provision of care are negatively influencing the outcomes of care for this population. The literature has established disparities in access to care for racial ethnic minorities (DHHS, 1885; Smedley 2003). There are a variety of factors contributing to differences in care received by racial/ethnic minorities. The IOM Integrated Model of Health Disparities depicted below identifies patient-level and system-level factors that serve as sources for unequal care received by racial/ ethnic minorities.

At the top of a list of possible conscious and unconscious decisions that both patients and clinicians make in the course of care, we observe social and economic influences that are built into the design of health delivery systems. Our analyses demonstrated cost containment while achieving quality outcomes (i.e. absence of any ACSH or all cause 30-day readmission). However, our analysis did not include factors such as cultural competency or unbiased clinical decisions that may have influenced provision of good quality care. While provision of culturally competent care is important in establishing good outcomes among patients of diverse backgrounds, without a health system designed to provide comprehensive care for all patients, we will not make progress towards reducing and ultimately eliminating racial/ethnic disparities. In fact early studies of California Medi-Cal Medicaid managed care have demonstrated significant reductions in the rate of ACSH between FFS and managed care beneficiaries (Bindman et al. 2005). When evaluating the effect on hospitalizations, including readmissions, the greatest reductions in hospitalization were seen among minority groups. For example, African Americans voluntarily enrolled in Medi-Cal had hospitalization rates that were 42.7% lower than their FFS counterparts. The difference was just 27.1% for Caucasian beneficiaries.

This underscores the fact that true system level reform in delivery of care must be supported by payment reforms. Our current structure based on volume of services provided cannot support provision of comprehensive care needed to improve quality of care received by all patients, with subsequent reductions in health disparities (Averill, 2010; Kelly, 2010). The need for payment reforms is further magnified by the coming increase in Medicaid eligibility under the ACA healthcare reforms. According to some estimates, Medicaid accounts for between one-fifth and one-fourth of state budgets. As states brace for the influx of more beneficiaries, payment reform as a driver of delivery reform will be paramount in maintaining both balanced budgets as well as high quality care for patients. In this respect, it should be noted that three of the four states represented (California, New York and Texas), are CMS Innovation Model partner states and are presently awardees of Medicaid Incentives for the Prevention of Chronic Disease state grants. Aligned with the Comprehensive Primary Care and Million Hearts Initiatives, these states have rolled out programs designed to incentivize use of preventative primary care services (http://innovation.cms.gov/initiatives/MIPCD/).

In cross-sectional analyses, presence of depression was associated with an increased rate of ACSH. However in longitudinal models, when compared to those with diabetes only, the presence of co-occurring depression resulted in an increase of ACSH, but a decreased rate of readmissions. As discordant conditions (Laiteerapong et al, 2011; Pentakota et al., 2012),we would expect an increased risk of both hospitalizations (Niefeld et al 2003; Davydow et al, 2013; Prina et al, 2012). Closer examination of primary care use and care coordination by chronic complex illness revealed that beneficiaries with diabetes and depression had higher rates of coordinated care (17%) compared to those with diabetes and no depression (14%). Similar findings were noted for primary care use. It is plausible that greater coordination of care among

beneficiaries with diabetes and depression may have reduced the risk of readmissions for this group. It is also possible that differences in severity of diabetes between the groups may have contributed to lower rates of readmission among those with diabetes and depression.

County-level

Contrary to our expectations, at the county-level, greater availability of resources actually increased the likelihood of poor quality outcomes in our second study of individuals with chronic complex illness. For example, the presence of mental health centers was associated with an increased likelihood of ACSH+Readmissions as well as increased likelihood of readmissions only. Under a fee-for-service system of care delivery, these findings may point to poor coordination between providers at these and other providers (Pentakota et al., 2012). Our findings could also be a result of differences in patient case mix. The presence of mental health clinics could indicate an area of greater medical need. In which case, we would expect to observe a higher likelihood of readmissions if demand for mental health services was due to presence of more individuals with disease (Curtis et al 2009).

Proponents of Medicaid payment and delivery reforms support integrated models of care for physical and mental health (Bao, 2013). Not only because our state Medicaid programs serve large numbers of patients with mental health conditions, but also because in many states, Medicaid is the single largest purchaser of mental health services (Quinn, 2010). State Medicaid programs are not ignorant of this special high rick group of beneficiaries they serve and are entering in to pilot programs to demonstrate improvements in care through provision of comprehensive primary care. The Texas Wellness Action Planning and Navigation for Adults with Multiple Chronic Conditions will provide motivational interviewing, patient navigators, patient centered wellness planning, and a flexible wellness account for beneficiaries to spend

toward achieving their personal health goals. The program includes additional provisions to work with beneficiaries with severe mental illness. As this is currently underway, future evaluations will be needed to determine success of the intervention in improving outcomes for patients with mental illness.

In the third aim analyses we observed conflicting results of the association between county-level supply of healthcare providers and expenditure benchmark attainment. Whereas lower levels of office based general practitioners decreased the likelihood of benchmark attainment, lower levels of office based OBGYNs increased the likelihood of benchmark attainment. The first finding is consistent with our understanding of the role of general medicine primary care providers in maintaining lower healthcare costs (Maciejewski et al, 2007; Liu et al., 2008). Although the use of OBGYN providers was measured separately, we recognize that OBGYNs are known providers of primary care for some women, especially young women. There is growing evidence that OBGYNs may miss opportunities to diagnose chronic disease or coordinate care with other primary care providers (Schmittdiel et al, 2011; Ehrenthal et al., 2011). Such missed opportunities may have led to greater expenditures to avoid poor quality outcomes in counties with greater availability of OBGYNs.

In cross-sectional multilevel analyses we observed that the risk of ACSH+Readmission was increased for beneficiaries residing in counties with primary care shortage compared to beneficiaries living in counties without primary care shortage. In longitudinal analyses we observed the opposite, a decrease in the likelihood of ACSH+Readmission for beneficiaries residing in counties with primary care shortage. The differential results could be due to the differences in study population. While the cross-sectional analyses included all Medicaid

beneficiaries, longitudinal analyses focused only on those with chronic complex illness (i.e. diabetes with and without depression).

CONCLUSIONS

Patient complexity in terms of chronic conditions increased the risk of any ACSH and readmissions, suggesting that chronic diseases need to be better managed perhaps within an integrated system. Access to primary alone may not be enough to reduce risk of preventable hospitalizations. There is a need for innovative strategies such as comprehensive primary care for our nation's vulnerable and indigent populations. In the absence of system level restructuring of Medicaid programs, states will need to prioritize interventions for targeted groups of beneficiaries. We propose that cost containment may be maximized by aiming to reduce racial disparities and serve those with mental illness. If programs provide comprehensive primary care services to beneficiaries (especially racial ethnic minorities) and those with severe mental illness or substance abuse we expect to see reductions in poor outcomes and improved expenditure profiles. While county-level variables were generally not associated with ACSH or readmissions, some features such as access to primary care at the county-level may reduce the risk of very poor outcomes such as combined ACSH and hospital readmissions. However, greater availability of other types of healthcare resources may indeed increase the risk of poor quality outcomes. These findings taken together suggest that problems in healthcare quality cannot be solved by investments in more resources alone, but by investing in the value of the care provided. State Medicaid programs should explore models of delivery that support value based provision of care over volume based care.

SIGNIFICANCE OF THE STUDY

The unique contributions of the proposed study are:

Policy relevance

State Medicaid Programs have begun to experiment with ACO type models to improve quality and reduce Medicaid spending. Our study contributes to the evolving discussion of these policy efforts and provide information (as a precursor) for Medicaid ACO models of care.

Historical efforts to reduce the ever-increasing inpatient Medicare expenditures included prospective payment systems (PPS) in which hospitals were reimbursed based on diagnosis-related group, bundled payments using patient specific disease profiles or lists of services. While these efforts have slowed the growth of Medicare spending for inpatient services in the short-term, its effect on quality of care remains unclear. While hospital costs and length of stay were reduced in the early years of implementation, it may have resulted in cost shifting towards other programs (Atlman, 1993; Chulis, 1991; Russell, 1989). There is also some evidence that decreased length of stays may have indirectly increased the number of discharges to nursing facilities due to reduced physical therapy sessions that would have taken place during hospitalization (Fitzgerald, 1987).

In light of these issues that have existed for decades, there is renewed interest in reducing inpatient expenditure burden. In Medicare, the PPS is being redesigned (CMS 2011b) to reduce inpatient expenditures while ensuring quality healthcare in accordance with Patient Protection and Affordable Care Act of 2010. Title III, Sections 3001 and 3025 of the ACA outline initiatives to link Medicare payments to quality performance (ACA, 2010). Specifically, the act calls for reductions in hospital reimbursements for "excess" readmissions that are above what

would be expected based on facility case mix. The ACA also calls for improvements in access to primary care and care coordination. In this context, preventable hospitalizations are considered markers of both healthcare quality and accountability. To achieve both quality and cost containment, the Centers for Medicare and Medicaid, have established the Accountable Care Organization (ACO) Medicare Shared Savings Program.

Along with changes in provision of healthcare and quality standards, come changes in financing as well. Currently, CMS policies will penalize institutions for certain disease specific readmissions (myocardial infarction, heart failure and pneumonia). ACOs have the goal of providing coordinated care with the aim of improving quality of care with costs at or below the ACO expenditure benchmark. The current ACO expenditure benchmark will be set based on the previous three-year average of cost per fee-for-service beneficiary that would have been cared for by an ACO.(CMS, 2011a) The relationship between quality improvement and costs is complex, and leads us to question whether it is feasible to attain good quality within the proposed expenditure benchmarks created by CMS?

Unified Approach

Analyzes both ACSH and readmissions with a longitudinal framework.

Traditional approaches to quality assessment have analyzed ACSH and readmissions cross-sectionally. With renewed calls for reducing preventable hospitalization and 30-day readmissions with coordinated primary care along a continuum of patient care set forth in recent policy efforts in ACA and by CMS, a unified longitudinal approach needs to be considered to inform policy and cost containment efforts.

Study population – Indigent, Medical Need and Young Adults

State Medicaid programs incur an estimated $374 billion in healthcare expenditures and provide healthcare services to the vulnerable, indigent and disabled face challenges with chronic illness, preventable hospitalizations and readmissions. There is lack of information on the extent of poor quality outcomes and costs related to avoiding poor quality outcomes. Our study findings fill a critical knowledge gap in this area.

It has been estimated that 61% of adult Medicaid beneficiaries have chronic or disabling conditions which place them at increased risk of hospitalization (Allen, 2000). Disabled adults are more likely to have three or more chronic conditions than non-disabled adults. It is estimated that 46% of Medicaid adults have multiple chronic or disabling disease (Allen, 2000). The total expenditures for beneficiaries with eight or more chronic conditions are 5% greater than the sum of the cost of each separate condition. When nine conditions are present, expenditures are 10% greater than the sum of individual conditions (Kronick, 2007). The rate of hospitalization among beneficiaries with multiple chronic diseases is 523 per 1000 person years, almost twice as high as the rate among beneficiaries with a single chronic condition (Allen, 2000). In 2008, ACSH accounted for 5.8% of Medicaid inpatient stays; Medicaid beneficiaries accounted for 10.7% of 30-day readmissions in 2007 (Jiang, 2010; Stranges, 2010). These figures underscore the great need imposed by the presence of chronic illness among Medicaid beneficiaries.

Complex Illness

Primary care and care coordination are vital to improve the healthcare of individuals with multiple chronic conditions, such as Medicaid beneficiaries. Sixty-one percent of adult Medicaid beneficiaries have chronic or disabling conditions (Allen, 2000).

Quality assessment should take a special look at implications for those with complex illness. It has been estimated that Medicaid beneficiaries with chronic or disabling conditions make an average of 19 outpatient visits per year (Allen, 2000). Accordingly, 25% of Medicaid enrollees, many of whom are disabled or have chronic diseases, require 70% of program resources (Kronick, 2007). From models of coordinated care, such as the ACO, we expect to observe most benefit among those who are high users of healthcare services, namely individuals with co-occurring conditions. However, we also expect these individuals to pose most challenging to manage. Co-occurring conditions can be considered complex illness, when conditions are discordant, have conflicting outcomes or exacerbating effects on one another. For example, care for diabetes and mental illness may be discordant if treatments with antipsychotic medications worsen glycemic control. The prevalence of diabetes among Medicaid enrollees is high (14%), furthermore, the condition occurs on its own less than 1% of the time, which highlights the extent of multimorbidity within this population (CDC, 2011; Boyd, 2010). For this case, special consideration for Medicaid beneficiaries with chronic complex diabetes will be made.

Use of Administrative Claims Data

Administrative data offer opportunities to measure ACSH and readmissions that can be accurately captured. They also provided payment information that may be difficult to collect using self-reports.

Although administrative records do not allow prospective experimental designs, their ease of use for measuring care along a continuum is well established; For example, CMS quality metrics for ACO models are obtained through a combination of CMS claims and administrative data. In addition, eighty-five percent of primary care continuity measures are obtained from

administrative records (Reid et al., 2002). Furthermore, analyses with administrative data allow for large numbers of beneficiaries even for low prevalence events such as combined ACSH+Readmission. The availability of county-level data enabled us to analyze the role of county-level healthcare resources on quality outcomes by linking county identifies to the 2008 Area Resource file. Thus, using administrative claims provides opportunity to compare different geographic regions, which would only be possible with expensive multi-center trials.

LIMITATIONS

The studies' findings should be interpreted within the context of its limitations. As our study relied on observational data, it may suffer from selection bias based on restrictions to only fee for service beneficiaries and inpatient users. Findings are not representative to all Medicaid populations because we used Medicaid data only from four states which had diverse racial/ethnic groups. Our metric for continuity of primary care identifies primary care use and not continuity in terms of patient encounters with the same care providers or team. As such our measure likely indicated volume of use from which value of use cannot be determined. We do however establish significant associations between our use variable and known quality metrics. Despite these associations, we do caution that use of primary care does not indicate quality of care received at a particular encounter. Furthermore these relationships may be driven by other unobservable factors/relationships. We report findings and implications relevant to beneficiaries with mental illness; however our dependent variables, ACSH and readmissions are not specific to mental health outcomes. We have assumed that the presence of co-occurring illness would impact outcomes related to physical illness. However due to the discordance of some physical and mental illness this relationship may not have been easily elucidated. The use of claims data,

although easily assessable, is not the most robust data source for evaluating clinical outcomes. Since diagnostic coding is used primarily to support billing and administrative uses, its utility for evaluating clinical endpoints is limited and challenged. For example, even in attempting to construct more sophisticated measures of primary continuity, we have observed inconsistencies in provider billing identifiers. For example some providers bill under a unique identifier and others do so using a facility of group identifier. Even within states, there are differences in the codes used to classify physician specialties. The studies presented here did not evaluate the rurality of counties even within an MSA. We know for example, that counties differ in their proximity to urban centers which can increase access to primary care, even within counties with primary shortage area designations (Miller, 1981: Rosenthal, 2005; Hart, 2005). Due to our focus on provision of primary care in ambulatory care settings, these analyses did not evaluate cost containment for provision of long term care services, another market for which state Medicaid programs are a primary purchaser.

FUTURE RESEARCH

Future studies may need to be conducted to answers questions that have been left unanswered or have arisen as a part of these findings. Our patient-level findings suggest that future research is needed to understand whether the intersection between quality and cost may reduce health disparities for racial/ethnic minorities. It was interesting that complex illness as defined here by discordant conditions did not produce significant findings for ACSH+Readmissions. Given the demographics of the population, research should be done to determine whether young age or female gender attenuates the relationship between complex chronic illness (diabetes and depression) and poor quality outcomes. Additionally, metrics that

combine continuity of care with value of care provided should be developed to evaluate care provided in FFS care structures. Current quality metrics work well in settings with team based care or where patients are routinely followed. However, as long as FFS, volume based models of care exist, quality assessment will remain a critical part for the population serviced thereby. Finally, current pioneer Medicaid ACO models need to be evaluated rigorously to determine whether the benefits were consistent with expectations before implementing them on a wide scale. We have shown that expenditure benchmark was attained for nearly 80% of FFS beneficiaries included in the study. These findings confirm the high concentration of expenditures within a small percentage of individuals and effective programs need to be developed to target these individuals. Expenditure benchmarks for future delivery models should be sensitive enough to show incremental efficiency, and discriminate enough to exclude that which could be obtained in an otherwise volume based system.

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