Phoenix Healthcare Value Measurement Initiative (PHVMI) Report (Public Version) January 2011

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The Arizona State University Center for Health Information and Research (CHiR) is an academic research center with a mission of providing actionable information to our community and its decision makers to improve the health of Arizona. The Arizona community recognizes CHiR as a trusted repository of data and the producer of reliable, objective information. Built upon a network of trust, CHiR offers a neutral environment in what is otherwise a competitive market. CHiR is home to Arizona HealthQuery (AZHQ), a massive relational database containing health information provided to CHiR on a voluntary basis by its network of stakeholders—health care providers, payers, and employer—who contribute their data to AZHQ and support its efforts for the community. AZHQ was created with the generous support of the Flinn Foundation and St. Luke's Health Initiatives.

CHiR is also aided by its panel of expert physicians, each of whom was nominated by his or her respective professional organizations. The expert physicians generously provide advice on a pro bono basis as a contribution to improving the health of the community.

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Forward

The Phoenix Healthcare Value Measurement Initiative (PHVMI) was initiated by employers and insurers in the greater Phoenix area who saw AZHQ, as a unique resource that could yield information to develop more effective pay for performance strategies.

PHVMI is structured as a 501(c)(3) not-for-profit corporation with a Board of Directors representing a cross section of important stakeholders in the healthcare community. St. Luke's Health Initiatives (SLHI), a Phoenix based philanthropic foundation, convenes and coordinates PHVMI and acts as its fiscal intermediary.

Subsequent to the proposed PHVMI collaborative and presumably because of PHVMI, CHiR was invited to be one of six national demonstration sites in what was then referred to as the Ambulatory Care Quality Alliance project. This project was a joint effort between the Agency for Healthcare Research and Quality (AHRQ) and Medicare (CMS).

In 2006, before the research contracts were completed, project leadership was shifted from AHRQ to CMS and was renamed the Better Quality Information (BQI) project. The BQI project became a focus of the Department of Health and Human Services (DHHS) as a part of Secretary Michael O. Leavitt's Transparency Initiative. Re-negotiation of the research contracts was not completed until 2007.The delays in initiating the BQI project also delayed the beginning of the PHVMI project since overlaps between the projects were not defined until BQI became operational.

The long delay in the process of negotiating the BQI contracts was costly in terms of lost participants in PHVMI. The BQI results did, however, include solutions to problems that would have been faced anew in the PHVMI project.

The following principles govern the nature of the information to be reported:

- No results will be reported on any individual or in a form that would permit the identification of an individual.
- All operations will adhere with the relevant state and federal confidentiality statutes and regulations.
- Community level data will be shared.

- Evaluations at the level of individual health care practices or organizations will be shared among the participants in PHVMI, but not published.
- Evaluations at the level of individual health care practices or organizations will only be published subject to the following conditions:
    - Measures and the performance results will be thoroughly assessed/evaluated against the AQA Parameters for Selecting Measures of Physician Performance (to include reliability/validity, risk-adjustment, and attribution);
    - The performance results will be shared for review and comment by PHVMI;
    - In the judgment of the PHVMI collaborative body, the benefits of publishing the performance results -- in whole or substantial part, for all or some segment of the sub-contractors membership -- outweigh the risks;

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Introduction

The essential components of effective health care include the choice of an appropriate regimen of care by a health care provider and adherence to that regimen by a patient. Community level information on adherence is important to the development of strategies to improve health care because there are large variations among geographic areas in health care practices and because there are important differences in the characteristics of patients in different communities. Relatively little is known, however, about adherence to guidelines in the day-to-day health care delivered in most communities in the United States.

The PHVMI project relies on data from three commercial insurers and the Arizona Medicaid (AHCCCS) system to describe adherence to guidelines in day-to-day care in Maricopa County, Arizona, the home of America's fifth largest city. The results include rates of adherence to more than 300 guidelines based on approximately 38 million claims and 993,000 patients, from 70 disease groups.

Average adherence rates are estimated for all payers; for patients of private and public insurers, respectively; and for patients of individual (de-identified) primary care physicians. The estimates are compared, where possible, to patient self-reports from surveys in Arizona; to the objectives of *Healthy People 2010*; to national averages and to those standards that are also reported by organizations in California, Massachusetts, Minnesota, Wisconsin and Texas. The comparisons are subject to important limitations that are more fully described in a subsequent section.

The descriptive results are followed by an empirical analysis of the characteristics of providers and patients that decrease or increase adherence to guidelines. The analysis distinguishes between variations in adherence rates that are attributable to differences among individual primary care physicians and variations in adherence rates that are influenced by differences among their patients. The distinctions are important for deciding how to best target interventions designed to increase adherence to recommended standards of care.

Background

There are a very large number of detailed criteria which, if satisfied, are assumed to significantly increase the quality of health care in the United States. The criteria have been developed over the last few decades, from a combination of expert opinion, the collection and critical evaluation of research studies, clinical trials and longitudinal studies of large cohorts of patients. (Framingham, 1999) Several national organizations, including Ambulatory Care Quality Alliance (AQA), Hospital Quality Alliance (HQA), National Quality Forum (NQF), and Public Health Quality Forum (PHQF) have been created to develop and expand the set of guidelines and are pursuing those objectives. Attempts to improve provider and patient adherence to guidelines range from the provision of economic incentives, such as “pay for performance” schemes for providers, to communications strategies and motivational techniques directed at both providers and patients. (Butterworth, 2008; Dunbar-Jacob & Mortimer-Stephens, 2001; Gallefoss & Bakke, 1999; Lindenauer, et al., 2007; Rosenthal, Frank, Li, & Epstein, 2005)

The application of a large array of health care guidelines to entire populations and to all physicians and hospitals in a nation is both recent and unique in the history of health care. It should not be surprising therefore, that progress has been slow and often subject to dispute.

Progress is Slow

Whether it is the fault of health care providers, their patients, or gaps in health insurance coverage, the failure of health care to meet well established standards is both prevalent and costly. It is estimated that between 4% and 11.4% of all hospitalizations and 7.6% of all ED visits are related to non-adherence to recommended standards of care. (DeVol & Bedroussian, 2007; Col, Fanale, & Kronholm, 1990; Grymonpre, Mitenko, Sitar, Aoki, & Montgomery, 1988)

Improvements in provider and patient adherence to guidelines have been modest. (National Committee for Quality Assurance, 2009; Cabana, et al., 1999; Carlsen, Glenton, & Pope, 2007) A review of 50 years of research on the topic concludes, for example, that slightly less than three-quarters of patients adhere to a variety of medical recommendations. (DiMatteo M. R., 2004) Patient adherence to prescribed regimens of drug care has been the focus of decades of experimentation and research but improvements in adherence rates have been small. (Butterworth, 2008; van Dulmen, Sluijs, van Dijk, de Ridder, Heerdink, & Bensing, 2007;

Glisson, et al., 2008) Non-adherence rates are as high as 40% to 86% for some conditions and/or patient groups, resulting in preventable visits to emergency departments and inpatient stays. (Dickinson, Verdile, Kostyun, & Salluzzo, 1996; Singal, et al., 1992)

There have been slight increases in some adult vaccination rates but the rates remain far below recommended standards. (Reinberg, 2010) The National Foundation for Infectious Diseases conducted two surveys, one of physicians and one of patients, and noted a 'significant communication breakdown' between providers and consumers. According to the surveys, 87 percent of physicians reported they had discussed vaccines with every patient, but 47 percent of patients say their physician never talked to them about vaccinations except for the flu vaccine.

Obstacles to Improved Adherence

The achievement of the objectives of standards and health care guidelines faces several obstacles. One obstacle is resistance by some segments of the health care profession to what they consider inappropriate standards or inappropriate attempts to submit physicians to externally imposed standards. Physicians are also sometimes suspicious of the use of external standards of care as a basis for reimbursement by health insurers.

Another issue voiced by some physicians is that the activities required to meet standards may not be covered by health insurers, imposing a cost burden on physicians who perform the recommended services An example of this problem is the time required to both explain the nature of a recommended practice or procedure, to gather the information from a patient on their underlying perception of what they are being asked to do, and to follow up to guarantee patient adherence. Although incentives in the form of penalties for low adherence rates or premiums for higher adherence rates may be offered to physicians, they may not be sufficient to reimburse the opportunity costs, in terms of reimbursement for direct care, of communicating with patients.

One of the most difficult obstacles to improving adherence rates is the fact that health care is produced jointly by providers and patients. A physician cannot, except in certain trauma cases, deliver health care without the cooperation and permission of his or her patients. The extent to which patients adhere to the recommendations of their physicians is influenced by a variety of not completely understood physician characteristics and patient attitudes, including perceptions of pain, ethnic and cultural traditions. Some examples include: race, insurance coverage, type of

medication, treatment (Nichol, et al., 2009); patient trust in physician (Nguyen, 2009); social support and partner stress (Malloy, Perkins-Porras, Strike, & Steptoe, 2008).

Adherence is also influenced by the extent to which the physician demonstrates (a) strong verbal and nonverbal communication skills, (b) effective questioning, (c) transmission of significant information, (d) partnership and participatory decision making, and (e) expressions of empathy and concern (Bensing & Dronkers, 1992; Roter, Frankel, Hall, & Sluyter, 2006; Roter et al., 1997) There is a 19% higher risk of non-adherence among patients whose physician has poor communication than among the patients whose physician communicates well. (Zolnierek & DiMatteo, 2009)

The average physician or other health care provider is unlikely to be knowledgeable of all, or even most, of the attitudes or circumstances that influence the willingness of an individual patient to adhere to his or her recommendations. Nor, given the pressures of time and lack of emphasis on communication skills is the average physician likely to possess the skills needed to improve patient adherence. All of these factors contribute to the well established lack of progress in improving adherence rates.

Another obstacle is the shortage of information, in most communities, that would make physicians aware of needs to improve the adherence rates of their patients. The shortage occurs in at least three forms, namely:

- the single disease focus of current standards do not reflect differences among patients that reflect differences in adherence to the standard that are related to a patient's health conditions other than the condition addressed by a standard.
- the shortage of information on day-to-day care in communities that should be used to compare to the results from communities with similar populations and standards of usual practice.
- a shortage of information in non-experimental settings on patients' behavior outside the health care setting

We will contribute information on the first two areas of shortage. Our data do not include information on patient behavior outside the health care setting.

Incomplete Information on Co-Morbid Conditions

The most frequent consumers of health care are persons with chronic illnesses. Chronic disease is the most prevalent, costly and preventable of all health problems. (Centers for Disease Control and Prevention, 2010) Nearly half of all Americans live with at least one chronic condition, incurring more than 75% of the nation's $2 trillion medical care costs. (National Center for Chronic Disease Prevention and Health Promotion, 2009) About 25% of persons with chronic disease have impaired daily functioning, and 70% or 1.7 million of deaths among Americans are attributable to chronic disease. To date, more than 1.4 million people have died from chronic diseases in 2010. (Centers for Disease Control and Prevention, 2010) Chronic illnesses are most prevalent among older persons who typically have multiple health problems. The CDC reports that 80% of older persons have one chronic illness and 50% have at least two chronic illnesses. (National Center for Chronic Disease Prevention and Health Promotion, 2010) Multiple health problems are associated with poor health outcomes, increased utilization of health care services, and increased health care cost. (Valderas, Starfield, Sibbald, Salisbury, & Roland, 2009; Wolff, Starfield, & Anderson, 2002)

The omission of patient specific information on the existence of multiple health problems can significantly bias the inferences drawn from current approaches to measuring adherence, including the results presented in this report. A patient's adherence regimens of care for a cardiovascular condition or diabetes can, for example, be substantially different for a patient who has behavioral problems than a patient who does not have such problems. Hopefully, the development of better patient profiles will be part of the next stages in the analysis of adherence to medical care and prescription drugs.

Despite the limitations of current results, the creation of detailed community level results is an important step in the evolution of the process of improving health care.

A Shortage of Comparison Data

Medical records, whether on paper or in electronic form, record the nature of the care given during a visit or a hospital stay. The records do not include information on the outcomes of care unless the patient is re-admitted to the hospital from which he or she was discharged or returns to the physician who was last seen. A physician must, even in these situations, rely either on self reports from patients as to their adherence to recommendations since the previous encounter or to symptoms at the current visit that permit inferences regarding a patient's

adherence or failure to adhere to the previous recommendations. Physicians whose patients are not seen regularly receive a fragmented picture of the patient's experiences over time.

Longitudinal data on patients is collected by commercial health insurers and public forms of health insurance, of which Medicaid and Medicare are the most prevalent. It is also true, however, that commercial insurers are often reluctant to share their data; that Medicare does not generally share micro level data that permit tracking individual patients; and that state Medicaid programs do not, for the most part, share their information on individual patients. The other limit of these reports is that the results apply only to the insurer's covered clients and clients move from one plan to another over time.

There is, therefore, a shortage of information on the average day-to-day health care received by the residents of a community. A collateral question is whether, when community level results are estimated, the information should be made public or only distributed to health care providers and insurers.

There is disagreement concerning whether public reporting is an effective tool (Chassin, Hannan, & Debuono, 1996; Lindenauer, et al., 2007) or whether unintended consequences result in negative outcomes. (Werner & Asch, 2005) There is also the belief, which has some empirical support, that allowing physicians to compare their performance to their peers within the same group or hospital or to the performance of similar health care professionals in the same community is a more effective stimulus to improve performance than public reporting. (Winickoff, Coltin, Morgan, Buxbaum, & Barnett, 1984; Dulko, 2007)

Data

The sources of patient, provider, medical, and pharmacy data in PHVMI include three private insurers, namely: Health Net of Arizona, CIGNA and Humana; one public insurer, the Arizona Health Care Cost Containment System (AHCCCS); and allopathic and osteopathic physician licensing data. The data do not provide universal coverage of the population of Maricopa County, but offer information on a very substantial portion of that population at a very detailed level of analysis.

Health Insurance Data

The data are drawn from Health Net of Arizona, CIGNA, Humana and the Arizona Medicaid system (AHCCCS). The CIGNA data include 87,190 patients with an average of 18 medical claims and 14 pharmaceutical claims per patient. The Humana data include 96,036 patients with an average of 25 medical claims and 12 pharmaceutical claims per patients. The AHCCCS data include 629,423 patients with an average of 65 medical claims and 15 pharmaceutical claims per patient. The Health Net of Arizona data include 105,721 patients with an average of 65 medical claims and 30 pharmaceutical claims per patient.

The CIGNA data include claims from January 1st 2007 to December 31st 2008. Humana data were submitted for the period from January 1st 2005 to December 31st 2006. The most recent data available at the initiation of PHVMI from Health Net of Arizona were in the middle of the other private insurer range, that is, from January 1, 2006 to December 31, 2007. The AHCCCS data were included for the same period. The majority of the data refer to the period 2006-2007. Given the relatively slow rate of change in the routine delivery of health care, it is not expected that the inclusion of different years of data will bias the results on adherence rates.

Some of the guidelines are time dependant, such as the guideline for mammography which requires two years of data for a patient to be considered. In situations in which the data were not available for the required time period for an otherwise eligible patient, the patient was not included in the data used to estimate adherence to the relevant guideline. The situations in which the required data were not available included the data for individual insurers for patients whose enrollment ended before the end of the required time period.

CHiR maintains Arizona HealthQuery (AZHQ), a community health data system that combines patient data from more than forty organizations. Neither CIGNA nor Humana participate in AZHQ. The data they have supplied are restricted to use in the PHVMI study alone. AHCCCS and Health Net of Arizona are AZHQ data partners and contribute their data for use in advancing the health of the community.

Omitted data is a significant obstacle in the analysis of the Humana and CIGNA data. Humana and CIGNA both restricted pharmacy claims in accordance with state laws protecting patient information. The CIGNA data also omit drug quantities or estimated supply duration making it impossible to analyze adherence to drug based regimens of care for patients insured by CIGNA. As a result, Humana and CIGNA data were stored separately from the AZHQ data and only provider-level measures were combined between the two data sources.

This report is divided into three main sections, namely:

- Part I: Comparisons of adherence rates for a selected number of guidelines with adherence rates from other states and national averages. Comparisons are also presented for *Healthy People 2010* objectives and for the results of the BRFSS survey for Arizona. Rates are presented for the community and for commercial insurers and AHCCCS, respectively. This report is to be circulated among the participants in the PHVMI 501(c)(3) corporation. A subsequent public report will be limited to results aggregated across payers unless the payers direct us differently.
- Part II: Reports the distribution of adherence rates, by disease category and guideline for selected disease categories, for primary care physicians. These results provide an additional dimension to the community wide results and permit comparisons to the previous results for the CHiR BQI study of primary care physicians in Maricopa County.
- Part III: addresses the question of the extent to which the differences in adherence rates among different physicians can be attributed to differences among the physicians relative to the extent to which the differences in adherence rates are attributable to differences among the physicians' patients.
- The report concludes with a summary of the results.

Although there are overlaps among the three sections, each section includes descriptions of the methods and data used to produce the results reported within the section.

Part I: Adherence to Standards

Introduction

The term “compliance” has, in common usage, been replaced by the term “adherence” to represent a more active role for patients in adherence to recommended regimens of health care, including appropriate use of medications. Adherence has been defined as the “active, voluntary, and collaborative involvement of the patient in a mutually acceptable course of behavior to produce a therapeutic result”. (Meichenbaum & Turk, 1987) We consider physician acceptance and application of practice guidelines to be the other element in determining patient adherence. Not all physicians agree with or follow the standards of care included in the “recommended regimens of care”.

Controlled trials and highly organized experiments can produce high levels of adherence, but significant improvements in adherence rates can only be achieved through changes in day-to-day care in non-experimental settings. The prerequisite for an effective strategy to improve adherence, whatever the strategy, is the creation of objective, believable information on rates of adherence to well established health care standards in day-to-day care in a community. This report compares day-to-day care for more than nine hundred thousand patients in Maricopa County, Arizona, home of America’s fifth largest city.

Methods

This section describes some definitions, the quality measures used to estimate adherence rates, the levels of aggregation used to report the results, and the software used to estimate adherence rates in Part I of the report. It is important to remember that, with few exceptions, the guidelines refer to processes of care rather than the outcomes of care. It is generally assumed that increases in adherence rates improve the outcomes of health care.

The methods used to estimate the multivariate models that estimate the relative influence of patients and physicians on adherence rates are described in Part III of this report.

Quality Measures

The last twenty years have seen the development of measurable practice guidelines by a variety of organizations, including the Ambulatory Quality Alliance (AQA), the National Quality Forum (NQF), the National Committee for Quality Assurance (NCQA) and its Healthcare Effectiveness Data and Information Set (HEDIS). Different subsets of the full array of measures are applied in a variety of ways by reporting agencies in some States and in the construction of national averages.

The quality measures can be divided into five categories namely: *Disease Management, Medication Adherence, Patient Safety, National Standards,* and *Care Patterns.*

Disease Management rules ask if the patient "received the accepted and recommended guideline treatment." These rules are divided into two levels based on the strength of their supporting evidence. The first level requires both a declaration of a necessary guideline based on evidence by recognized professional societies, specialty organizations, or national clearinghouse guidelines and at least one randomized, large, controlled clinical trial while the second level only requires one or the other.

Medication Adherence rules estimate the degree to which a patient is adhering to prescribed clinically relevant medication. For the majority of medications, the literature has not defined a clear threshold of sub-optimal medication adherence. Research studies have used medication adherence thresholds ranging from 70-90%. The thresholds used for the medication adherence rules in this report vary among the rules and are defined in the results as part of the description of the respective rules.

Patient Safety measures, including drug interactions and other adverse effects, are expressed in guidelines published by professional societies, specialty organizations, national guideline clearinghouses and manufacturer's recommendations.

National Standard (NS) measures include the rules endorsed by the NQF and AQA. These measures can be further classified three categories, namely: National HEDIS (NS-H), HEDIS Atypical (NSHA), and AMA (NS-A) measures.

The *Care Pattern* rules are based on guidelines that don't fit in the previous categories. Some of the rules are hybrid measures created as part of the software used in our evaluation.

The categories of conditions and patients for which adherence rates are calculated are described in Table 1. The detailed measures associated with these categories are described in Figure 28 through Figure 42 and Appendix Table A.

Table 1. Categories of Conditions and Patient Inclusion Criteria

Category	Inclusion Criteria
Adenoidectomy	All members that are less than 18 years of age
ADHD, Follow-Up Care for Children Prescribed ADHD Medication (NS)	Children ages 6 to 12 who were prescribed ADHD medication
Adolescent Well-Care Visits (NS)*	Persons 12 - 21 years of age
Alcohol and Other Drug Dependence Treatment (NS)*	Persons 13 years or older who had a drug or alcohol related diagnosis or detoxification encounter
Antidepressant Medication Management (NS)*	Persons age 18 or older with antidepressant medication
Asthma	All asthmatic persons age 5 years or older
Asthma, Use of Appropriate Medications (NS)*	All asthmatic persons 5 to 50 years of age
Atrial Fibrillation	Persons 18 years or older diagnosed with Atrial Fibrillation
Breast Cancer	Females age 18 – 75 years with new or reoccurring Breast Cancer
Breast Cancer Screening (NS)*	Females age 42-69 years
Bronchitis, Acute, Avoidance of Antibiotic Treatment in Adults (NS)*	Persons 18 years to 64 years of age with Acute Bronchitis
Cardiac Surgery (NS)*	Persons 18 years of age or older with a Coronary Artery Bypass Graft
Cerebral Vascular Accident & Transient Cerebral Ischemia	Persons 18 years of age or older with a Cerebral Vascular event
Childhood Immunizations (NS)*	Children 0 to 2 years of age
Chlamydia Screening (NS)*	All sexually active females age 16-24
Cholesterol Management for Patients with Cardiovascular Conditions (NS)*	Persons 18-75 years of age with Ischemic Vascular Disease
Chronic Kidney Disease	Persons 15 years or older with Chronic Kidney Disease
Chronic Obstructive Pulmonary Disease	Persons 40 years of age or older with Chronic Obstructive Pulmonary Disease
Colon Cancer	Persons 18 years or older diagnosed with Colon Cancer
Congestive Heart Failure	Persons that are 18 years or older with Congestive Heart Failure

Category	Inclusion Criteria
Congestive Heart Failure (NS)	Persons that are 18 years or older with Congestive Heart Failure
COPD Exacerbation, Pharmacotherapy Management (NS)*	Persons that are 40 years of age or older with Chronic Obstructive Pulmonary Disease
COPD, Use of Spirometry Testing in Assessment and Diagnosis (NS)*	Persons that are 42 years of age or older with Chronic Obstructive Pulmonary Disease
Coronary Artery Disease	Persons that are 18 years or older with Coronary Artery Disease
Coronary Artery Disease (NS)*	Persons that are 18 years or older with Coronary Artery Disease
Depression	Persons 6 years of age or older with Depression
Diabetes Care (NS)*	Persons 5-75 years of age with Diabetes Mellitus
Diabetes Mellitus	Persons with Diabetes Mellitus
Disease-Modifying Anti-Rheumatic Drug Therapy for Rheumatoid Arthritis (NS)*	Persons 18 years or older with Rheumatoid Arthritis
Emergency Medicine (NS)*	Persons 40 years of age and older who have had Emergency Medicine Service
Epilepsy	Persons 2 years of age or older with Epilepsy
Glaucoma Screening in Older Adults (NS)*	Persons 67 years of age or older with Glaucoma
Hepatitis C	Persons 3 years of age or older with Hepatitis C
High-Risk Medications in the Elderly (NS)*	Persons 65 years of age or older
HIV/AIDS	Persons 2 years of age or older with two or more HIV/AIDS related claims
Hyperlipidemia	Persons 18 years of age or older diagnosed with Hyperlipidemia
Hypertension	Persons 18 years of age or older diagnosed with Hypertension
Influenza Vaccination (NS)*	Persons 51 years of age or older
Low Back Pain, Use of Imaging Studies (NS)*	Persons 18-50 years of age with Lower Back Pain
Mental Illness, Follow-Up After Hospitalization (NS)*	Persons 6 years of age or older hospitalized for mental-illness
Migraine Headache	Persons 6 years of age or older with Migraines
Multiple Sclerosis	Persons 18 years of age or older with Multiple Sclerosis
Osteoporosis Management	Persons 40–85 years of age with Osteoporosis

Category	Inclusion Criteria
Otitis Externa, Acute	Persons 2 years of age and older with acute otitis
Otitis Media, Acute	Children 2 months to 18 years of age with acute otitis
Persistence of Beta-Blocker Treatment after a Heart Attack (NS)*	Persons 18 years of age or older who have had an Acute Myocardial Infarction
Pharyngitis, Appropriate Testing for Children (NS)*	Persons 2-18 years of age with Pharyngitis
Pneumonia, Community-Acquired Bacterial (CAP)	Persons 18 years or older with Bacterial Pneumonia
Postmenopausal Bleeding	All females 50 years of age or older with post-menopausal bleeding
Potentially Harmful Drug-Disease Interactions in the Elderly (NS)*	Persons 65 years of age or older
Pregnancy Management	Females 12 years of age or older with a delivery procedure
Prostate Cancer	Males 18 years of age or older with Prostate Cancer
Rheumatoid Arthritis	Persons 2 years of age or older with Rheumatoid Arthritis
Sinusitis, Acute	Persons 3 years of age or older diagnosed with Acute Sinusitis
Tonsillectomy	Persons 0-20 years of age that had a Tonsillectomy procedure
Tympanostomy Tube Placement	Children 0-11 years of age that had a Tympanostomy Tube Placement procedure
Upper Respiratory Infection (URI), Appropriate Treatment for Children (NS)*	Children 3 months to 18 years of age with an Upper Respiratory Infection
Well-Child Visits in the Third, Fourth, Fifth and Sixth Years of Life (NS)*	Children 3-6 years of age

Software

The comparison of a large number of standards of care for a large population requires a complex array of assumptions and procedures. Based on our experience with the BQI project and the experience of the other five projects with a variety of methods, we selected Symmetry *EBM Connect*® 7.6 as our software of choice. *EBM Connect*®, a product of the Ingenix Corporation, identifies gaps between clinical evidence and health care practice with applications for a variety of health care organizations. (Ingenix, Inc., 2008) *EBM Connect*® compares actual, observed patient care with care indicated by research-based guidelines. (Ingenix, Inc., 2008) Statistical analysis, including the estimation of multivariate models (Part III of this report)

designed to identify some of the influences that lead to adherence or non-adherence with the selected guidelines is accomplished using SAS® for Windows 9.1.3

Part II: The Distribution of Primary Care Physicians by Patient Adherence Rates

Introduction

The average rates of adherence for physicians and their patients among payers or for the community at large are useful measures of typical care in a community. Arithmetic means can, however, be skewed by a relatively few medical practices with patients at either the best or worst adherence rates. Examining variations in adherence rates among physician practices is, therefore, a useful complement to the information that we present on the community as a whole. This report focuses on primary care physicians to permit direct comparisons with the results of the Better Quality Information (BQI) project's results on Medicare patients, which were restricted to primary care physicians.

Methods

We define a primary care physician (PCP) to be a physician with one or more of the following specialties: adolescent medicine, family medicine, family practice, general practice, preventive medicine, geriatric medicine, geriatrics, gerontology, internal medicine, pediatrics, pediatric medicine, osteopathic manipulative medicine. The specialty information is obtained from information submitted to the allopathic and osteopathic licensing agencies and recorded in CHiR's health care workforce data set.

The assignment of responsibility for a patient is a fundamental problem for studies of the effectiveness of care or adherence to clinical guidelines. The obstacle to assigning responsibility for a patient to a physician is that patient care, unlike manufacturing processes, cannot be easily divided into distinct steps with discrete, identifiable outcomes. A typical patient with a chronic condition will, for example, see several different physicians and non-physician health care professionals in the course of treatment, not all of whom are supervised by any one physician. There is, therefore, considerable uncertainty concerning which provider or group of providers should be responsible for the outcomes of care. The several alternative methods of assigning responsibility for the outcomes of care to a provider are all approximations, typically relying on

the share of visits or share of costs attributable to each of the providers in the health care process.

In our previous study of network versus out of network care in three states, patients were assigned to network or non-network based on the relative shares of total health care costs. The threshold was a value reflecting a clear break point in the distribution of costs by provider. The process left some cases that could not be assigned to either of the comparison groups. (Johnson, Baldwin, & Marcus, 1999)

In the BQI project, the six participating organizations used different methods. (Delmarva Foundation for Medical Care, 2008) CHiR assigned patients to physicians using the following criteria:

1. Most recent physical exam or assessment performed by physician, limited to allowed specialties OR
2. The physician within the allowed specialty who performed largest number of evaluation and management type visits OR
3. The physician with the most recent visit is assigned in the event of a tie.

An analysis of the attribution method using a small sample of physicians suggested that the patient to provider attribution worked quite well (over 94% accuracy), except in cases where a physician had affiliated with a practice during the measurement period. (Delmarva Foundation for Medical Care, 2008)

The attribution methodology used in PHMVI is similar to the one used in BQI and is based on the “Treating Physician Attribution” methodology used by the Ingenix Symmetry EBM Connect® software. The specialty codes on claims associated with a patient’s disease condition were used to define physicians as primary care providers. The designations were verified by comparisons with the self reported specialty codes on physician licensing records from the MD and DO licensing boards of Arizona that are part of the CHiR health care workforce data set. Physicians who could not be matched to the licensing data were excluded.

In PHVMI, primary care physicians are assigned responsibility for disease conditions which, in our opinion, permitted reasonable attribution of patients to physicians. The complete set of selected disease treatment groups is described in Table 6.

Table 6. Selected Disease Treatment Groups for Primary Care Physicians

Type of Condition	EBM Case ID	Condition Description
Chronic Condition	100004	Congestive Heart Failure
Chronic Condition	100103	Atrial Fibrillation
Chronic Condition	100311	Diabetes Mellitus
Chronic Condition	100404	Asthma
Chronic Condition	100901	HIV/AIDS
Chronic Condition	101802	Rheumatoid Arthritis
Chronic Condition	102500	Hypertension
Chronic Condition	102600	Coronary Artery Disease
Chronic Condition	103300	Chronic Obstructive Pulmonary Disease
Chronic Condition	103400	Hepatitis C
Chronic Condition	103500	Hyperlipidemia
Chronic Condition	103601	Depression
Chronic Condition	103700	Osteoporosis Management
Chronic Condition	103800	Breast Cancer - Part I
Chronic Condition	104000	Migraine Headache
Chronic Condition	104100	Multiple Sclerosis
Chronic Condition	104200	Chronic Kidney Disease
Chronic Condition	104600	Epilepsy
Chronic Condition	104700	Prostate Cancer - Part I
Chronic Condition	104800	Colon Cancer - Part I
Chronic Condition	104900	Obesity and Overweight
Chronic Condition	105000	Cerebral Vascular Accident & Transient Cerebral Ischemia
Chronic Condition	105100	Inflammatory Bowel Disease
Chronic Condition	105200	Diabetes Care (National Standard)
Chronic Condition	105300	Coronary Artery Disease (National Standard)
Chronic Condition	105500	Asthma, Use of Appropriate Medications (National Standard)
Chronic Condition	105600	Cholesterol Management for Patients with Cardiovascular Conditions (National Standard)
Chronic Condition	105700	Congestive Heart Failure (National Standard)
Chronic Condition	106000	Disease-Modifying Anti-Rheumatic Drug Therapy for Rheumatoid Arthritis (National Standard)
Episodic Condition	200100	ADHD, Follow-Up Care for Children Prescribed ADHD Medication (National Standard)
Episodic Condition	200200	Adenoidectomy
Episodic Condition	200300	Tonsillectomy
Episodic Condition	200400	Tympanostomy Tube Placement
Episodic Condition	200600	Mental Illness, Follow-Up After Hospitalization (National Standard)
Episodic Condition	201000	Low Back Pain, Use of Imaging Studies (National Standard)
Episodic Condition	201100	Pharyngitis, Appropriate Testing for Children (National Standard)
Episodic Condition	201200	Sinusitis, Acute
Episodic Condition	201300	Otitis Media, Acute
Episodic Condition	201400	Postmenopausal Bleeding
Episodic Condition	201500	Pregnancy Management
Episodic Condition	201800	Upper Respiratory Infection (URI), Appropriate Treatment for Children (National Standard)
Episodic Condition	201900	Bronchitis, Acute, Avoidance of Antibiotic Treatment in Adults (National Standard)
Episodic Condition	202000	Antidepressant Medication Management (National Standard)

Type of Condition	EBM Case ID	Condition Description
Episodic Condition	202300	COPD, Use of Spirometry Testing in Assessment and Diagnosis (National Standard)
Episodic Condition	202400	Osteoporosis Management in Women Who Had a Fracture (National Standard)
Episodic Condition	202600	Cardiac Surgery (National Standard)
Episodic Condition	202700	Alcohol and Other Drug Dependence Treatment (National Standard)
Episodic Condition	202800	Emergency Medicine (National Standard)
Episodic Condition	203000	COPD Exacerbation, Pharmacotherapy Management (National Standard)
Episodic Condition	203100	Persistence of Beta-Blocker Treatment after a Heart Attack (National Standard)
Episodic Condition	203200	Otitis Externa, Acute
Episodic Condition	203300	Pneumonia, Community-Acquired Bacterial (CAP)
Preventative Care	300500	Chlamydia Screening (National Standard)
Preventative Care	300700	Breast Cancer Screening (National Standard)

Patients often have multiple conditions. An individual patient could, for example, receive care for asthma, diabetes and hypertension and as a result have up to three different physicians responsible for his or her care. Our focus on primary care physicians is designed to simplify, as much as possible, the patient to physician attribution since a patient with multiple conditions is likely to receive much of the care for all their conditions from their primary care physician, even if they would also make periodic visits to specialists.

In the treating physician model, the number of physical examination and assessment visits, the most recent visit, and the first visit were tabulated by physician for each patient-disease condition for which that physician had submitted a claim. A physician is then assigned responsibility for a patient's disease condition by applying the following criteria and ending the sequence when it is possible to make an attribution:

1. Physician with more than one physical examination or assessment visit for the patient-disease condition.
2. Physician with the most number of professional visits for the patient-disease condition.
3. Physician who had the earliest initiating visit and most recent professional visit for the patient-disease condition.
4. Physician with the most recent professional visit for the patient-disease condition.

If no qualifying physician can be associated with a patient, then that patient's disease condition is excluded from the final physician adherence measurements.

Chronic disease and episodic disease conditions of a patient are assigned to a physician using the treating physician method. The assignment of patients to physicians for preventive screening uses a slightly different approach. Preventative screening procedures are utilized prior to or near the onset of a disease conditions. For this reason, there aren't enough relevant visits to use the prior attribution methodology accurately. To create a comparable methodology the logic used in the treating physician methodology is expanded to physical examinations or assessments for all disease conditions; thus assigning a general PCP to the patient. This general PCP is assigned the responsibility for preventative screening measures. After all possible attributions an adherence percentage is calculated for the physician based on their patients' adherence to the relevant standards. Physicians who were assigned responsibility for less than ten standards of care are excluded from the report to avoid non-representative results that could reflect the limitations of the methods of attribution.

Data

The data on physicians were obtained from both the claims data and a separate physician data set maintained by CHiR with the assistance of the physician licensing agencies. The data set including all physicians with Arizona licenses has been maintained, with the omission of two years in the 1990's, by CHiR since 1991. It includes all the information required for licensing by the allopathic and osteopathic licensing boards plus a set of survey questions, which change over time, collected from those physicians who choose to respond. Response rates in most years average 60% or better. (Johnson, Qiu, Harootunian, & Edge, 2010; Johnson, Wilson, Edge, Qiu, Oliver, & Russell, 2009; Qiu & Johnson, 2009) It is important to remember that the response rate is for the population of physicians with Arizona licenses rather than a sample from that population. Thus, the number of responses is several multiples of the number that would be obtained from a 60% response rate from a sample. The required licensing data include specialties and a number of physician characteristics, such as years of experience and demographic characteristics that could influence adherence rates.

Linking data by provider across the payer sources was challenging in that different provider identifiers were used by each insurer. Therefore, we augmented the available identifiers via UPIN, DEA ID, license numbers, and provider social security numbers, as well as name and

practice location. We also used information from the CHiR health care workforce data set to compensate for some of the limitations of using claims data to identify physicians.

The CHiR health care workforce data were used to identify primary care physicians for some of the comparisons of practice with guidelines in this section. The licensing data were also used to create variables for the models in Part III that relate variations among physician characteristics to variations in adherence rates.

The use of the primary care specialty definitions generated a data set of 3,140 physicians in active practice in Maricopa County. The number of PCPs varies widely among the different disease categories and within disease categories in terms of the number of practice standards that apply to the patients for whom a physician is responsible. Although not universally true, the number of standards that are applied to a particular physician generally positively correlated with the size of a physician's practice.

Results

The results in Figure 43 show the distribution of primary care physicians among categories of adherence rates for all disease groups, guidelines and payers. The results show that adherent patients represent between 70% and 100% of the patients treated by seventy-two percent of the primary care physicians. The aggregation of data across all the dimensions of adherence is a useful technique for summarizing the results, but the results require very careful interpretation to avoid incorrect inferences.

The adherence rates are not, for example, weighted by the numbers of patients or the number of procedures to which the guidelines apply. Thus, a mean adherence rate of, for example, 10% for a group of ten patients is given the same weight as the adherence rate of, for example, 20% for a group of 1,000 patients, yielding an average rate across both groups of 15%. Obviously an improvement equal to one percentage point in the adherence rates of each group generates a much greater patient benefit in the second, larger group of patients. The number of procedures and criteria for which a patient is eligible also vary considerably across diseases. The other limitations in terms of inferences include the fact that the results are not controlled for differences among patients or payers that can influence rates of adherence.

Part II Summary

The results in Part II are consistent with the findings in Part I that the type of health condition is an extremely important influence on adherence rates and, in this instance, on the distribution of physicians according to their patient's rates of adherence.

Although there are wide variations among conditions, it is true that the majority of physicians demonstrate very low adherence rates for patients with mental illness. The result is not surprising since our comparisons are restricted to primary care physicians. The results may also, however, reflect the shortage of ongoing care for persons with mental illness that has been a chronic problem in Maricopa County for many years.

Aside from mental illness, there is no simple summary that can characterize the clustering of physicians by adherence rates because of the wide variations among different conditions. Some of the best results are obtained for the avoidance of practices such as prescribing antibiotics for persons with upper respiratory infections or doing imaging studies for persons with acute low back pain. Although standard tests for patients with diabetes are also among the best results, screening for diabetic retinopathy is the worst case example for the percentage of physicians with patients in the lowest (<40%) adherence rate group.

The results aggregated data for individual physicians by combining the claims data with CHiR's physician workforce data. The use of physician specific data does not, however, provide complete answers as to the reasons for the wide variations in patient adherence rates. Although beyond the scope of this report, a detailed analysis of the results, including a review by clinicians would appear to be a useful next step.

The evaluation of the characteristics of physicians in the lowest adherence rate group in our initial data set revealed an interesting implication for methods of physician profiling, namely that reliance on the specialties in which physicians are trained without consideration of their practice settings and the specialties that they practice has a negative effect on the measurement of adherence rates.

One implication is that comparisons of profiles of patient adherence rates among individual physicians or physician groups can be misleading if the nature of the practice settings are not adequately described. The results presented here show, for example, that the addition of controls for setting and the nature of practice substantially improved average adherence rates

by disproportionately reducing the proportion of physicians with relatively low patient adherence rates. Thus, the results suggest a need to control for practice settings that limit continuity of care as well as for patient and physician characteristics to better craft strategies for improving adherence rates.

The next section of this report contributes to a better understanding of the relative importance of patient and physician characteristics as influences on adherence rates. The results were completed before our tests revealed the problem with settings and specialties. We plan to revise the results in Part III in the future, although we do not expect that the revisions will substantially affect the relative importance of physician and patient characteristics on adherence rates.

Part III: Modeling Influences on Adherence: Physician, Patient & Payer

Introduction

The results in Part I of this report demonstrate that the adherence rates in Maricopa County are, with some important exceptions, below the target values considered to represent quality health care. Part I also reviewed the findings of numerous research studies indicating that progress toward the achievement of higher rates of adherence has been, at best, slow in the United States. The current situation is best described as one in which the potential benefits of improved knowledge concerning effective health care are not well realized.

The overall measures of adherence presented in Part II (Figure 44) presently reflect the joint influences of physician adherence with a published guideline and patient adherence. Thus, a physician might recommend a screening mammogram to all his/her patients age 42-69, but some women might not follow this advice. One of the most fundamental but unanswered questions is: 1) the extent to which the variation in measures of adherence are attributable to differences in the types and behaviors of the patients who are treated by different physicians; and 2) the extent to which the differences are attributable to differences among the physicians in their practices with regard to making recommendations to their patients. A better understanding of the relative contribution of patients and physicians to overall measures of adherence is important because it could affect the choice of strategies designed to improve adherence. A related question is the effect of health insurance reimbursement practices and copayment policies on the adherence of both physicians and patients with recommended care.

This part of the report used multivariate statistical analysis, specifically multilevel modeling, in an attempt to assess the contributions to the variations in adherence rates among physicians of 1) the characteristics and efforts of physicians, 2) the behavior and characteristics of their patients, and 3) coverage and reimbursements by different payers. The data do not permit a direct assessment of physician behaviors with regard to making recommendations, nor do they include patients' perceptions of illness or cultural attitudes. The results include the effects, all else equal, of different payers although specific details on coverage and reimbursement are not measured. Although the results are constrained by the omissions of individual characteristics

and the details of coverage by payer, they include observable characteristics of a very large number of physicians and their patients to begin to distinguish between the influence of physicians and that of their patients in the determination of rates of adherence.

Seventeen patient groups with different conditions were selected for this multivariate analysis. The health conditions were selected based on the prevalence of the chronic condition and the sample size being large enough to provide an estimation of adherence rates. We required each physician to see at least 5 patients with the same condition in order to prevent aberrant cases from skewing our results. In addition to this selection criteria, conditions which had observations from less than 50 patients were also excluded.

Background

Prior research on the association of patient demographic characteristics (i.e., age, sex, ethnicity, marital status and socio-economic status), with adherence, are inconsistent and generally show only small associations. The results range from findings that demographic characteristics are of no importance to those in which they are significant influences on patient adherence. (DiMatteo, Giordani, & Lepper, 2002; Vermeire, Hearnshaw, Van Royen, & Denekens, 2001; Martin, Williams, Haskard, & DiMatteo, 2005) Whether the variations are appropriate reflections of unobserved differences in interactions between patient characteristics and different health conditions or simply the artifacts of different methods is not clear.

There are some consistent findings that a history of depression, perceptions about treatment and illness as well as social support influence adherence. The type and severity of illness also influence adherence. Studies also consistently find patient–physician communication is an important influence on adherence. The odds of a patient adhering have been found to be 2.16 times greater if his or her physician is a good communicator. (Zolnierek & DiMatteo, 2009; Stewart, 1995; DiMatteo, Giordani, Lepper, & Croghan, 2002) These results assume, of course that the physician in question adheres to the recommended practices, and that is not always the case.

The educational attainment of patients has been estimated to increase patient adherence to treatment for asthma, hypertension, and diabetes. In addition, it is suggested that collaborative

efforts can improve adherence to treatments for chronic illness. (Bender & Rand, 2004; Ron, et al., 1994; Ary, Toobert, Wilson, & Glasgow, 1986)

Analysis of individual relationships between patients and physicians and the role of physicians as communicators is important for the development of appropriate strategies to improve adherence. The advantages of small, in depth studies of these relationships is, however, achieved at the cost of limiting inferences to larger groups of physicians and patients. The results presented here gather information from a very large population of physicians and patients and with some information on the effects of insurance coverage, at the cost of omitting exactly the types of information produced by the smaller, more individualized studies. Thus, our results complement to studies of physician-patient communications by distinguishing between physician-driven results and the effects of differences among their patients on adherence rates.

Methods

Since multiple patients are often treated by the same physician, they are likely to have similar adherence rates because of factors such as physician-patient communication patterns; and they are probably similar in some of their characteristics because of geographic patterns of access, insurance coverage and associated characteristics such as education. The correlation of characteristics among patients within a group tends to inflate the measures used to determine whether estimated coefficients are or are not statistically significant.

We select physicians who saw at least five patients for a given condition, thereby removing physicians with so few patients that their familiarity with the relevant standards might not be representative of practice in Maricopa County.

We use a two level or hierarchical statistical model to attempt to study the separate associations of patient and physician variables with adherence. The first level of the model considered the association of differences among the individual patients who were, in aggregate, the patients treated by an individual physician with adherence. Thus, factors relating to the association of patient characteristics with adherence rates are the level 1 (patient) variables. The second part of the model (level 2) assessed differences among physicians with adherence, independent of the effects of the characteristics of their respective patients. Thus, the physician characteristics are the level 2 (physician) variables. The estimates from the model provide information about

the extent to which differences in overall adherence rates are associated with differences among individuals within a group of patients, treated by the same physician, and differences among physicians, independent of the effects of differences among their patients.

The variables used in this model are: physician years of experience, patient age, number of visits by each patient, patient gender, type of insurer, and ethnicity. Physician years of experience, patient age and number of visits by each patient are continuous variables. For these variables, the coefficient represents the expected change in adherence for a one unit change in the continuous variable. Gender, type of insurer and ethnicity are dummy coded variables. For gender, male is coded zero and female is coded 1. As a result, the gender coefficient is the expected change in adherence rates for females versus males. In other words, the coefficient for gender captures the magnitude of the difference in female adherence from the baseline male adherence rate. A coefficient of .01 would suggest that the average female adherence rate for a given condition would be 1% higher. For type of insurer, private is coded zero and public is coded 1. For each of the ethnicity dummy codes, white is coded zero and the commensurate comparison group is coded 1.The interpretation for binary dummy coded variables for type of insurer and ethnicity is the same as for gender; the expected average change in the group coded 1 compared to the group coded zero.

The variable age, gender, ethnicity and years of experience were chosen because past literature had identified them as playing a role in adherence. Although the effect of these demographic variables does not always have clear and consistent effects, they were included here in an attempt to account for as many known sources of variance for which we have data. This will help to determine whether or not adherence is more of an inherent trait or if it can be explained in large part by other variables previously proposed in the literature.

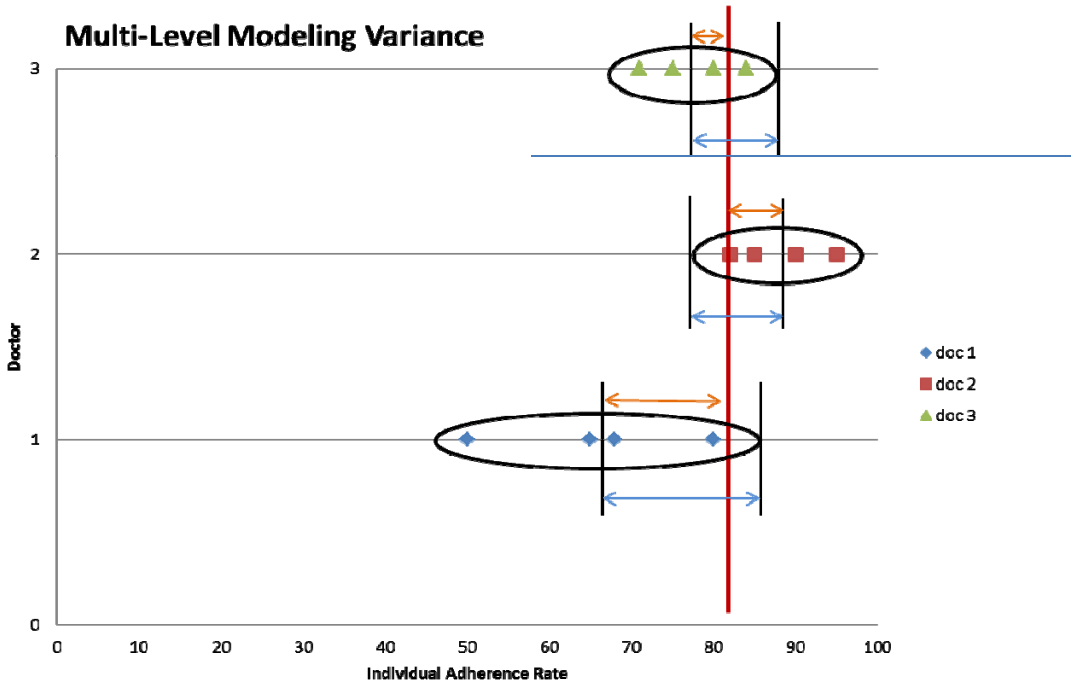
Type of insurer is thought to be a marker variable for a number of other conditions such as socioeconomic status, which have been reported in previous literature to be related to adherence. Furthermore, we found investigating this of substantive interest. The variable number of visits by each patient was chosen in part because chronic versus non-chronic conditions sometimes see differential adherence rates. As a result, this is to some extent a marker for the chronic level of a patient’s condition. In addition, including number of visits covaries out differences in the average adherence rates based on the number of observations

we have for each patient. (DiMatteo, Giordani, Lepper, & Croghan, 2002; Vermeire, Hearnshaw, Van Royen, & Denekens, 2001; Martin, Williams, Haskard, & DiMatteo, 2005)

Despite decades of research on adherence, no clear picture has emerged regarding the expected effect of individual variables across a range of conditions. The effects of the variables included in our model have varying levels and direction of significance across studies and conditions. Although it is of interest to see the effect of these variables, the primary reason for choosing them was to determine the effect of adherence attributable to individuals and physicians. By including variables commonly studied and that have been shown to in some capacity to relate to adherence, when we place them in the full model, we account for variance which is unexplained in our baseline model without predictors. Although, this is not a complete list of the influences on adherence, by looking at the reduction in variance in the full model compared to the baseline model we can get a measure of variance after accounting for this set of predictors.

A graphical example of the measures that we have described is presented in Figure 152. The examples are hypothetical, solely to illustrate the structure of the estimates that are obtained from the hierarchical (multilevel), two level model. Figure 152 shows that an adherence rate for a group or for all patients is influenced by two sets of characteristics, the first of which include individual characteristics such as age, sex, and the number of times they visit the same physician. The second part includes influences such as their physician's communication skills and clinical experience. The effects of the third set of influences on adherence rates, namely differences in coverage and reimbursement among different payers are omitted in the figure for simplicity.

Figure 152. Multi-Level Modeling Variance



In this graph, adherence rates are plotted against individual physicians. The thick red line is the mean adherence rate for all patients. The points within the circles represent the individual patients that together are the patient groups seeing a single physician. So, the mean adherence rate for all patients across all physicians is slightly over 80%, and the patient groups are for physicians 1, 2 and 3, respectively.

The vertical black lines in the center of the circles (one circle for each of the patient groups) are the mean adherence rate for the respective physicians. Thus, the average adherence rate for the patients treated by physician 1 is approximately 65%; for physician 2 it is approximately 90% and so forth. The blue arrows between the physician specific average adherence rate to the vertical black line at the end of the circle is indicating the variation among individual patients within a group of patients treated by the same physician. The average spread or variance across all physicians (e.g. physician 1, 2 and 3) is the level 1 variance. If there was no level 1 or individual patient (level 2 variance), there would be no circle and the patients would have the same adherence rate. The orange arrows between the physician specific average adherence rate and the mean adherence rate across all physicians represent the variance between each physician and the mean for all the physicians.

The magnitude of this difference is represented in Figure 152 by the orange arrows (distance between average adherence of all patients seen by a specific physician and the average adherence rate across all physicians). As physicians play a larger effect on adherence rates, relative to the effects attributable to patients, the orange arrows extend further. Factors such as physician's communication patterns and years of experience influence how their patients adhere, but we do not have data on communication patterns. However, we can measure the separate effects that physician characteristics (level 2) and patient characteristics (level 1) variables have on adherence rates.

Data

The sources of patient, provider, medical, and pharmacy data in this section include three private insurers, namely: Health Net of Arizona, CIGNA and Humana; one public insurer, the Arizona Health Care Cost Containment System (AHCCCS); and allopathic and osteopathic physician licensing data. The data do not provide universal coverage of the population of Maricopa County, but offer information on a very substantial portion of that population at a very detailed level of analysis. This is the same data set used in Part I of this report with the exception that we restrict the data to patients of physicians who see at least five patients with a given condition. The data are limited to the set of health conditions described in Table 7 below. These conditions were selected because they are chronic episodic conditions which provide multiple measures and the ability to sufficiently aggregate into physician level results.

Table 7. Chronic Conditions Studied in Multi-Level Statistical Models Examining Associations of Patient and Physician Variable with Adherence

% Adherent	Condition
56.3	Diabetes Care
88.4	Asthma
35.3	CAD
36.4	CHF
38.6	Cholesterol Mgmt
49.3	DMARD Therapy in RA
37.5	ADHD
77.9	LBP Imaging
32.3	Pharyngitis
80.4	URI
32.4	Bronchitis, Acute
34.7	Depression Med Mgmt
37.5	COPD
38.0	Alcohol Treatment
82.9	Emergency Medicine
35.8	COPD Exacerbation
67.5	Cardiac Surgery

We attempt to show that the influence of patient characteristics on adherence rates, relative to physician characteristics, varies with the types of health care conditions for which patients are treated. The random effects multi-level or hierarchical model is the initial step in the development of a more complex model. For each of the several disease conditions, the model serves to test whether (1) the amount of total variance in adherence rates that is attributable to physician characteristics is sufficient to analyze physician characteristics in more detail or whether a simpler model that considers patient characteristics alone would suffice; or (2) the characteristics of the different patients within a group treated by the same physician are so closely correlated that the correlation within each group will bias the result. This correlation among groups of patients treated by the same physician (level 2) is known as the intra-class correlation or ICC. The ICC is a measure of how similar measurements are to one another when taken from the same group. In this study the ICC measures the correlation between the adherence rates of different patients who see the same physician. The ICC ranges between 0 (no correlation) and 1 (complete correlation). As the ICC increases, we can conclude that there