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Designing Effective Physician Incentives: Assessing the Relationship between Patient Satisfaction and Clinical Quality in an Ambulatory Environment

Tawnya Bosko
Medical University of South Carolina

DESIGNING EFFECTIVE PHYSICIAN INCENTIVES: ASSESSING THE RELATONSHIP BETWEEN PATIENT SATISFACTION AND CLINICAL QUALITY IN AN AMBULATORY ENVIRONMENT

BY

Tawnya Bosko
DHA Candidate, College of Health Professions,
Department of Healthcare Leadership & Management

James S. Zoller, PhD
Chair, Dissertation Committee

Medical University of South Carolina

A doctoral project submitted to the faculty of the Medical University of South Carolina in partial fulfillment of the requirements for the degree
Doctor of Health Administration
in the College of Health Professions

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Approved by:

Chair, Project Committee	James Zoller, PhD	7/22/15 Date
Member, Project Committee	Kathryn Wilson, PhD	7-27-15 Date
Member, Project Committee	Walter Jones, PhD	8/10/15 Date
Dean, College of Health Professions	Lisa Saladin, PhD	8/12/15 Date

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As the United State healthcare system continues to evolve from a reimbursement system based on volume to one based on value, understanding the relationship between physician quality metrics such as patient satisfaction and clinical quality metrics is extremely important. In order to improve value by effectuating behavior change, physician financial incentives must be designed based on desired outcomes. Understanding the relationship between performance indicators and aligning incentives is integral to successfully incentivizing physician behavior change. This study assessed the relationship between patient satisfaction and clinical quality in an ambulatory setting and

determined that they are separate domains, but certain types of clinical quality are identifiable by patients and thus impact satisfaction.

1. INTRODUCTION

1.1 BACKGROUND AND NEED

The United States healthcare delivery system is undergoing significant change as a result of the Patient Protection and Affordable Care Act ("ACA") that was signed into law by President Obama in 2010 (Sommers, 2012). While the ACA has many provisions that impact various parts of the healthcare system, of note is the introduction of accountable care organizations ("ACOs") and other quality based reimbursement structures, which incentivize healthcare providers via a "carrot and stick" approach to keep their patients healthier (Gold, 2014). Whether or not ACOs and revised financial incentive structures will be successful in improving the quality of healthcare provided is yet to be determined. However, the very existence of these changes, and the associated regulations, have created a transformational process whereby the healthcare reimbursement system is evolving from one based on volume (reimbursement for each unit or service provided) to one based on value (reimbursement for keeping patients healthier and/or meeting quality criteria). In general, value is a measure of the output an organization, individual, country or other entity achieves relative to the costs that are incurred to create the output (Porter, 2010). In healthcare, value is typically defined as the overall health outcomes, or quality of health achieved per dollar spent on achieving that outcome (Porter, 2010). It is based on this definition that the United States is often seen as one of the lowest value healthcare systems in the developed world (Davis, Stremikis, Squires, & and Schoen, 2014).In fact, in 2012, the United States spent sixteen point two percent

(16.2%) of its gross domestic product (“GDP”) on healthcare, which ranked first among Organization for Economic Cooperation and Development (“OECD”) countries, yet its average life expectancy in 2011 was 78.4 years, which is below the OECD average and ranks twenty-sixth of thirty-four OECD countries (OECD, 2013). Thus, it is understandable why regulations attempting to improve the value of the United States healthcare system have been enacted.

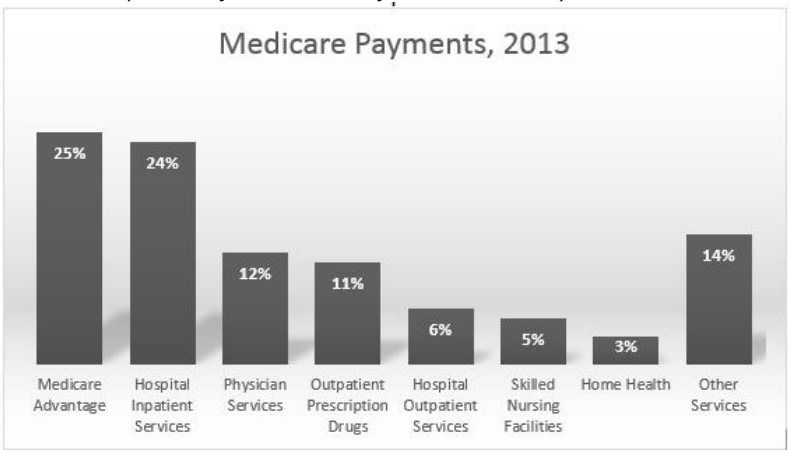
As part of this attempted transition to reimbursement based on value or quality from reimbursement based on volume, financial incentives, physician reimbursement and overall physician compensation are increasingly becoming tied to quality based factors such as patient satisfaction results and performance on clinical measures such as those provided by the healthcare effectiveness data and information set (HEDIS). There is not currently a clear, consistent mechanism by which to measure the quality of healthcare services administered by individual physicians and other healthcare providers, nor is there a definitive answer to which of the employed measures ultimately impact clinical outcomes. However, according to the Medical Group Management Association (“MGMA”), the transition is starting to occur where physicians are witnessing their reimbursement from payers begin to be linked to performance on patient satisfaction results and other clinical performance measures and less based strictly on the volume of healthcare services provided (MGMA, 2014). Further, according to MGMA, primary care physicians (“PCPs”) indicated that 5.96% of their total compensation was linked to quality; and specialists (“SCPs”) noted that an average of 5.70% of their total compensation was driven by performance on

quality measures in 2013 (MGMA, 2014). Performance on patient satisfaction was also cited as a factor of total compensation with PCPs indicating a slight increase in the percentage of compensation tied to patient satisfaction in 2013 over the 2% in 2012; and SCPs stating that an average of 2.31% of their compensation was based on performance on patient satisfaction in 2013 compared to 1.61% that was reported in 2012 (MGMA, 2014). The same survey showed the median compensation for PCPs to be $232,989 and for SCPs to be $402,233, meaning that for PCPs, average compensation for quality was $13,886.14; and for patient satisfaction it was $5824.73. While for SCPs average compensation based on quality was $22,927.28; and patient satisfaction was $9,291.58 (MGMA, 2014). Other surveys have shown that up to 59% of physicians have at least some portion of their compensation tied to patient satisfaction results (Zgierska, 2014).

While there has been significant change in reimbursement to physicians, this change has happened in a relatively short period of time. Many commercial payers base their reimbursement on Medicare, which was enacted in 1965 when President Lyndon B. Johnson signed the Title XVIII Amendment to the 1935 Social Security Act (Sanaz Hariri, 2007). In 2013, Medicare represented $585.7 billion in expenditures, which was approximately 20 percent of the total national health expenditure (“NHE”) for that year (The Center for Medicare and Medicaid Services, 2014). Payments to physicians represented 12% of total Medicare spending, the third highest individual category of spending as shown in Figure 1.

Figure 1

(The Henry J. Kaiser Family Foundation, 2014)



From its beginning in 1965, Medicare reimbursed physicians and hospitals primarily based on the amounts that were charged, in accordance with the methodology of most private insurers at that time, namely Blue Cross and Blue Shield (Wilensky, Medicare Physician Payments: Where We've Been; Where We Need to Go, 2012). Because reimbursement for Medicare and privately insured patients was based on physicians' or hospitals' historical charged amounts, there was an inherent incentive to progressively increase charges in order to maximize revenues (Starr, 1982). It is projected that as a result of allowing physicians to increase reimbursement by increasing their charges, the rate of growth in spending averaged 13 percent annually from 1967 through 1974 (Holtz-Eakin, 2004). The first major change to the Medicare physician reimbursement structure came in 1975, with the implementation of the Medicare Economic Index ("MEI"), which provided the first type of cap on charge based increases (Dutton, 1981). Even with the implementation of the MEI to cap charge increases for physician services, spending continued to rise drastically from volume increases (Wilensky, Medicare Physician Payments: Where We've Been; Where We Need

to Go, 2012). In 1992, the resource based relative value scale ("RBRVS") was implemented as the revised physician fee schedule for Medicare (Sanaz Hariri, 2007). The RBRVS system, developed by researchers at Harvard University School of Public Health, placed greater emphasis on the resources necessary to perform a procedure and intended to correct the discrepancy that existed between payment for interventional and non-interventional services (Sanaz Hariri, 2007). The RBRVS system remains the fundamental reimbursement structure for physicians today.

In almost every year since 2003, Congress has intervened to either grant an increase in physician reimbursement or has acted to freeze reimbursement in order to prevent a decrease that would have been required by the statutory formula associated with the Sustainable Growth Rate ("SGR") (Health Affairs, 2013) with the SGR finally being repealed by the Medicare Access and CHIP Reauthorization Act of 2015 ("MACRA").The increases in spending, failure of the SGR and the recognition that the current reimbursement system does not reward quality are all factors that have contributed to the movement toward a revised, value-based system (Sanghavi, 2013).

Clearly, a revision to the Medicare physician reimbursement structure has been needed for quite some time. However, the push toward reimbursement tied to value as opposed to being tied to volume can largely be attributed to the changing market dynamics from provisions of the ACA. While the vast legislation was meant to provide coverage for more American people, it also contains

significant cost containment and health delivery reform provisions. Specifically, the ACA includes requirements such as

- “Allow providers organized as ACOs that voluntarily meet quality thresholds to share in the cost savings they achieve for the Medicare program. To qualify as an ACO, organizations must agree to be accountable for the overall care of their Medicare beneficiaries, have adequate participation of primary care physicians, define processes to promote evidence-based medicine, report on quality and costs, and coordinate care. (Shared savings program established January 1, 2012)” (The Henry J. Kaiser Family Foundation, 2013)
- “Create an Innovation Center within the Centers for Medicare and Medicaid Services to test, evaluate, and expand in Medicare, Medicaid, and CHIP different payment structures and methodologies to reduce program expenditures while maintaining or improving quality of care. Payment reform models that improve quality and reduce the rate of cost growth could be expanded throughout the Medicare, Medicaid, and CHIP programs. (Effective January 1, 2011)” (The Henry J. Kaiser Family Foundation, 2013).
- “Establish a hospital value-based purchasing program in Medicare to pay hospitals based on performance on quality measures and extend the Medicare physician quality reporting initiative beyond 2010. (Effective October 1, 2012)” (The Henry J. Kaiser Family Foundation, 2013)

The underlying theme of the cost containment and health system performance sections of the ACA is that reimbursement should be tied to quality and outcomes. And, in an historic announcement in early 2015 HHS indicated that it had established the goal and framework to increase payments tied to quality or value through alternative payment models to 30 percent of traditional Medicare payments by the end of 2016, and 50 percent of payments to models such as ACOs or bundled payments by the end of 2018 (The U.S. Department of Health and Human Services, 2015). In addition to the ACO models and bundled payment options, the value based payment incentives and penalties for physicians, some of which began before the ACA but were solidified or made permanent by the ACA, currently include Meaningful Use ("MU") (and the previous electronic prescribing incentive), Physician Quality Reporting System ("PQRS") and the Value Based Payment Modifier ("VBPM") (The Center for Medicare and Medicaid Services, 2015).

- The MU program was initially designed to incentivize providers to implement electronic health records ("EHR" or "EHRs"). There are multiple stages of MU with the maximum incentive that an eligible professional could receive being $44,000 over the five year period (The Center for Medicare and Medicaid Services, 2015). In 2015, the penalty phase of MU was implemented with downward payment adjustments to providers that are eligible but decide not to participate in the MU program of 1-2% depending on their electronic prescribing results (The Center for Medicare and Medicaid Services, 2015). The

maximum penalty for failure to meet MU will reach 5% of the Medicare physician fee schedule amount by 2019 (The Center for Medicare and Medicaid Services, 2014). The detailed MU measures include core measures such as maintaining an active medication list, providing patients with an electronic copy of their health information and providing clinical summaries for patients at each office visit, among others; menu measures such as sending reminders to patients for preventive/follow-up care or submitting data to immunization registries; and clinical quality measures such as blood pressure measurement for hypertension or adult weight screening and follow-up among others (The Center for Medicare and Medicaid Services, 2015). There is a significant component related to patient communication and outreach in addition to systems capabilities and clinical quality.

- The PQRS program is a reporting program that uses a combination of incentive payments and negative payment adjustments to promote reporting of quality information by eligible professionals (“EPs”). The program provides an incentive payment to practices with EPs that satisfactorily report data on quality measures for covered Physician Fee Schedule (PFS) services furnished to Medicare Part B Fee-for-Service beneficiaries (The Center for Medicare and Medicaid Services, 2015). For 2015, there are 255 measures included in PQRS (The Center for Medicare and Medicaid Services, 2015). Measures come from multiple sources, including those provided by the National

Committee for Quality Assurance's ("NCQA") HEDIS and other medical specialty societies. There are six (6) domains, which include communication and care coordination, community/population health, effective clinical care, efficiency and cost reduction, patient safety; and person and caregiver-centered experience and outcomes (The Center for Medicare and Medicaid Services, 2015). Most practices are required to report nine (9) or more measures across at least three (3) different domains (The Center for Medicare and Medicaid Services, 2015). Some of the requirements vary depending on the size of the group participating; and whether or not the participant is part of an ACO. For those EPs that elect not to participate in PQRS, the penalty in 2015 is 2% of their Medicare PFS.

- The VBPM was instituted in The ACA which "requires that Medicare establish a value-based payment modifier that provides for differential payment under the Medicare PFS based upon the quality of care furnished compared to cost during a performance period. It requires that the Value Modifier be applied to specific physicians and groups of physicians determined as appropriate starting January 1, 2015, and to all physicians and groups of physicians by January 1, 2017. The statute requires the Value Modifier to be budget neutral. Budget neutrality means that, in aggregate, the increased payments to high performing physicians and groups of physicians equal the reduced payments to low performing physicians and groups of physicians" (The

> Center for Medicare and Medicaid Services, 2015). The VBPM is closely linked to PQRS and provides additional incentive or penalty based on PQRS performance and reporting. The VBPM does not apply to participants in a Medicare ACO as they have other financial incentives and reporting requirements that vary from the general physician population (The Center for Medicare and Medicaid Services, 2015).

Under MACRA, these incentive and penalty models were consolidated under the newly created Merit-Based Incentive Payment System (“MIPS”) beginning in 2019. Additionally, two different tracks were enacted, the MIPS track and the Alternative Payment Models (“APM”) track (The Center for Medicare and Medicaid Services, 2015). MIPS is a budget neutral model that has incentives for EHR (meaningful use measures) weighted at 25%, Quality (PQRS measures) weighted at 30%, Resource Use (Cost measures) weighted at 30%, and Clinical Improvement (care coordination, patient satisfaction and access measures) weighted at 15% (The Center for Medicare and Medicaid Services, 2015). Physicians may opt out of MIPS if they opt for the APM track that requires participation in two-sided risk based models, quality measurement and potentially Patient Centered Medical Home (“PCMH”) (The Center for Medicare and Medicaid Services, 2015). The trend in reimbursement for physician services is clearly in the direction of reimbursement and incentives tied to clinical quality, patient satisfaction and overall cost control; and incentives are being enacted with the intent of changing physician behaviors.

There has been significant research as to the impact of financial incentives on improving quality in healthcare. For example, a study of the Premier Hospital Quality Incentive Demonstration project found that hospitals in the demonstration initially showed positive improvements in quality compared to a control group. However, the effects did not last, and at the five-year point of the demonstration, there were no significant differences in performance scores between participating hospitals and the comparison group of hospitals (Werner, 2011). However, other studies have demonstrated different results. Researchers at Dartmouth College and the National Bureau for Economic Research ("NBER") assessed results of the Medicare Physician Group Practice Demonstration, a pilot project put forth by the Center for Medicare and Medicaid Services ("CMS") that ran from 2005 to 2010. In the pilot program, physicians from ten large practices received bonuses for meeting lower cost growth than local controls and for meeting quality targets (Colla, 2012). The study showed an improvement in quality but a less significant impact on the growth of spending (Colla, 2012).

The healthcare industry is composed of many financial incentives, oftentimes competing, including the manner in which physicians are paid, the reimbursement weights for certain services; and in the ways health insurance coverage, co-payments, and deductibles are structured for patients, among others (Loewenstein, 2012). While the literature remains mixed as to the impact of financial incentives on transforming physician behavior related to quality improvement and administrative processes (Health Affairs: Health Policy Briefs, 2012), economic theory would suggest that individuals, including physicians, are

self-interested utility maximizers and would respond to financial incentives (Loewenstein, 2012). Additionally, behavioral economics tells us that in certain cases, individuals lack information to make rational decisions, and at other times they appear to act contrary to their own known interests, such as when individuals overeat, decline to take a medication, or opt not to wear seat belts (Loewenstein, 2012).

Following the logic that physicians will respond to financial incentives, many experts remain critical of performance incentives tied to patient satisfaction because the things that "satisfy" patients may not be in their best interest (Pho, 2012). An often cited example is that of antibiotics or pain medications (Sonnenberg, 2014). In both instances, there is information asymmetry between the physician and the patient. The patient may think they "need" antibiotics, or they may "want" pain medications, but neither may be the best clinical practice depending on the situation. Physicians have the information to make the best determination, but patient satisfaction results could be harmed and ultimately their compensation impacted if they deviate from what the patient desires.

The topic of information asymmetry and uncertainty in healthcare is not new. In Kenneth Arrow's seminal paper *Uncertainty and the Welfare Economics of Medical Care* (1963) he explained that "uncertainty as to the quality of the product is perhaps more intense here (medical care industry) than in any other important commodity" (p. 951) (Arrow, 1963). Physicians are our most educated and highly trained medical professionals, thereby creating an information asymmetry between physicians and patients. While it is understood that this

information asymmetry may vary across physician-patient relationships, generally speaking, it may be difficult for patients to assess the quality of the medical care that they receive from a physician due to the inherent uncertainty related to information asymmetry. It has been shown that when information regarding quality isn't available before consumers make a purchase, quality may deteriorate to the lowest level in the market (Akerlof, 1970). Basically, (Akerlof, 1970) showed that since purchasers cannot tell the difference between high quality used cars and lemons (poor quality used cars), all used cars sell for the same price, regardless of quality (Haas-Wilson, 2001). Accordingly, owners of high quality used cars have no incentive to sell their cars and only low quality used cars (lemons) are sold (Haas-Wilson, 2001). Luckily, we have not witnessed this sort of "race to the bottom" with regard to physician services, primarily because in the market for physician services, quality is at least partially endogenous and physicians have control over the quality of service that they sell; and patients can obtain some information about quality of a physician, or at least perceived signals of quality such as word-of-mouth referrals (Haas-Wilson, 2001). Over time, however, signals of quality can become ineffective (Haas-Wilson, 2001). Since Arrow's time, access to medical information has expanded significantly, primarily due to the internet. It is hoped that improved access to medical information could generate more informed healthcare consumers who are able to select a physician offering the lowest quality-adjusted prices (Haas-Wilson, 2001).

1.2 PROBLEM STATEMENT

The ACA has put forth multiple policy changes designed to change healthcare provider behavior. Specifically, hospitals are already experiencing Medicare reimbursement tied to patient satisfaction results; and Medicare physician reimbursement is directly impacted by patient satisfaction results as well. Commercial payers are at varying stages of factoring patient satisfaction into reimbursement models. Additionally, various quality measures have been incorporated into physician compensation and reimbursement, most often measures related to performance on HEDIS. Because there is not a common methodology for measuring patient satisfaction or defining quality, there is limited data that assesses the relationship between patient satisfaction and quality of care provided by physicians in the ambulatory setting. It is not known whether clinical, technical quality (as measured by described indicators) is a determinant of patient satisfaction. Thus, it is difficult to develop appropriate financial incentives when the implications are not fully understood. This study's objective is to assess the association between patient satisfaction and physician clinical quality, specifically whether patient satisfaction results are a signal for physician quality and whether performance on quality measures is a predictor of overall patient satisfaction.

1.3 RESEARCH QUESTIONS AND RESEARCH HYPOTHESES

Are patients able to recognize clinical technical quality and thus they are more satisfied with physicians that perform better on quality metrics? Or, are patient satisfaction and clinical quality unrelated measures? Our hypotheses are as follows:

Hypothesis 1: There is no relationship between patient satisfaction scores and physician performance on global quality metrics.

Hypothesis 2: There is no relationship between patient satisfaction scores and physician performance on clinical metrics related to antibiotic prescribing practice.

Hypothesis 3: There is no relationship between patient satisfaction scores and physician performance on preventive healthcare quality metrics.

Hypothesis 4: There is no relationship between patient satisfaction scores and physician performance on chronic disease management metrics.

Hypothesis 5: There is no relationship between patient satisfaction scores and physician generic prescribing practice metrics.

Hypothesis 6: There is no relationship between patient satisfaction scores and physician performance on vaccine related healthcare quality metrics.

1.4 INTENDED POPULATION

Assessing this relationship will help to determine whether there is congruence between quality performance and patient perceived quality in the way of satisfaction and therefore provide insight to appropriate financial incentive structures for physicians. Ultimately, by more clearly understanding the relationship between patient satisfaction and physician clinical quality, more informed policy decisions could be made to incentivize appropriate behavior. This information could be useful to payers, provider organizations and policy makers charged with designing complex reimbursement to change the current healthcare system.

2. LITERATURE REVIEW

2.1 PHYSICIAN COMPENSATION AND INCENTIVES

In total physician penalties related to quality and performance will reach 7-9% of the Medicare PFS depending on group size by 2017 (The Center for Medicare and Medicaid Services, 2015). These incentive and penalty programs are designed based on the general underlying microeconomic theory that physicians are profit maximizers and thus will respond to incentives (Pauly, 1978). It has been shown that physicians dictate quantity and specifically, the treatment that the patient requires and often make this decision based on factors that affect the physician (McGuire T. , 2000). After controlling for normal demand-side variables, including demand-price, income and clinical need, supply of care variables including price, physician attitudes and partnership incentives directly influence what happens to the patient in terms of treatment (Gaynor, 1995). In fact, the discussion of the impact that financial incentives have on physician behavior has been widely debated and investigated both in economics and healthcare related disciplines (Shafrin J. , 2010).

Determining whether physicians are perfect agents for their patients, meaning they make medical decisions solely based on what is best for the patient; or whether physicians act as “homo economicus”, meaning they are strict profit maximizers is integral to the discussion of incentives (Shafrin J. , 2011). The most recognized study on the impact of financial incentives on medical services is the RAND Health Insurance Experiment (“HIE”). The original purpose

of the HIE was to assess how much more medical care people would use if it was free and what the consequences for their health were (RAND Health, 2015). However, a sub-part of the study randomly assigned households to Fee-For-Service ("FFS") and capitated plans, allowing research on reimbursement methodologies and healthcare utilization. Manning, et al (1987) showed that members of capitated plans had 72% of the total expenditures of members in FFS plans (Manning, 1987). Other studies have supported these results (Hickson, 1987) (Shen, 2004). Shafrin (2010) showed that when surgeons are compensated on a FFS basis as opposed to capitation, surgical rates were 78% higher, even after controlling for adverse selection. These studies provide evidence that financial incentives influence physician behavior, however, the available studies focus on the mechanism of reimbursement, i.e. fee-for-service or capitation versus incentives directed at certain quality metrics or service indicators.

The overall analysis and understanding of physician payment is covered within the economic literature on contracts and incentives, referred to as agency theory (Milgrom, 1992). The underpinning of incentive contracts is that the effort put forth by an individual or organization (the principal) is used to induce and incentivize behaviors by another individual or organization (the agent) (Robinson, 2001). The various methods of payment to physicians represent a form of an incentive contract which links the physician to a larger organization such as a medical group, insurance company or other employer (hospital, etc.) (Robinson, 2001). There are three main categories of physician reimbursement, each setting

up their own incentives for physician behavior (Robinson, 2001). The three main categories are fee-for-service (retrospective), capitation (prospective) and salary (Robinson, 2001). As previously indicated, Medicare reimburses for physician services largely on a fee-for-service basis, as do many commercial payers. However, as the healthcare system has evolved, various forms of blended reimbursement and compensation methodologies have developed, but fee-for-service has remained a dominant method (Robinson, 2001).

The structure of physician reimbursement and compensation is complex and the failures of the available core methodologies have led to increasing hybrid based methodologies such as those that attempt to reward quality in terms of outcomes and patient experience or satisfaction. The focus is around the structure of payment which links compensation with measures of performance (Robinson, 2001) with the ultimate goal of changing physician behavior to improve overall healthcare value. According to Robinson (2001, p. 155-156) there are four distinctive physician behaviors that revised payment methodologies attempt to persuade:

- Physician Productivity and Patient Service: Healthcare is ultimately a service industry, which promotes physicians being productive in order to provide the service and to be attentive to the needs and desires of individual patients. Fee-for-service best incentivizes these behaviors.

- Risk Acceptance: Physicians should accept and care for the sickest patients just as they do the well patients. They should not be encouraged to avoid the chronically ill, time intensive patients. Fee-for-service also performs well in incenting these behaviors.
- Efficiency and Appropriate Scope of Practice: Physicians should be encouraged to consider cost-benefit and balance their recommendations considering the most appropriate service in the most appropriate location dependent on patient needs. Efficiency measures would not support over or under utilization. Fee-for service and capitation each have their strengths and weaknesses in this regard, fee-for-service encouraging supplier-induced demand and capitation promoting the right care at the right time and location, but also encouraging under-utilization.
- Cooperation, Evidence-Based Medicine and Outcomes: The US Healthcare system is fragmented, lacks communication and integration. Physicians should be encouraged to collaborate, coordinate care and focus on evidence-based medicine to promote optimal clinical outcomes. Fee-for-service does not compensate for these types of activities, thus making it counterproductive, and capitation offers some potential for focusing on “epidemiological patterns of illness” and resource conservation, but falls short of encouraging physician collaboration and integration.

Research on the implications of reimbursing physicians based on quality metrics is a newer concept and is much more limited. Flodgren, et al (2011) found that financial incentives were ineffective in improving compliance with guidelines and that “target payments and bonuses” did not improve compliance with guidelines (Flodgren, 2011). Scott, et al (2011) showed that evidence on the use of financial incentives as it related to improvements in the quality of primary care was inconclusive (Scott, 2011). Still others have shown that results are mixed, specifically that with regard to impact of pay for performance on clinical effectiveness, there is a range from negative or no effect to positive effect, dependent on the measure and program (Van Herck, 2010). Christianson (2007) also showed mixed results with limited evidence to support financial incentives targeted at improving quality but a few significant impacts were reported (Christianson, 2007). Others in the field of behavioral economics have shown that financial rewards can undermine motivation and have a detrimental impact on performance when the task is cognitively complex, ultimately suggesting that pay-for-performance programs may have an unintended negative consequence (Himmelstein, 2014). Li, et al (2014) found a moderate response to financial incentives and that physicians responded to financial incentives for certain services (such as pap smears, mammograms, colorectal cancer screening and senior flu shots) but not for others (toddler immunizations) and recommended that financial incentives designed to improve quality performance proceed with caution (Li, 2014).

2.2 ASYMMETRIC INFORMATION

In addition to the financial incentives and penalties that are hoped to change physician behavior in order to drive changes in healthcare delivery, CMS and many commercial payers have instituted transparency of the available pricing and performance information. Specifically, CMS has implemented its Hospital Compare (http://www.medicare.gov/hospitalcompare/search.html) and Physician Compare (http://www.medicare.gov/physiciancompare/search.html) websites, which allows consumers (patients) to view information on certain quality and cost measures across providers. Figure 2 shows an example of a clinical measure and patient satisfaction result for a selected Medicare ACO from the physician compare website. Reporting requirements, and thus data availability, differ depending on whether or not a physician participates in a Medicare ACO, but information on the MU program and PQRS participation is generally available via the Physician Compare website for all physicians.

Figure 2

(The Center for Medicare and Medicaid Services, 2015)

Quality Measure	Performance Rate
Hemoglobin A1c Control (HbAlc) (< 8 percent) Percentage of patients ages 18 to 75 years of age with diabetes mellitus who had HbA1c < 8.0 percent.	60%
Patients' Rating of Doctor Using any number from 0 to 10, where 0 is the worst provider possible and 10 is the best provider possible, what number would you use to rate this provider?	94%

Transparency of information related to price and quality is extremely important in order for the market to function properly. In microeconomics, it is typically assumed that there is perfect information in the market being assessed. By perfect information, economists mean that the consumers and producers of a product or service each have complete information on the price and quality of the goods or services under consideration; or that consumers are as well informed about the product or service as the seller (Folland, 2006). Healthcare clearly suffers from a lack of perfect information in that information on price and quality are often unavailable, and that information is often asymmetric. There are many issues related to asymmetric information in the healthcare market, such as adverse selection and agency problems. For purposes of this section, the focus will be on agency related to asymmetric information, specifically those situations where there is asymmetric information between physicians and patients leading to an agency problem.

As initially explained by Arrow (1963, p. 951) “Uncertainty as to the quality of the product is perhaps more intense here than in any other important commodity…because medical knowledge is so complicated, the information possessed by the physician as to the consequences and possibilities of treatment is necessarily very much greater than that of the patient, or at least so it is believed by both parties. Further, both parties are aware of this informational inequality and their relation is colored by this knowledge.” For example, oftentimes in the physician-patient relationship the patient has significantly less information than the physician with regard to their condition, treatment, risk and

benefits of treatments, the cost of treatment and the quality of the provider offering the treatment (Folland, 2006). If a patient seeks the services of a physician for a sore throat, they trust the physician to choose the right course of treatment based on the physician's knowledge of whether the sore throat is caused by a virus or bacteria and other patient specific factors. The patient does not have the information to determine whether or not the physician chose the best course of treatment. This leads to the agency relationship.

By definition, an agency relationship is a relationship "formed whenever a principal (for example, a patient) delegates decision-making authority to another party, the agent. In the physician-patient relationship, the patient (principal) delegates authority to the physician (agent), who in many cases also will be the provider of the recommended services. The motive behind this delegation of authority is that the principals recognize that they are relatively uninformed about the most appropriate decisions to be made and that the deficiency is best resolved by having an informed agent" (Folland, 2006) p. 207. Given this scenario, we would expect a perfect agent to make medical decisions as the patient would make decisions for themselves if they had the same information that the physician has (Folland, 2006). Under this principal-agent structure, the role of the agent (physician) is to maximize the utility of the principal (patient) within available resources (Vick, Agency in Health Care: Examining Patients' Preferences for Attributes of the Doctor-Patient Relationship, 1998). Thus, physicians must include the utility of their patients' desire for quality healthcare into their profit maximizing objective function (McGuire T. , 2000). There

becomes the possibility that these two objectives in a physician's behavioral model (the patients' utility derived from quality healthcare and the physician's utility derived from profit maximization) may be in conflict depending on incentives and payment system structures within the market (Dwyer, 2012). Thus, clarity of the efficiency of final outcomes is often clouded (Dwyer, 2012). The information asymmetry and principal-agent problem between physicians and patients has been recognized as one of the fundamental market failures in healthcare (Smith, 2005), in the words of Arrow (1963), specifically "a failure to reach an optimal state in the sense of Pareto" (947).

Medical care is essentially a market for information, that is, patients are seeking information and advice from physicians that they cannot ascertain on their own (Haas-Wilson, 2001). However, once the information is delivered, there are also questions to be answered about appropriate clinical interventions (Smith, 2005). Pauly (1978) developed a classification system of physician services and explained there are "diagnostic", "prescriptive-informative" and "active-therapeutic" services. Further, he explained "administration of an injection, surgical procedure or a normal delivery" are examples of active-therapeutic care, which is more of a skill than exchange of information (Pauly, 1978). The physician's knowledge and information is, however, necessary as a precursor to any therapeutic treatment. Markets for information have been extensively researched by economists and it is generally recognized that these markets have specific peculiarities that lead to inefficiencies and failures in the market (Haas-Wilson, 2001). These market failures include the fact that "sellers

of information often have difficulty capturing the returns on the information they provide", "buyers of information rarely know the value of the information until after it is purchased and sometimes never at all" and "buyers of a product often have less information about the product's value (price and/or quality) than do its sellers" (Haas-Wilson, 2001) (p.1034). The market failure related to sellers having difficulty capturing returns on information is diminished by the patient specificity of the information, but the issue of lack of quality information prior to purchase is very pronounced in the market for healthcare services (Haas-Wilson, 2001).

It has been shown in the economics literature that in markets where quality information is unavailable prior to purchase, quality is reduced to the lowest level in the market (Akerlof, 1970). Further, (Leland, 1979) showed that quality is reduced to the lowest level in those markets where price is available without cost to the consumer, quality information is unavailable and price and quality are unrelated. Fortunately, this race to the bottom in terms of quality in the market for physician services has not occurred (Haas-Wilson, 2001). This is predominantly because in the market for physician services (as opposed to used cars in the Akerlof model), quality is somewhat endogenous because physician have some control over the quality of the service they are providing (Haas-Wilson, 2001). Further, unlike the Akerlof model where consumers were unable to obtain any information on quality prior to purchase, patients are able to obtain at least limited information on quality through word of mouth, past experiences, physician signaling (Haas-Wilson, 2001), or the increasingly prevalent quality

information made available over the internet. Even before the increasing availability of quality information and scorecards, Arrow recognized that a consumer or patient may not be able to observe whether or not “the physician is using his knowledge to the best advantage” (Arrow, 1963, p. 965) but the consumer can get at least some information about quality before making a purchasing decision through different signals provided by the physician or other sources (Haas-Wilson, 2001). For example, consumers could assume that physicians who work the longest hours, or physicians that it takes longer to gain an appointment with are of higher quality because they have more patients (Haas-Wilson, 2001). Thus work hours or appointment availability could be a signal of quality (Haas-Wilson, 2001). However, the “rat race” dynamic erodes the accuracy of these signals when lower quality physicians recognize that worked hours or appointment availability serve as a signal of quality and they adjust their hours or appointment availability accordingly (Haas-Wilson, 2001). Even with access to at least limited information on quality, it is still possible for quality to diminish (Haas-Wilson, 2001). If high prices are used as a signal of high quality, “dishonest firms” could sell lower quality products at higher than market prices (Cooper, 1984). This phenomena has also been demonstrated by (Chen, 1982) where it was shown that when asymmetric information occurs, even if price and quality information are available, consumers could still be charged higher prices for low quality services (Haas-Wilson, 2001). The key to an efficient market is the availability of reliable data on price and quality. As shown by Klein and Leffler (1981), profit maximizing firms are not likely to cheat with

regard to delivery of high quality services so long as prices are sufficiently above costs (Klein, 1981). Thus, by making information on quality more readily available, it is the goal of healthcare reform policies that more informed consumers will be able to make better decisions as to their choice of healthcare providers, meaning they will select the provider with the lowest quality-adjusted prices (Haas-Wilson, 2001). Another positive outcome of increased transparency of price and quality information is that physicians and other providers will decrease their quality-adjusted prices either by decreasing prices or improving quality (Haas-Wilson, 2001).

2.3 LINK BETWEEN PATIENT SATISFACTION AND CLINICAL QUALITY

Patient satisfaction and patient preferences with their physicians have been extensively studied in the available research from many different aspects. For example, Godager (2012) showed that overall, patients prefer physicians that are similar to themselves in observable characteristics (Godager, 2012). Vick and Scott (1998) showed that the most important attribute to patients was the ability to talk to their doctor, and choosing their own treatment was the least important element (Vick, 1998). Still others have assessed patient's abilities to ascertain technical quality of care and found that "patients' assessments are not a sufficient basis for assessing the technical quality of their primary care" (Rao, 2006) p. 1.

Studies on the relationship between patient satisfaction and physician quality performance are limited, primarily because much of the data is relatively new in the provider realm; and there is a lack of consistent methodology for assessing quality. In support of linking physician payment to patient satisfaction data, studies have shown a relationship between patient perceptions of their physician and overall outcomes such as adherence, satisfaction, trust, health status change and symptom resolution (Franks, 2006). Zolnierek (2009) showed the link between patient satisfaction and improved adherence to physician recommendations (Zolnierek, 2009). On the other hand, researches have shown that patients often request elective services that offer limited benefit based on marketing or other non-medically evident motives; and physicians often honor such requests to improve patient satisfaction (Kravitz, 2005). And, research has shown that in cases where physicians' compensation is more heavily tied to patient satisfaction, physicians are more likely to order elective testing such as advanced imaging services for back pain (Pham, 2009).

Still others have challenged whether or not patients are able to ascertain technical quality, questioning whether emphasizing patient satisfaction is detrimental to clinical treatment decisions. Lembke (2013) explains, "In some institutions, patient-survey ratings can affect physicians' reimbursement and job security. When I asked a physician colleague who regularly treats pain how he deals with the problem of using opioids in patients who he knows are abusing them, he said, "Sometimes I just have to do the right thing and refuse to prescribe them, even if I know they're going to go on Yelp and give me a bad

rating." His "sometimes" seems to imply that at other times he knowingly prescribes opioids to abusers because not doing so would adversely affect his professional standing. If that's the case, he is by no means alone" (Lembke, 2013) p. 36.

One of the most significant recent studies showed that among those patients with the highest patient satisfaction scores, there was a lower odds of visiting the emergency department, a higher odds of inpatient admission, increased total expenditures (relative to less satisfied patients), increased prescription drug expenditures and higher overall mortality (Fenton, 2012). The study by Fenton, et al (2012) assessed the relationship between patient satisfaction and healthcare utilization, expenditures and outcomes as opposed to quality in terms of defined metrics such as HEDIS. Using the Medical Expenditure Panel Survey ("MEPS"), mortality follow-up data and results of the Consumer Assessment of Heath Plans Survey, Fenton, et al (2012) conducted a prospective cohort study in which they estimated the association between patient satisfaction and healthcare utilization based on emergency department visits and inpatient admissions, healthcare expenditures in total and for just prescription drugs and mortality during a period of 3.9 years of follow-up. Fenton, et al (2012) adjusted for patient demographics such as age, sex, race/ethnicity, census region, household income and education level among others. They also considered insurance status of the patient, chronic disease burden, overall health status and availability of a usual source of care. Patient satisfaction results were divided into four quartiles. While the Fenton, et al (2012) study did not have

quality metrics available, it did show that patients in the highest patient satisfaction quartile were less likely to have an emergency room visit, which is a positive effect of patient satisfaction but of concern was that Fenton, et al (2012) also found that more satisfied patients are more likely to have an inpatient admission, have higher total health and prescription drug spending and have an increased risk of mortality.

Similar to the Fenton, et al (2012) study, Sacks, et al (2015) assessed hospital patient satisfaction as it relates to outcomes, however, their study was focused on surgical outcomes (Sacks, 2015). Specifically, they used the American College of Surgeons National Surgical Quality Improvement Project ("ACS NQIP") data along with Medicare inpatient claims, the American Hospital Association annual survey and patient satisfaction results retrieved from Hospital Compare to assess post-operative mortality, major complications, minor complications, failure to rescue and readmissions relationship with patient satisfaction. Sacks, et al (2015) used a global patient satisfaction composite for their dependent variable, aggregating the results from the HCAHPS questions "the number of patients reporting that they would recommend the hospital to family or friends" and "the number of patients giving the hospital a global rating of 9 or 10 out of 10" and assigning hospitals too quartiles based on satisfaction scores (Sacks, 2015 p.E3). The authors did find a statistically significant relationship between patient satisfaction quartile and 30 day mortality as well as failure to rescue and minor complications. Specifically, patients treated at the highest quartile hospitals for patient satisfaction had a 15% lower odds of death

within 30 days, an 18% lower odds of failure to rescue and a 13% lower odds of minor complications (Sacks, 2015). However, the relationships were not always linear. For the findings related to mortality and failure to rescue, “the lowest risk-adjusted rates were noted in the second highest quartile, with slightly higher rates (although not statistically significantly higher) in the highest quartile (Sacks, 2015) p. E5. The study did not show a statistically significant relationship between patient satisfaction and major complications or patient satisfaction and readmissions (Sacks, 2015). The authors concluded that “patient satisfaction may fall into a different domain of heath care quality from other surgical quality metrics” (Sacks, 2015) p. E5.

Other studies have looked more directly at the relationship between patient satisfaction results and clinical technical quality. For example, (Farley, 2014) found that “current evidence demonstrates that patient satisfaction is not a validated proxy for quality” (p. 354). Farley, et al (2014) conducted a literature review to assess the relationship between patient satisfaction and clinical quality. Studies assessed included hospital quality, nursing quality and physician quality among others, for a total of 26 studies reviewed. They ultimately recommended that patient satisfaction not be misinterpreted as a measure of clinical quality (Farley, 2014). (Manary, 2013) also reviewed the available literature to determine whether or not patients’ reports of their satisfaction with healthcare services are reflective of the quality of care. Their findings showed lack of consensus on the relationship between patient satisfaction and clinical quality, but they ultimately concluded that the evidence is suggestive of patient experience measures being

"robust, distinctive indicators of health care quality" (p. 203). However, their focus did not include specific measures of technical quality and identified items such as adherence, overall outcomes and physician-patient communication (Manary, 2013). Additionally, they cited the flaws in using health plan data in some of the previous studies, and point to the challenges with timeliness of surveys provided by health plans or primary care physicians that often conduct surveys on an annual basis as reasoning for the findings that show lack of correlation (Manary, 2013).

(Chang, 2006) used a global rating of patient experience derived from the CAHPS survey to assess the relationship with quality as measured by the Assessing Care of Vulnerable Elders ("ACVE") including 207 quality indicators. They found that better communication was associated with improved patient satisfaction, but that technical quality of care did not show statistically significant association with patient satisfaction global ratings (Chang, 2006). They recommended that "vulnerable elders' global ratings of care not be used as a marker of technical quality of care" (p. 665). (Gandhi, 2002) attempted to create a report card for the ambulatory environment since the concept was prevalent with hospitals and health plans, but not with ambulatory clinics. In doing so, they used HEDIS-like measures such as "clinic function, patient satisfaction, diabetes guideline compliance and asthma guideline compliance" (Gandhi, et al 2002). As part of that process, they assessed the relationship between each of the five domains and found no significant correlation between any of the domains (Gandhi, et al, 2002). Still others have found a relationship between patient

satisfaction and outcomes but noted that “more goes into satisfaction than just outcomes” (Kane, 1997) p. 714. However, their study was limited to surgical patients undergoing a cholecystectomy. Of note, is that this study relied on patient interviews before surgery and at 6 months post-surgery, focusing on health status at the baseline interview and satisfaction as well as health outcomes at the follow-up interview (Kane, 1997).

Another study that focused on surgical quality and hospital care showed that hospitals with higher patient satisfaction scores were those hospitals that provided more efficient care and had higher surgical quality (Tsai, 2015). For their study, they used the Hospital Consumer Assessment of Healthcare Providers and Systems (“HCAHPS”) survey combined with Medicare data on 6 common surgical procedures to measure efficiency and quality, including items such as length of stay, mortality rate and readmission rate (Tsai, 2015). Another study, though not based in the United States, showed an inverse relationship between quality of care and patient satisfaction (Hutchison, 2003). While their study focused on the ambulatory environment, quality was measured by quality of care criteria created by an expert review panel for 8 common acute conditions and responses to satisfaction questionnaires that focused on communication, the physician’s attitude and wait-time (Hutchison, 2003). And, others have reviewed the literature and determined that “research leaves open if patient experiences with received care can serve as a valid quality indicator which should be utilized for reimbursement purposes (Schoenfelder, 2012).

As of the time of this writing, there are two (2) known studies that assess patient satisfaction results as it relates to quality metrics using patient satisfaction survey and HEDIS (quality) results in an ambulatory environment. However, each of these studies uses health plan data for the analysis.

- Schneider, et al (2001) assessed the relationship between health plan enrollee responses to the Consumer Assessment of Health Plans Survey 2.0 and clinical quality using a national sample of 233 Medicare health plans' HEDIS results from 1998. Thus, this study assessed patient satisfaction with their care as it relates to the health plan versus a provider specific survey. Schneider, et al (2001) used five composite measures and four ratings from the Consumer Assessment of Health Plans Survey; and six HEDIS measures for their assessment. Specifically, they grouped the Consumer Assessment of Health Plans Survey results into reporting composites based on the domain that the response most closely represented. The five composites ultimately included: "getting needed care", "getting care quickly", "health plan information and customer service", "courtesy and respect of doctor's office staff" and "communication with providers" (Schneider, et al, 2001) p. 1325. And, elements assessing the doctor-patient relationship as well as enrollees' average ambulatory use were included (Schneider, et al, 2001). The HEDIS health plan performance rates from 1998 included in the study were: the proportion of eligibly women that had their mammogram, the proportion of diabetic patients that had their recommended annual eye

exam, the proportion of patients that had a myocardial infarction (heart attack) that were treated with a beta blocker, the proportion of patients that had a cardiovascular event such as myocardial infarction or cardiac revascularization that had a serum low density lipoprotein (“LDL”) test done, the proportion of patient admitted to the hospital for a mental health condition that had follow-up within 30 days of hospitalization, the proportion of patients diagnosed with a mental health condition that had effective continuation of antidepressant medications (Schneider, et al 2001). The study was performed using heath plan data and perspective, thus its approach differs from this research. Linear regression was used to assess the relationship between specific Consumer Assessment of Health Plans Survey composites and specific HEDIS measure results as opposed to an overall rating of patient satisfaction and quality. The researchers did identify a pattern of associations in the measures that they interpreted as suggestive of the Consumer Assessment of Health Plan Survey (patient satisfaction) and HEDIS (quality) measures being complementary in that two of the Consumer Assessment of Health Plan Survey composites were consistently associated with most HEDIS measures, those being “enrollees’ experience with obtaining needed care” and “enrollees’ experience obtaining information and customer service from their health plan” (Schneider, 2001). However, they also found that the Consumer Assessment of Health Plans Survey global rating as measured by the average score of health plans was not significantly associated with HEDIS

results, showing that patients' overall satisfaction with their care and their health plan were not associated with the health plan's performance on HEDIS results.

- Sequist, et al (2008) assessed the association between clinical quality using HEDIS measures and patient experience using the Ambulatory Care Experiences Survey ("ACES") using data from 373 practice sites and 119 individual primary care physicians in the state of Massachusetts. The authors created three composites from the HEDIS results, two that addressed processes of care (preventive measures and disease management) and one that addressed outcomes (Sequist, et al, 2008). Seven composites from the ACES results were created that included "doctor-patient communication", "clinical team interactions", "health promotion and support", "integration of care", "office staff", "visit-based continuity" and "organizational access" (Sequist, et al, 2008 p. 1787). Their analysis was based on Spearman correlation coefficients where they calculated Spearman correlation coefficients between the HEDIS quality composites and the ACES patient satisfaction composites. Much like Schneider, et al (2001), the data used was obtained from health plan reported information as opposed to provider specific. Data collected in this manner are primarily claims based in nature and/or include some component of medical record review by the health plan (Sequist, et al, 2008). However, Sequist, et al (2008) were able to calculate the HEDIS scores to the individual physician level using the available data. While

Sequist, et al (2008) used a different patient satisfaction survey tool (ACES) than Schneider, et al (2001), they were similar in that they were both health plan administered. The authors showed an “absence of overwhelmingly strong correlations” (Sequist, et al, 2008 p. 1788) between patient satisfaction results and clinical quality metrics and deduced that clinical quality and patient satisfaction “represent sufficiently distinct activities” (Sequist, et al, 2008 p. 1788). And further, they stated “patients using such data to select a primary care physician may need to make trade-offs between technical performance and interpersonal performance” (Sequist, et al, 2008 p. 1788).

Each of these studies ultimately found that satisfaction has limited if any correlation with quality as measured by HEDIS metrics, the most commonly used quality metrics in an ambulatory environment (Fenton, 2012). Overall, data and evidence of the relationship between patient satisfaction results and individual physician performance on quality measures remains ill-defined. Additionally, the only available research has been conducted using health plan data as opposed to provider data. This research extends the currently available research by studying the correlation between patient satisfaction and clinical quality using a physician organization’s quality data set and patient satisfaction results as well as using a more robust set of metrics and physician characteristics and demographics. To our knowledge, this is the first study to use physician organization data in this manner, primarily because of the relative infancy of quality programs within provider organizations.

3. METHODOLOGY

3.1 RESEARCH DESIGN

Data will be obtained from a regional physician hospital organization ("PHO") in northeast Ohio. In 2011, the PHO implemented an integrated EHR across all of its physician practices; and in 2012 it designed and implemented a physician performance bonus program in efforts to begin linking physician reimbursement to quality and patient satisfaction metrics. The PHO consists of approximately 120 physicians across various specialties, with a strong primary care base. For purposes of this study, the PHO's clinical quality database from calendar year 2013 will be utilized and linked with its patient satisfaction database and physician demographics. The clinical quality metrics database includes 27 HEDIS measures that were included in the performance bonus program for calendar year 2013. Patient Satisfaction results include patient responses to the Clinician and Groups ("CG")-CAHPS survey (attached as Exhibit 1) received during the calendar year, 2013 for the PHO physicians. Because the majority of the HEDIS measures included in the PHO's performance bonus program apply exclusively to primary care physicians, the study was limited to family medicine, internal medicine, pediatric and gynecology physicians.

This study's focus is patient satisfaction as expressed by patient ranking of their physician on a scale of 1-10, 10 being the highest and its connection to physician performance on quality metrics as measured by individual physician performance on HEDIS measures as determined by documentation in the EHR.

Previous studies have mostly used claims based data. Patient identifiable information is not provided. Every patient satisfaction response received during calendar year 2013 was included so long as there was corresponding quality performance data for the designated physician. Thus, individual patients may be represented more than one time if they had multiple physician visits within the time period and responded to the patient satisfaction survey more than once. In administration of the patient satisfaction survey, the PHO issued a survey to every patient with an email address on file each time they had an office visit at one of the participating practices. For those patients without an email address on file, a monthly random selection of patients was identified to receive a hard-copy, mailed survey. The results of the electronic surveys and paper surveys were combined by scanning the paper surveys through a character recognition program and including them in the electronic database. Due to the nature of the survey process, those patients that visit the doctor more frequently or see more doctors within the PHO network would have more opportunities to respond to a survey and may be represented in the data more than once. Further, patients that responded more than once may have different results for each response. During the time period, the response rate to the survey was 12%. Though this may be considered a low response rate for surveys in general, relative to patient satisfaction in healthcare, it is slightly above the average of 11% (Scaletta, 2015). Further, a limitation of this data is the fact that the data is limited to physicians affiliated with one organization in northeast Ohio.

3.2 DATA SOURCES

Data from the PHO's patient satisfaction database include patient level responses to the CG-CAHPS 6 point questionnaire during calendar year 2013 by physician with corresponding patient age, gender, race/ethnicity, city of residence and insurance status expressed as Commercial, Medicare, Medicaid or self-pay. City of residence will be used to supplement the database with median household income by city of residence. The database contains 4,617 responses for the time period, of which 3,017 are for PCPs. The overall physician rating is the focus of this research and is reflected by the score on the following question from the CG-CAHPS survey: "Using any number from 1 to 10, where 1 is the worst doctor possible and 10 is the best doctor possible, what number would you use to rate this doctor?"

This data will be paired with the PHO's clinical quality metric database which includes physician performance on designated HEDIS measures. The data is not matched to the patient level, i.e. it cannot be determined whether an individual physician met a certain quality measure for a specific patient that responded to the patient satisfaction results. Thus, the individual physician is the data element that links the patient satisfaction and quality measures. The total physician quality measure score is included for each patient satisfaction response for that physician and performance for each individual quality metric are also available. For the 2013 performance year, there were 27 clinical measures applicable to the PCPs in the PHO. However, not every measure is applicable to every type of PCP. For purposes of this study, PCP is defined as a

physician in the data set with the specialty of Internal Medicine, Family Medicine, Pediatrics or Gynecology. Specialists were excluded due to the scarcity of clinical quality metrics applicable to them. For purposes of exclusions, specialists were defined as any physician with a primary specialty other than Internal Medicine, Family Medicine, Pediatrics or Gynecology.

Table 1 reflects the measures and the thresholds that physicians were required to meet as part of the performance bonus program. The measures were selected based on the PHO's contracts with the three major payers in their market. These measures represent the HEDIS measures that are incorporated into the PHO's payer contracts as quality metrics that they are accountable for under the terms of their pay for performance program. The threshold is payer stipulated based on HEDIS methodologies which includes a regional adjustment (The National Committee for Quality Assurance, 2015). As part of their NCQA accreditation, health plans/payers are required to submit data on their provider network's performance on certain HEDIS measures. Thus, NCQA has a benchmark and threshold system for rating health plan performance. According to NCQA "As described in the Standards and Guidelines for the Accreditation of Health Plans, NCQA requires organizations to submit specified HEDIS measures and CAHPS 5.0H survey results annually. NCQA determines the HEDIS measure portion of the score by comparing organization results with a national benchmark (the 90th percentile of national results) and with regional and national thresholds (the 75th, 50th and 25th percentiles). NCQA uses the higher of two scores: the result based on comparison with the average of the regional and

national thresholds, or the result based on comparison with national thresholds". For example,

Figure 3 represents the NCQA scoring for cervical cancer screening. The payer defined benchmark for this measure for the PHO was 76%, which is above the 50th percentile for the PHO's region (5) and is at the 50th percentile for national (The National Committee for Quality Assurance, 2015). The 90th percentile at the regional level is not reported by NCQA.

Figure 3

Source: NCQA, 2015

***Commercial* Cervical Cancer Screening**

Benchmarks and Thresholds *(updated from 2014)*

HHS REGION	PERCENTILES			
	90th	75th	50th	25th
1	NA	84	81	77
2	NA	80	78	76
3	NA	78	77	74
4	NA	80	77	73
5	NA	79	75	73
6	NA	76	74	69
7	NA	75	73	71
8	NA	78	74	69
9	NA	80	78	72
10	NA	75	72	70
NATIONAL	**82**	**79**	**76**	**72**

Table 1

HEDIS Clinical Quality Metrics

Measure	Population	Requirement	Frequency	Threshold	Specialty
Blood Pressure ("BP") Measurement	All members > 18	Document BP	Annually	63.00%	All
Tobacco Use Status	All members 13+	Document tobacco use status	Annually	76.00%	All
Childhood Immunizations – Measles, Mumps, Rubella	Patients turning 2 in measurement period	MMR immunization	On or before 2nd birthday	61.63%	Pediatrics ("Peds"), Family Practice ("FP")

("MMR")					
Childhood Immunizations - Varicella	Patients turning 2 in measurement period	VZV immunization	On or before 2nd birthday	61.63%	Peds, FP
Well Child Visits	All members 0-18	Age 0-1: At least 5 visits, age 2-18: At least 1 visit	Annually	61.63%	Peds, FP
Appropriate Testing for Children with Pharyngitis	Patients 2-18 years of age with a diagnosis of only pharyngitis (ICD 462)	Children 2–18 years of age diagnosed with pharyngitis and dispensed an antibiotic must have a test for group A streptococcus for the episode	Strep test administered in the 7-day period	63.64%	Peds, FP
Annual Preventive Visit	All members > 18	Annual preventive visit	Annually	50.00%	Internal Medicine ("IM"), FP
Breast Cancer Screening	Females 40-69	Patient had mammogram during year or within the past year	Bi-annually	74.00%	IM, FP, Gynecology ("GYN")
Colorectal Cancer Screening	Patients 50-80	Fecal occult blood (["FOBT"], gFOBT, or iFOBT) test in current year, or flexible sigmoidoscopy in the past 5 years, or double contrast barium enema within the past 5 years, or colonoscopy in the past 10 years	Varies	58.00%	IM, FP
Cervical Cancer Screening	Females 21-64	Pap smear performed	Every 36 months	76.00%	IM, FP, GYN

Appropriate Antibiotic use with Acute Bronchitis	Patients 18-64 who had an outpatient visit with any diagnosis of acute bronchitis (ICD 466)	Patients should not be dispensed a prescription for antibiotic medication on or within 3 days after the Index Episode start date	Within 3 days of episode	63.64%	IM, FP
Diabetes Care - HbA1C	All diabetic members	HbA1C testing on all diabetic patients	Annually	90.00%	IM, FP
Diabetes Care - LDL - C	All diabetic members	LDL-C testing on all diabetic patients	Annually	84.00%	IM, FP
Diabetes Care - Nephropathy Screening	All diabetic members	Nephropathy screening, visit w/nephrologist, ACEI/ARB	Annually	85.00%	IM, FP
Diabetes Care - Eye Exam	All diabetic members	Comprehensive eye exam in measurement year or a negative retinal exam in prior year	Annually	67.86%	IM, FP
Lipid Screening - Cardiac Conditions	Patients with ischemic vascular disease or discharged alive with PCI, CABG, AMI	LDL-C testing on all patients	Annually	63.64%	IM, FP
Annual Monitoring of Persistent Medications: Anticonvulsants	Patients who are treated with Anticonvulsants during the measurement year	Patients have at least 1 serum drug measurement (for the prescribed drug) during the measurement year	Annually	75.00%	IM, FP
Annual Monitoring of Persistent Medications: Digoxin	Patients who are treated with Digoxin during the measurement year	Patients have at least one serum potassium and either a serum creatinine or a BUN test during the measurement	Annually	75.00%	IM, FP

		year			
Annual Monitoring of Persistent Medications: Diuretics	Patients who are treated with diuretics during the measurement year	Patients have at least one serum potassium and either a serum creatinine or a BUN test during the measurement year	Annually	75.00%	IM, FP
Appropriate Asthma Medicines	Patients with persistent asthma. Excludes members with any history of emphysema, chronic obstructive pulmonary disease, cystic fibrosis, and acute respiratory failure.	Patients have at least 1 claim for an asthma controller medication	Annually	63.64%	IM, FP, Peds
Beta Blocker after Acute Myocardial Infarction ("AMI")	Patients hospitalized and discharged with an AMI who do not have a contraindication to beta blockers	Patients need prescription for beta blocker for at least 6 months post discharge	Continually for 6 month period	63.64%	IM, FP
Beta Blocker for Heart Failure	Patients 18 years or older who have been diagnosed with heart failure any time in the past	Patients need prescription for beta blocker	Continually	63.64%	IM, FP

Osteoporosis Management	Females 67+ who suffered a fracture	Perform bone mineral density or prescribe Rx for osteoporosis within 12 months before or 6 months after a fracture	12 months before - 6 months after a fracture	63.64%	IM, FP, Gyn
Glaucoma Screening	Patients age 67 years old older who do not have a diagnosis of glaucoma or glaucoma suspect anytime in the past	Patients need glaucoma screening from an optometrist or ophthalmologist	Every 2 years	70.00%	IM, FP
New Episode of Depression - Acute Phase Treatment	Patients with newly diagnosed depressions who started an antidepress ant	Patients need to remain on antidepressant therapy for at least 84 days in the 114-day period following start of antidepressant	Annually	63.64%	IM, FP
Generic Dispensing Rate	All members	Prescribe medications that come in generic form or document medical necessity of brand medication	N/A	84.00%	All
High-Risk Medications in the Elderly	Patients age 65 and older	Avoid certain drugs with a high-risk of side effects, when there may be safer drug choices	Continually	< 7%	All
Treatment for Children with Upper Respiratory Infection (“URI”)	Children ages 3 months to 18 years who were assessed with URI	Patients should not be dispensed a prescription for antibiotic medication on or within three days after the Index Episode start date	Within 3 days of Episode	63.64%	IM, FP

Physician demographic and productivity factors will be made available from the PHO for linking with the patient satisfaction and clinical quality metrics data. Based on the individual physician, the demographic information will be added to the database. The physician demographic and productivity factors available include: physician age, physician gender, physician race/ethnicity, physician specialty, physician degree (MD/DO), physician medical school ranking, physician board certification status, physician wRVUs for the calendar year 2013 and total visit volume by facility for calendar year 2013. Previous studies have not included physician characteristics in their analysis.

3.3 STUDY SAMPLE

The study sample includes all responses to the PHO issued CG-CAHPS survey that were received in calendar year 2013 where the physician of record had clinical quality performance data available for calendar year 2013 and the physicians' specialty was one of the designated primary care physician specialties. There are a total of 3016 observations, producing a power estimate of 99.99%. This sample was chosen because of the number of observations and extensive quality metrics.

3.4 MEASUREMENT OF VARIABLES

3.4.1 PRIMARY OUTCOME MEASURE

For each model, the primary outcome measure will be the patient rating of physician score as provided on the CG-CAHPS survey. This response is provided on a scale of 1-10, 1 being the worst physician and 10 being the best. The CG-CAHPS survey is a tool created by the Agency for Healthcare Research and Quality ("AHRQ"). Its validity and reliability have been studied and it has

been found that “The CG-CAHPS Adult Survey has acceptable psychometric properties at the individual level and practice site level. The analyses suggest that the survey items are measuring their intended concepts and yield reliable information” (Dyer, 2012). Further, the global rating of the doctor variable has been found to be positively and significantly correlated with the composites of the CG-CAHPS survey (Dyer, 2012). The overall doctor rating question with a scaling of 1-10 is an ordinal variable.

3.4.2 COVARIATES

Covariates will be selected from the available data and will be based on those variables that are perceived to have an impact on patient satisfaction. The primary variables of interest are P4P score (composite of all clinical quality metrics), wRVU, which provides information on how busy the doctor is individually and office visit volume which shows the size and volume of an individual office location. Other covariates were included as controls, specifically those around physician and patient characteristics and demographics. The data set will be supplemented with the medical school ranking for each physician’s medical school as provided by StartClass, which ranks medical schools based on factors such as median Medical College Admissions Test score for admitted students, median grade point average of admitted students, acceptance rate, total enrollment and other factors. Additionally, the median household income of the patients’ city of residence will be included using data from the US Census bureau. The composite performance score on the clinical quality metrics was used as a covariate in model 1 to measure the association between performance

on clinical quality measures and patient satisfaction. The composite score for quality metrics is the average of each individual physician's performance on the measures applicable to their specialty. In model 2, a composite score of the 3 antibiotic related measures will be added as shown in

Table 4 since antibiotic prescribing is often cited as one of the detrimental effects of asymmetric information when physicians' compensation is tied to patient satisfaction. Table 2 reflects the covariates included in model 1 and Table 3 reflects the covariates included in model 2. Models 3-6 will mirror model 2 with the exception of replacing the antibiotic composite with each of the other composite measures as shown in Table 6.

Table 2

Model 1 Variables

Dependent Variable		Patient Related Variables		Physician Related Variables	
Rating of Physician (1-10)	Continuous	Age	Continuous	Age	Continuous
		Gender	Categorical	Gender	Categorical
		Race/Ethnicity	Categorical	Medical School Ranking	Continuous
		Insurance Status	Categorical	Degree	Categorical
		Median Household Income	Continuous	Board Certification Status	Categorical
				Productivity (wRVUs)	Continuous
				Office Visit Volume	Continuous
				Composite Score on Quality Metrics	Continuous

Table 3

Model 2 Variables

Dependent Variable		Patient Related Variables		Physician Related Variables	
Rating of Physician (1-10)	Continuous	Age	Continuous	Age	Continuous
		Gender	Categorical	Gender	Categorical
		Race/Ethnicity	Categorical	Medical School Ranking	Continuous
		Insurance Status	Categorical	Degree	Categorical
		Median Household Income	Continuous	Board Certification Status	Categorical
				Productivity (wRVUs)	Continuous
				Office Visit Volume	Continuous
				Composite Score of the 3 Antibiotic Related Measures	Continuous

3.6 STATISTICAL ANALYSIS

Cross-sectional regression analysis will be conducted using the data from calendar year 2013 assessing the dependent variable (patient satisfaction rating), patient and physician related variables as shown in Table 2 and Table 3 in order to test the null hypotheses. The dependent variable will be the response to “Using any number from 1 to 10, where 1 is the worst doctor possible and 10 is the best doctor possible, what number would you use to rate this doctor?” by doctor from the CG-CAHPS survey. Predictor variables will be assessed by using multiple linear regression models to measure effect. Multiple linear regression model 1 will include the composite score (average of individual scores, equally

weighted) for performance on clinical quality metrics as a predictor variable. This composite score includes all measures applicable to each physician's specialty.

Multiple linear regression model 2 will include the composite score (average of individual scores, equally weighted) for performance on only the 3 clinical quality measures related to antibiotic prescribing as shown in Table 4. Antibiotic prescribing practices are particularly relevant to this analysis because of the issue of asymmetric information. Patients often go to their doctor seeking antibiotics to feel better, but only the physician has the knowledge to determine whether or not an antibiotic will be useful in the patient's treatment plan. Since antibiotics are used for bacterial infections and are not useful in viral infections, the physician must first assess whether the patient has a viral or bacterial infection. If the patient has a virus, an antibiotic is not needed, but there often isn't a solution for the patient other than to "wait it out" and rest. Patients are thus more inclined to prefer an antibiotic as compared to no treatment, particularly since they do not have the knowledge to know whether their condition is viral or bacterial. One of the major criticisms of compensating physicians based on patient satisfaction has to do with this very issue—physicians are incentivized to increase patient satisfaction but the things that improve patient satisfaction, such as receiving antibiotics to help their illness, may not be in their best interest. Physicians are left in a quandary of whether to prescribe an antibiotic when it may not be necessary, but keeps the patient happy versus upsetting the patient and withholding the antibiotic, which is the correct thing to do clinically.

Multiple linear regression models 3-6 will include one of each of the remaining composite scores to assess the impact of each type of quality measure. Specifically, composites will be created for vaccine adherence, antibiotic usage, preventive services, chronic condition management and generic prescribing as delineated in Table 5.

Table 4

Antibiotic Measures

Measure	Population	Requirement	Frequency	Threshold	Specialty
Appropriate Testing for Children with Pharyngitis	Patients 2-18 years of age with a diagnosis of only pharyngitis (ICD 462)	Children 2–18 years of age diagnosed with pharyngitis and dispensed an antibiotic must have a test for group A streptococcus for the episode	Strep test administered in the 7-day period	63.64%	Peds, FP
Appropriate Antibiotic use with Acute Bronchitis	Patients 18-64 who had an outpatient visit with any diagnosis of acute bronchitis (ICD 466)	Patients should not be dispensed a prescription for antibiotic medication on or within 3 days after the Index Episode start date	Within 3 days of episode	63.64%	IM, FP
Treatment for Children with Upper Respiratory Infection (“URI”)	Children ages 3 months to 18 years who were assessed with URI	Patients should not be dispensed a prescription for antibiotic medication on or within three days after the Index Episode start date	Within 3 days of Episode	63.64%	IM, FP

Table 5

Composite Groups

Measure	Composite Group
Appropriate Testing for Children with Pharyngitis	Antibiotics
Appropriate Antibiotic use with Acute Bronchitis	Antibiotics
Treatment for Children with Upper Respiratory Infection (“URI”)	Antibiotics
Diabetes Care - HbA1C	Chronic Condition
Diabetes Care - LDL - C	Chronic Condition
Diabetes Care - Nephropathy Screening	Chronic Condition
Diabetes Care - Eye Exam	Chronic Condition
Lipid Screening - Cardiac Conditions	Chronic Condition
Annual Monitoring of Persistent Medications: Anticonvulsants	Chronic Condition
Annual Monitoring of Persistent Medications: Digoxin	Chronic Condition
Annual Monitoring of Persistent Medications: Diuretics	Chronic Condition
Appropriate Asthma Medicines	Chronic Condition
Beta Blocker after Acute Myocardial Infarction (“AMI”)	Chronic Condition
Beta Blocker for Heart Failure	Chronic Condition
Generic Dispensing Rate	Generics
Blood Pressure (“BP”) Measurement	Preventive
Tobacco Use Status	Preventive
Well Child Visits	Preventive
Annual Preventive Visit	Preventive
Breast Cancer Screening	Preventive
Colorectal Cancer Screening	Preventive
Cervical Cancer Screening	Preventive
Osteoporosis Management	Preventive
Glaucoma Screening	Preventive
Childhood Immunizations – Measles, Mumps, Rubella (“MMR”)	Vaccine
Childhood Immunizations - Varicella	Vaccine

For this analysis, p-values less than .05 will be considered to be of statistical significance.

4. RESULTS

We analyzed between 1849-2944 patient satisfaction observations, depending on the model, along with PCP performance on HEDIS quality metrics from calendar year 2013 for a regional PHO in northeast Ohio using Stata® version 13.1. The mean overall patient satisfaction rating was 9.54 (scale 1-10) and mean overall PCP quality score was 74.74%. There were 44 PCPs represented in the data, 24 osteopathic and 20 allopathic; 15 females and 29 males. Ordinary least squares ("OLS") regression was used to determine whether overall quality or certain quality composites were predictors of patient satisfaction ("DoctorRating"). The mean patient satisfaction score was high and had a very high frequency of ratings of either 9 or 10 (89.1% of respondents rated their doctor using a "9" or "10"). Therefore, transformation of the DoctorRating variable was attempted by grouping scores of 1-4 into one score and retaining scores of 5-10. Using this grouped variable, the models were attempted using ordered probit regression. However, there was not a significant difference in the results between models and the r-squared values were higher using OLS and the ungrouped DoctorRating variable. Thus OLS was used for all models.

In all six models, our null hypothesis was that there is not a relationship between patient satisfaction and the clinical performance metric being tested versus the alternative that there is a relationship between patient satisfaction and performance on the clinical quality metric being tested, though in models 1 and 4 our prediction was that the null hypothesis was true.

4.1 MODEL ONE: OVERALL QUALITY COMPOSITE

We predicted that overall, patients would not be more satisfied with physicians that performed better on clinical quality metrics due to issues of information asymmetry; and that patient satisfaction and clinical quality are distinct, unrelated domains, which represents the null hypothesis in this model that there is no relationship between overall clinical quality and patient satisfaction. Table 6 reflects the results of this model:

Table 6

OLS Results: Overall Quality Score Model- Hypothesis 1

Number of obs:	2944
F(19, 2924):	3.80
Prob > F:	0.0000
R-squared:	0.0310
Root MSE	1.0449

DoctorRating (Patient Satisfaction)		Coef.	Robust HC3 St. Err.	t	P>|t|	95% Conf. Interval	
Quality and Volume	*QualityScore*	-0.003	0.002	-1.310	0.190	-0.006	0.001
	wRVU	-0.000001	0.000018	-0.060	0.952	-0.00004	0.00003
	Visit_Volume	-0.000004	0.000003	-1.480	0.138	-0.00001	0.000001
Physician Characteristics	MD	0.125	0.064	1.950	0.051	-0.001	0.250
	MedicalSchoolRank	0.003	0.007	3.470	0.001	0.001	0.004
	BoardCertStatusNo	-0.092	0.084	-1.090	0.274	-0.257	0.073
	BoardCertStatusEligible	0.040	0.735	0.060	0.956	-1.400	1.481
	ProviderAge	0.001	0.014	0.080	0.939	-0.027	0.029
	Provider_Age^2	-0.00006	0.00014	-0.420	0.672	-0.0003	0.0002
	Provider_Male	0.101	0.067	1.520	0.128	-0.029	0.232
Patient Characteristics	Median_Income_Patient_City	-0.000002	0.000001	-2.630	0.009	-0.000004	-0.000001
	Patient_Male	0.029	0.039	0.730	0.463	-0.048	0.105
	PatientRaceHispanic	0.347	0.139	2.500	0.012	0.075	0.619
	PatientRaceOther	-0.077	0.261	-0.300	0.767	-0.589	0.434
	PatientRaceAfricanAmerican	0.038	0.153	0.250	0.806	-0.263	0.338
	PatientAge	0.008	0.002	5.090	0.000	0.005	0.012
	SelfPay	0.116	0.102	1.140	0.253	-0.083	0.316
	Medicaid	0.124	0.130	0.960	0.339	-0.131	0.379
	Medicare	-0.059	0.050	-1.160	0.246	-0.158	0.040
	Constant	9.088	0.476	19.110	0.000	8.155	10.020

As shown, we did not find a statistically significant relationship between DoctorRating and clinical quality (“QualityScore”) with a p-value of .190 and therefore fail to reject our null hypothesis that the two are unrelated, distinct domains. Additionally, the r-squared value of .0310 shows that only 3.1% of the variance in DoctorRating is predicted by the model. Multiple regression diagnostics were performed and ultimately, the Breusch-Pagan and White’s tests showed evidence of heteroscedasticity in model 1. Because heteroscedasticity was detected in the model, HC3 robust standard errors were used. Control variables that were shown to be significant predictors of patient satisfaction rating include (p-values in parentheses) medical school ranking (.001), median household income of the patient’s city (.009), patient race of Hispanic (.012) and patient age (.000). All statistically significant variables had a positive association with DoctorRating with the exception of median household income of the patient’s city of residence, which is negatively associated with Doctor Rating, meaning that those patients that reside in cities with lower household incomes are more satisfied with their physician overall, after controlling for insurance status, race, age, gender and other factors. However, the coefficient is near zero. The statistically significant and positively correlated variables indicate that patients are more satisfied with physicians that attended a higher ranked medical school, Hispanic patients are more satisfied with their physicians as compared to Caucasian patients and patients’ satisfaction with their physician increases as patients age. Also, being an allopathic physician was not statistically significant at

the .05 level (.051). However, it was statistically significant in other models, indicating a potential relationship with patient satisfaction.

4.2 MODEL TWO: ANTIBIOTIC COMPOSITE

Our second model centered on the detrimental impacts of reimbursing physicians for patient satisfaction. Critics cite prescribing antibiotics as one of the major areas where there is asymmetric information, i.e. the patient desires to be prescribed an antibiotic to cure their condition, but they don't have the knowledge to know whether or not an antibiotic is an effective treatment for their condition- only the physician has this knowledge. And, oftentimes taking an antibiotic can be detrimental to the patient's health and to the general health of the public (antibiotic resistant bacteria). Thus, the argument is that if physicians are incentivized to improve patient satisfaction, they may inappropriately prescribe antibiotics in order to keep patients happy, even though there are negative health consequences. Because there were three HEDIS measures related to antibiotic prescribing practices, we were able to test our hypothesis that there is no relationship between patient satisfaction and performance on antibiotic prescribing measures against the null hypothesis that there is an inverse relationship between antibiotic prescribing practices and patient satisfaction by using the antibiotic prescribing composite ("ABX") as a measure in model two of our analysis. Results of that model are displayed in Table 7.

Table 7

OLS Results: Antibiotics Composite Model- Hypothesis 2

Number of obs: 2787
F(19, 2924): 5.66
Prob > F: 0.0000
R-squared: 0.0374
Adj R-squared 0.0308
Root MSE 1.0634

DoctorRating (Patient Satisfaction)		Coef.	Std. Err.	t	P>|t|	95% Conf. Interval	
Quality and Volume	*ABX*	0.419	0.240	1.750	0.081	-0.052	0.889
	wRVU	-0.00003	0.00002	-1.480	0.139	-0.0001	0.00001
	Visit_Volume	0.00001	0.000003	1.640	0.100	-0.000001	0.00001
Physician Characteristics	MD	0.118	0.000003	1.790	0.074	-0.012	0.248
	MedicalSchoolRank	0.002	0.001	2.330	0.020	0.000	0.003
	BoardCertStatusNo	0.154	0.127	1.210	0.226	-0.957	0.404
	BoardCertStatusEligible	-0.016	0.762	-0.020	0.983	-1.510	1.478
	ProviderAge	-0.026	0.018	-1.430	0.152	-0.061	0.009
	Provider_Age^2	0.0002	0.0002	1.050	0.292	0.000	0.001
	Provider_Male	0.298	0.066	4.520	0.000	0.169	0.427
Patient Characteristics	Median_Income_Patient_City	-0.000002	0.000001	-2.730	0.006	-0.000004	-0.000001
	Patient_Male	0.053	0.042	1.270	0.203	-0.029	0.136
	PatientRaceHispanic	0.413	0.437	0.950	0.344	-0.443	1.269
	PatientRaceOther	-0.063	0.178	-0.350	0.724	-0.412	0.286
	PatientRaceAfricanAmerican	-0.001	0.224	0.000	0.998	-0.441	0.439
	PatientAge	0.009	0.002	5.700	0.000	0.006	0.012
	SelfPay	0.146	0.152	0.960	0.336	-0.151	0.443
	Medicaid	0.157	0.162	0.970	0.334	-0.161	0.475
	Medicare	-0.027	0.053	-0.500	0.618	-0.132	0.078
	Constant	9.112	0.481	18.950	0.000	8.169	10.055

As shown in Table 7, there was not a statistically significant relationship (.081) between patient satisfaction rating and the antibiotic prescribing composite, ABX. Thus, we fail to reject our null hypothesis that there is no relationship between patient satisfaction rating and antibiotic prescribing performance. Based on this study, it appears that antibiotic prescribing practices are not a significant predictor of patient satisfaction. Much like model one,

medical school ranking and patient age remain statistically significant and positive predictors of patient satisfaction, though the coefficient of both is near zero. Also similar to model one, median household income of the patient's city of residence is still statistically significant and negatively associated with patient satisfaction rating in this model. However, the coefficient remains near zero. Unlike model one, physician gender is a statistically significant predictor (.000) of patient satisfaction rating with a positive relationship meaning that patients are more satisfied with male PCPs after controlling for other factors. There was no evidence of heteroscedasticity in this model or any of the following models, so robust standard errors were not used. The adjusted R-squared of this model was .0308, meaning 3.08% of the variance in DoctorRating was predicted by the model.

4.3 MODEL THREE: PREVENTIVE MEASURE COMPOSITE

In our third model, we predicted that patients are more satisfied with physicians that perform better on preventive healthcare quality metrics because preventive reminders serve as a signal of quality by showing interest in the patient's well-being and are less difficult to understand as opposed to our null hypothesis that there is no relationship between performance on preventive measures and patient satisfaction. Table 8 depicts the results of our analysis using the preventive measure composite ("Preventive").

The Preventive composite was not significant at the .05 level (.063). Therefore, we fail to reject the null hypothesis that there is no relationship between preventive measure performance and patient satisfaction. However, as

in models one and two, medical school rank (.003) and patient age (.000) are both statistically significant and positively associated with Preventive. Also like the previous models, median income of the patient's city continues to be statistically significant and negatively associated with patient satisfaction, yet the coefficient is near zero. In this model, as well as model two, provider gender of male (.000) is statistically significant and positively associated with patient satisfaction. Adjusted r-squared for model three was .0310, indicating 3.1% of the variance in DoctorRating is accounted for within the model.

Table 8

OLS Results: Preventive Composite Model- Hypothesis 3

Number of obs:	2787
F(19, 2924):	5.69
Prob > F:	0.0000
R-squared:	0.0376
Adj R-squared	0.0310
Root MSE	1.0633

	DoctorRating (Patient Satisfaction)	Coef.	Std. Err.	t	P>|t|	95% Conf. Interval	
Quality and Volume	*Preventive*	-0.379	0.204	-1.860	0.063	-0.779	0.021
	wRVU	-0.00001	0.00002	-0.500	0.614	-0.00005	0.00003
	Visit_Volume	0.00001	0.000003	1.740	0.082	-0.000001	0.00001
Physician Characteristics	MD	0.123	0.065	1.880	0.060	-0.005	0.251
	MedicalSchoolRank	0.002	0.001	2.950	0.003	0.001	0.004
	BoardCertStatusNo	0.018	0.093	0.190	0.848	-0.165	0.201
	BoardCertStatusEligible	0.036	0.761	0.050	0.962	-1.456	1.528
	ProviderAge	-0.022	0.018	-1.230	0.219	-0.056	0.013
	Provider_Age^2	0.0001	0.0002	0.780	0.434	-0.0002	0.0005
	Provider_Male	0.246	0.067	3.690	0.000	0.115	0.376
Patient Characteristics	Median_Income_Patient_City	-0.000002	0.000001	-2.790	0.005	-0.000004	-0.000001
	Patient_Male	0.051	0.042	1.210	0.226	-0.031	0.133
	PatientRaceHispanic	0.394	0.437	0.900	0.367	-0.462	1.251
	PatientRaceOther	-0.067	0.178	-0.380	0.706	-0.416	0.282
	PatientRaceAfricanAmerican	0.004	0.224	0.020	0.986	-0.436	0.444
	PatientAge	0.008	0.002	5.520	0.000	0.005	0.011
	SelfPay	0.126	0.152	0.830	0.406	-0.172	0.424
	Medicaid	0.158	0.162	0.970	0.330	-0.160	0.476
	Medicare	-0.026	0.053	-0.490	0.627	-0.131	0.079
	Constant	9.542	0.499	19.140	0.000	8.565	10.520

4.4 MODEL FOUR: CHRONIC CARE COMPOSITE

For our fourth model, we predicted that patients are unable to ascertain the technical quality related to chronic condition management and thus there is no relationship between chronic disease management metrics and patient satisfaction, versus the alternative hypothesis that there is a relationship between patient satisfaction and performance on chronic disease metrics. Chronic conditions and their labs, medications and other treatments are more complex to understand and therefore, patients may not be able to determine clinical quality. Table 9 shows the overall results of this model.

For model four, as predicted, we fail to reject our null hypothesis that there is no relationship between performance on chronic care metrics and patient satisfaction. The chronic care composite ("ChronicCare") was not statistically significant (.328) and was thus unrelated to patient satisfaction in this model. Like previous models, medical school rank, provider gender of male and patient age were all statistically significant and positively associated with patient satisfaction; and the median household income of the patient's city was statistically significant and negatively associated with patient satisfaction, though the coefficient remained near zero. Where being an allopathic physicians was borderline significant in previous models, it is now statistically significant in this model (.015) and positively associated with patient satisfaction indicating that patients are more satisfied overall with allopathic PCPs as compared to osteopathic PCPs. Adjusted R-squared remained around 3% as with previous models.

Table 9

OLS Results: Chronic Care Composite Model- Hypothesis 4

Number of obs:	2787
F(19, 2924):	5.55
Prob > F:	0.0000
R-squared:	0.0367
Adj R-squared	0.0301
Root MSE	1.0638

	DoctorRating (Patient Satisfaction)	Coef.	Std. Err.	t	P>|t|	95% Conf. Interval	
Quality and Volume	*ChronicCare*	0.252	0.258	0.980	0.328	-0.253	0.757
	wRVU	-0.00002	0.00002	-1.310	0.190	-0.0001	0.00001
	Visit_Volume	0.00001	0.000003	1.560	0.119	-0.000001	0.00001
Physician Characteristics	MD	0.156	0.064	2.430	0.015	0.030	0.282
	MedicalSchoolRank	0.002	0.001	3.030	0.002	0.008	0.004
	BoardCertStatusNo	0.012	0.094	0.130	0.896	-0.171	0.196
	BoardCertStatusEligible	0.089	0.762	0.120	0.907	-1.404	1.583
	ProviderAge	-0.018	0.018	-0.990	0.321	-0.052	0.017
	Provider_Age^2	0.0001	0.0002	0.660	0.508	-0.0002	0.0004
	Provider_Male	0.283	0.065	4.350	0.000	0.155	0.410
Patient Characteristics	Median_Income_Patient_City	-0.000003	0.000001	-3.080	0.002	-0.000005	-0.000001
	Patient_Male	0.053	0.042	1.260	0.207	-0.029	0.135
	PatientRaceHispanic	0.435	0.437	1.000	0.320	-0.422	1.291
	PatientRaceOther	-0.064	0.178	-0.360	0.720	-0.413	0.285
	PatientRaceAfricanAmerican	0.005	0.224	0.020	0.981	-0.435	0.445
	PatientAge	0.009	0.002	5.650	0.000	0.006	0.012
	SelfPay	0.141	0.152	0.930	0.352	-0.156	0.439
	Medicaid	0.158	0.162	0.970	0.330	-0.160	0.476
	Medicare	-0.028	0.054	-0.530	0.595	-0.133	0.076
	Constant	8.978	0.551	16.290	0.000	7.897	10.059

4.5 MODEL FIVE: GENERIC PRESCRIBING METRIC

Model five in this analysis was unique in that it included the metric for generic prescribing practices. It is the only model that includes a specific metric that directly impacts patients financially outside of office copays and coinsurance. If a physician performs well on the generic prescribing measure, patients' out-of-pockets expenses are reduced and would likely contribute to their overall satisfaction with their PCP. For that reason, we predicted that patients are more satisfied with physicians that perform better on generic prescribing measures

because it reduces their out of pocket expense. Again, our null hypothesis was that there is no relationship between patient satisfaction and generic prescribing. Table 10 reflects the outcomes of that analysis:

Table 10

OLS Results: Generic Prescribing Model- Hypothesis 5

Number of obs:	2787
F(19, 2924):	5.73
Prob > F:	0.0000
R-squared:	0.0378
Adj R-squared	0.0312
Root MSE	1.0631

DoctorRating (Patient Satisfaction)		Coef.	Std. Err.	t	P>|t|	95% Conf. Interval	
Quality and Volume	*Generics*	0.714	0.347	2.060	0.040	0.033	1.395
	wRVU	-0.00002	0.00002	-0.890	0.375	-0.00005	0.00002
	Visit_Volume	0.00001	0.000003	1.860	0.063	-0.0000003	0.00001
Physician Characteristics	MD	0.124	0.065	1.920	0.055	-0.003	0.252
	MedicalSchoolRank	0.002	0.001	3.150	0.002	0.009	0.004
	BoardCertStatusNo	0.009	0.093	0.090	0.926	-0.174	0.191
	BoardCertStatusEligible	-0.003	0.761	0.000	0.996	-1.496	1.489
	ProviderAge	-0.017	0.018	-0.980	0.326	-0.052	0.017
	Provider_Age^2	0.0001	0.0002	0.620	0.535	-0.0002	0.0004
	Provider_Male	0.248	0.066	3.760	0.000	0.119	0.377
Patient Characteristics	Median_Income_Patient_City	-0.000002	0.000001	-2.740	0.006	-0.000004	-0.000001
	Patient_Male	0.050	0.042	1.190	0.236	-0.033	0.132
	PatientRaceHispanic	0.439	0.437	1.010	0.315	-0.417	1.295
	PatientRaceOther	-0.063	0.178	-0.350	0.724	-0.412	0.286
	PatientRaceAfricanAmerican	0.006	0.224	0.030	0.978	-0.434	0.446
	PatientAge	0.008	0.002	5.580	0.000	0.005	0.011
	SelfPay	0.151	0.152	0.990	0.321	-0.147	0.448
	Medicaid	0.157	0.162	0.970	0.332	-0.161	0.476
	Medicare	-0.028	0.053	-0.520	0.604	-0.133	0.077
	Constant	8.517	0.594	14.340	0.000	7.352	9.682

As predicted, generic prescribing (“Generics”) was statistically significant (.040) and positively associated with patient satisfaction, thus we reject our null hypothesis in favor of the alternative hypothesis that patients are more satisfied with physicians that perform better on generic prescribing measures. As in previous models, medical school ranking (.002), provider gender of male (.000)

and patient age (.000) were statistically significant and positively associated with patient satisfaction; and median household income of the patient's city of residence continues to be statistically significant and negatively associated with patient satisfaction, although the coefficient remains near zero. Adjusted R-squared continues to be approximately 3% as in the previous models.

4.6 MODEL SIX: VACCINATION COMPOSITE

In the sixth and final model, we used a composite of the vaccine measures ("Vaccine") to assess the relationship with patient satisfaction. Much like preventive measures, we predicted that patients are more satisfied with physicians that perform better on vaccine related healthcare quality metrics because vaccination reminders and administration serve as a signal of quality by showing interest in the patient's well-being and are less difficult to understand. Again, our null hypothesis was that there is not a relationship between vaccination administration performance and patient satisfaction. Table 11shows the detailed results.

The composite for vaccine was statistically significant (.012) and positively associated with patient satisfaction, meaning patients were more satisfied with PCPs that performed better on vaccine administration quality metrics. Therefore, we reject our null hypothesis that there is no relationship between patient satisfaction and vaccination administration performance in favor of the alternative hypothesis that "patients are more satisfied with physicians that perform better on vaccine related healthcare quality metrics". Because this composite was limited to physicians in the family medicine or pediatrics specialties, each model was re-

run to verify that results were similar in this sample. All significant results were the same as in the broader sample.

Table 11

OLS Results: Vaccination Model- Hypothesis 6

Number of obs:	1849
F(19, 2924):	3.83
Prob > F:	0.0000
R-squared:	0.0383
Adj R-squared	0.0283
Root MSE	1.1501

	DoctorRating (Patient Satisfaction)	Coef.	Std. Err.	t	P>|t|	95% Conf. Interval	
Quality and Volume	*Vaccine*	0.411	0.178	2.320	0.021	0.063	0.760
	wRVU	0.000005	0.00003	0.170	0.862	-0.00005	0.0001
	Visit_Volume	0.00001	0.00001	2.080	0.038	0.000001	0.00002
Physician Characteristics	MD	0.085	0.088	0.970	0.334	-0.087	0.257
	MedicalSchoolRank	0.002	0.001	2.110	0.035	0.0002	0.004
	BoardCertStatusNo	-0.220	0.182	-1.210	0.227	-0.577	0.137
	BoardCertStatusEligible	-0.016	0.826	-0.020	0.985	-1.636	1.605
	ProviderAge	-0.046	0.022	-2.110	0.035	-0.090	-0.003
	Provider_Age^2	-0.0004	0.000	1.720	0.085	-0.00005	0.008
	Provider_Male	0.276	0.087	3.180	0.001	0.106	0.447
Patient Characteristics	Median_Income_Patient_City	-0.000003	0.000001	-3.010	0.003	-0.00001	-0.000001
	Patient_Male	0.021	0.057	0.370	0.710	-0.090	0.132
	PatientRaceHispanic	0.485	0.473	1.020	0.306	-0.090	1.413
	PatientRaceOther	-0.066	0.208	-0.320	0.751	-0.444	0.342
	PatientRaceAfricanAmerican	-0.024	0.255	-0.090	0.925	-0.474	0.476
	PatientAge	0.009	0.002	4.670	0.000	-0.524	0.013
	SelfPay	0.209	0.180	1.160	0.245	0.005	0.562
	Medicaid	0.262	0.198	1.330	0.185	-0.126	0.650
	Medicare	-0.061	0.073	-0.840	0.402	-0.203	0.081
	Constant	9.475	0.612	15.490	0.000	8.275	10.675

As in previous models, medical school rank (.035), provider gender of male (.001) and patient age (.000) were statistically significant and positively associated with patient satisfaction; and median household income of the patient's city of residence (.003) continued to be statistically significant and negatively associated with patient satisfaction. Provider age was statistically

significant in this model, unlike the others and was negatively associated with patient satisfaction. Interestingly, visit volume, meaning the volume of office visits at the location where the patient was seen, was statistically significant in this model and was positively associated with patient satisfaction. The interpretation of this would be that patients are more satisfied with PCPs at higher volume office locations, which is somewhat surprising. However, the coefficient is near zero and the relationship was not positive in any of the other models.

4.7 SUMMARY RESULTS

Table 12 shows summary results for statistical significance across all six models. “N” represents no statistically significant relationship; and “+” or “-” represents the sign of the coefficient where there is a statistically significant relationship. The summary table clearly shows the statistically significant and positive relationship across all six models between medical school rank and patient satisfaction and between patient age and patient satisfaction. These results indicate that patients are more satisfied with PCPs that attended higher ranked medical schools; and patients become more satisfied with their PCP as they age. Additionally, in five of the six models, provider gender of male was statistically significant and positively associated with patient satisfaction, indicating patients are more satisfied with male PCPs as compared to females even after controlling for the gender of the patient and other factors. Patient race of Hispanic (as compared to Caucasian) and visit volume were each statistically significant and positively associated with patient satisfaction, but only in one model each.

Table 12

Summary of Results Across Models

DoctorRating (Patient Satisfaction)		Model						Total
		Quality Score	ABX	Preventive	Chronic Care	Generics	Vaccine	
Quality and Volume	*Global Score or Composite*	N	N	N	N	"+"	"+"	2
	wRVU	N	N	N	N	N	N	0
	Visit_Volume	N	N	N	N	N	"+"	1
Physician Characteristics	MD	N	N	N	"+"	N	N	1
	MedicalSchoolRank	"+"	"+"	"+"	"+"	"+"	"+"	6
	BoardCertStatusNo	N	N	N	N	N	N	0
	BoardCertStatusEligible	N	N	N	N	N	N	0
	ProviderAge	N	N	N	N	N	"-"	1
	Provider_Age^2	N	N	N	N	N	N	0
	Provider_Male	N	"+"	"+"	"+"	"+"	"+"	5
Patient Characteristics	Median_Income_Patient_ City	"-"	"-"	"-"	"-"	"-"	"-"	6
	Patient_Male	N	N	N	N	N	N	0
	PatientRaceHispanic	"+"	N	N	N	N	N	1
	PatientRaceOther	N	N	N	N	N	N	0
	PatientRaceAfricanAmerican	N	N	N	N	N	N	0
	PatientAge	"+"	"+"	"+"	"+"	"+"	"+"	6
	SelfPay	N	N	N	N	N	N	0
	Medicaid	N	N	N	N	N	N	0
	Medicare	N	N	N	N	N	N	0

Likewise, being an allopathic physician was statistically significant and positively associated with patient satisfaction in one model, but it was near the .05 significance in four of the other models (p-values of .051, .074, .060 and .055). Based on the statistical significance in the chronic care model, it would appear that patients may be more satisfied with allopathic PCPs as compared to osteopathic PCP. Interestingly, wRVU which measures individual physician productivity and served as an indicator of how busy each physician was in this model, was not related to patient satisfaction; and as mentioned, visit volume, or the volume of patients seen at a specific office location was weakly significant,

showing significance in only one of six models. We do believe that our results are generalizable to the larger population since we used all satisfaction results received and the blends of PCP specialties, gender and other factors was robust. We have no reason to believe that the quality performance of the sample physicians is any different than the larger population.

5. DISCUSSION

5.1 DISCUSSION OF RESULTS

As with previous studies assessing the relationship between patient satisfaction and clinical quality in an ambulatory setting (Sequist, 2008) (Schneider, 2001), our results are mixed. Unlike (Sequist, 2008) and (Schneider, 2001), our analysis utilized individual patient satisfaction results to the CG-CAHPS survey (as opposed to a health plan CAHPS survey) and used a more robust set of HEDIS measure results extracted from the provider EHR as opposed to claims based data from health plan(s). Both data sets were supplemented with physician and patient demographics and characteristics. In line with our first hypothesis, patient satisfaction global ratings were not found to be statistically significantly related to overall clinical quality as measured by a robust set of HEDIS metrics. Based on this result, it appears that clinical quality and patient satisfaction are separate domains and design of physician financial incentives should take this into account.

Our study did have a low adjust R^2 across all models. This could be related to a number of factors. First, there are certain disciplines such as psychology and other social sciences that often have low adjusted R^2 values because they predominantly assess or predict human behavior (Frost, 2013). In our study, we are trying to predict the drivers of patient satisfaction, which is directly based on human behavior and perception, which could certainly contribute to the low R^2 values. Additionally, we likely haven't captured all of the predictors of patient satisfaction in our model. Since our focus was on the

relationship between clinical quality and patient satisfaction, we did not include other predictors from the patient satisfaction survey that likely impact patient satisfaction such as the patient's evaluation of whether a physician listened closely to them, explained things clearly; or whether the office staff were courteous and helpful, as examples. Including these other aspects of patient satisfaction may improve the overall R^2 but would not offer additional contribution to our assessment of the relationship between clinical quality and patient satisfaction, particularly since previous studies have shown a positive relationship between overall rating of a physician and the other physician related metrics in the CG-CAHPS survey. However, further research should be conducted to explore the other predictors of overall patient satisfaction rating.

Our study contributed significantly to the available research with our analysis and findings assessing the relationship between antibiotic prescribing practices and patient satisfaction. Based on the underlying theory of asymmetric information, it is believed that patients lack the knowledge to understand when they need antibiotics and thus may prefer physicians that perform worse on antibiotic prescribing measures (those that prescribe antibiotics more often when it is not indicated). Physician critics argue that they are incentivized to prescribe antibiotics when not necessary so that they keep patients satisfied. Based on this theory, we hypothesized that the antibiotic composite and patient satisfaction would be negatively related, meaning patients would prefer those physicians that performed worse on antibiotic prescribing measures. However, our analysis showed no statistically significant association between antibiotic prescribing

practices and patient satisfaction. While the two are unrelated, there is not an inverse relationship as critics suspect related to issues of information asymmetry. This information is extremely helpful for guidance in designing effective incentive models and in explaining the usefulness of the measures to physicians.

Likewise, the two composites associated with preventive care and chronic care failed to show a statistically significant relationship to patient satisfaction, indicating again that clinical quality and patient satisfaction are separate, distinct domains. However, we hypothesized that preventive care would show a positive relationship due to preventive reminders serving as a signal of quality. This did not hold true. Upon further consideration, it may be that while preventive reminders serve as a signal for quality, they also include the less desirable testing that patients tend to delay and/or not comply with such as pap smears, mammograms and colonoscopies. Thus, performance on these metrics suffers but does not negatively impact patient satisfaction. Regarding chronic care metrics, we predicted that there would be no relationship between quality and patient satisfaction. Chronic care measures are complex and difficult for patients to understand, making them a challenging signal of quality to patients. Our prediction held true in the analysis, showing no significant relationship between chronic care metric performance and patient satisfaction.

We did identify two quality composites that were significantly related to patient satisfaction—the generic prescribing measure and the vaccine composite. We predicted that each of these measures would have a positive relationship with patient satisfaction based on the theory that generic prescribing directly

impacts patients financially; and, much like preventive measures, vaccine administration would serve as a signal of quality to patients and/or their parents. Unlike the majority of preventive measures, vaccines can be administered directly in the physicians' office, so the quality signal is not offset by delays in testing. Our hypotheses were confirmed in our analysis, generic prescribing performance was positive and statistically significantly associated with patient satisfaction. Further, the vaccine composite was also positive and statistically significantly associated with patient satisfaction.

Though not the focus of our study, several control variables did show repeated statistical significance with patient satisfaction across most or all models-- medical school ranking, provider gender of male, patient age (all positive associations) and median income of the patient's city of residence (negative association). Because physician characteristics such as medical school attended are not normally available in the data sources used for this type of research, the medical school ranking has not been controlled for in previous analyses. Our research showed a positive and statistically significant association between medical school ranking and patient satisfaction across all six of our models. While it is difficult to make inferences about these results, it could be that higher ranked medical programs place more emphasis on training targeted at characteristics that improve patient satisfaction. Further, provider gender of male (as compared to female) was positive and statistically significant across five out of six of our models. This result shows a preference for male PCPs after controlling for other factors. And, patient age was positively associated with

patient satisfaction, indicating that as patients age, they are more satisfied with their PCP. This could be caused by multiple factors, including but not limited to length of time the patient has been seeing their PCP or increasing likelihood of health concerns as patients age. Lastly, median household income of the patient's city of residence was negatively associated with patient satisfaction, meaning that patients who reside in lower income cities are more satisfied with their physicians after controlling for other factors. Of note is that control variables representing how busy the physician or their office location is (wRVU and Office Visit Volume) were not related to patient satisfaction, nor was physician board certification status.

Our results are practically important to those designing financial incentive models for physicians, particularly where patient satisfaction and clinical quality are both involved. It is clear from our analysis that metrics that have a direct financial impact on patients, such as generic prescribing; and metrics that are easy for patients to understand and can be performed directly in the physicians' office are related to patient satisfaction. If an incentive program incorporates both patient satisfaction and clinical quality, those metrics that are related to patient satisfaction (i.e. where the patient is able to ascertain clinical quality) should be left out of incentive models in order to reduce complexity of the models and because patient satisfaction is already impacted by performance on those metrics. Further, for metrics where there is a negative relationship, the incentives may be in conflict, reducing the effectiveness of the incentive. The main concern in terms of negative relationship is often with antibiotics and pain medications.

We were unable to study pain medication prescribing, but the antibiotic concern appears unfounded in our analysis. Additional studies looking at the individual measures as opposed to composites would be helpful to further elucidate which metrics are related to patient satisfaction and thus could be eliminated or handled differently within incentive models due to redundancy or conflict.

5.2 CONCLUSIONS

The majority of our evidence shows that patient satisfaction and clinical quality as measured by HEDIS metrics in an ambulatory setting are unrelated domains of healthcare service. Our study provides patient level satisfaction data and robust, provider based clinical metric performance results. Further, while we have shown that overall patient satisfaction and clinical quality are unrelated, there are certain metrics or groups of metrics that are statistically significant and related to patient satisfaction, specifically generic prescribing and vaccine administration. These metrics that are related to patient satisfaction are different from other quality metrics in that they either 1) directly impact the patient financially (generic prescribing) or 2) are an easily identifiable signal of quality to the patient, i.e. the doctor recommended vaccines to keep the child healthy and the vaccine could be administered in their office the same day. Other, more complex measures are more greatly impacted by asymmetric information and therefore are unrelated to quality.

Additionally, while we conclude that patient satisfaction and clinical quality are separate domains overall, we also have shown that there is not an inverse relationship between patient satisfaction and antibiotic prescribing practices as

often cited by critics of tying physician financial incentives to patient satisfaction results.

Our finding that there is not a relationship between most clinical quality metrics and patient satisfaction is important to the effective design of provider incentives going forward. While both patient satisfaction and clinical quality are important they are mostly separate domains and financial incentives should be structured accordingly. However, there are certain metrics that appear to be related to patient satisfaction. These metrics, such as generic prescribing percentage and vaccine administration could be excluded from incentive programs because their performance is already accounted for in patient satisfaction measurement. On the contrary, if there are metrics that show an inverse relationship, the weight of the clinical quality metric should be increased to offset the impact of the inverse relationship and incentivize quality even at the cost of reduced satisfaction. Further studies that assess the relationship between individual metrics and patient satisfaction should be conducted in order to appropriately incentivize provider behavior.

Overall, our findings show that from a policy perspective, performance incentives may be structured incorrectly. Physician reimbursement and incentive models are being structured and implemented without a clear understanding of their implications. Taking these findings into consideration and including this type of analysis in the design of incentives is important to driving our healthcare system to a more value based structure. Ultimately, policymakers, health plans and provider systems charged with designing physician financial incentives in the

evolving value based system should consider the different domains of healthcare services and align incentives with desired outcomes and behavioral changes.

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APPENDICES

APPENDIX 1: PATIENT SATISFACTION SURVEY

1. **Our records show that you got care from the doctor named above in the last 12 months**

   ☐ *Yes* ☐ *No*

2. **Is this the doctor you usually see if you need a check-up, want advice about a health problem, or get sick or hurt?**

   ☐ *Yes* ☐ *No*

3. **How long have you been going to this doctor?**

   ☐ *Less than 6 months*
   ☐ *At least 6 months but less than 1 year*
   ☐ *At least 1 year but less than 3 years*
   ☐ *At least 3 years but less than 5 years*
   ☐ *5 years or more*

4. **In the last 12 months, how many times did you visit this doctor and get care for yourself?**

   ☐ *None* ☐ *4*
   ☐ *1 time* ☐ *5 to 9*
   ☐ *2* ☐ *10 or more times*
   ☐ *3*

5. **In the last 12 months, did you phone this doctor's office to get an appointment for an illness, injury or condition that needed care right away?**

   ☐ *Yes* ☐ *No*

6. **In the last 12 months, when you phoned this doctor's office to get an appointment for care you needed right away, how often did you get an appointment as soon as you thought needed?**

   ☐ *Never*
   ☐ *Almost Never*
   ☐ *Sometimes*
   ☐ *Usually*
   ☐ *Almost Always*
   ☐ *Always*
   ☐ *Not Applicable*

7. **In the last 12 months, did you make any appointments for a check-up or routine care with this doctor?**

   ☐ *Yes* ☐ *No*

8. **In the last 12 months, when you made an appointment for a check-up or routine care with this doctor, how often did you get an appointment as soon as you thought you needed?**

   ☐ *Never*
   ☐ *Almost Never*
   ☐ *Sometimes*
   ☐ *Usually*
   ☐ *Almost Always*
   ☐ *Always*
   ☐ *Not Applicable*

9. **In the last 12 months, did you phone this doctor's office with a medical question during regular office hours?**

   ☐ *Yes* ☐ *No*

10. **In the last 12 months, when you phoned this doctor's office during regular office hours, how often did you get an answer to your medical question that same day?**

    ☐ *Never*
    ☐ *Almost Never*
    ☐ *Sometimes*
    ☐ *Usually*
    ☐ *Almost Always*
    ☐ *Always*
    ☐ *Not Applicable*

11. **In the last 12 months, did you phone this doctor's office with a medical question after regular office hours?**

    ☐ *Yes* ☐ *No*

12. **In the last 12 months, when you phoned this doctor's office after regular office hours, how often did you get an answer to your medical question as soon as you needed?**

    ☐ *Never*
    ☐ *Almost Never*
    ☐ *Sometimes*
    ☐ *Usually*
    ☐ *Almost Always*
    ☐ *Always*
    ☐ *Not Applicable*

13. **Wait time includes time spent in the waiting room and exam room. In the last 12 months, how often did you see this doctor within 15 minutes of your appointment time?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

14. **In the last 12 months, how often did this doctor explain things in a way that was easy to understand?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

15. **In the last 12 months, how often did this doctor listen carefully to you?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

16. **In the last 12 months, did you talk with this doctor about any health problems or concerns?**

☐ *Yes* ☐ *No*

17. **In the last 12 months, how often did this doctor give you easy to understand instructions about taking care of these health problems or concerns?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

18. **In the last 12 months, how often did this doctor seem to know the important information about your medical history?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

19. **In the last 12 months, how often did this doctor show respect for what you had to say?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

20. **In the last 12 months, how often did this doctor spend enough time with you?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

21. **In the last 12 months, did this doctor order a blood test, x-ray, or other test for you?**

☐ *Yes* ☐ *No*

22. **In the last 12 months, when this doctor ordered a blood test, x-ray, or other test for you, how often did someone from this doctor's office follow up to give you those results?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

23. **Using any number from 1 to 10, where 1 is the worst doctor possible and 10 is the best doctor possible, what number would you use to rate this doctor?**

- ☐ *1*
- ☐ *2*
- ☐ *3*
- ☐ *4*
- ☐ *5*
- ☐ *6*
- ☐ *7*
- ☐ *8*
- ☐ *9*
- ☐ *10*

24. **In the last 12 months, how often were clerks and receptionists at this doctor's office as helpful as you thought they should be?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

25. **In the last 12 months, how often did clerks and receptionists at this doctor's office treat you with courtesy and respect?**

- ☐ *Never*
- ☐ *Almost Never*
- ☐ *Sometimes*
- ☐ *Usually*
- ☐ *Almost Always*
- ☐ *Always*
- ☐ *Not Applicable*

APPENDIX 2: SCHEDULE OF ABBREVIATIONS

Appendix 2
Schedule of Abbreviations

Abbreviation	Description
ACA	The Patient Protection and Affordable Care Act
ACEI	Angiotensin Converting Enzyme Inhibitors
ACES	Ambulatory Care Experiences Survey
ACO or ACOs	Accountable Care Organization(s)
ACVE	Assessing Care of Vulnerable Elders
AHRQ	The Agency for Healthcare Research and Quality
AMI	Acute Myocardial Infarction
APM	Alternative Payment Models
ARB	Angiotensin II Receptor Blockers
BP	Blood Pressure
BUN	Blood Urea Nitrogen Test
CABG	Coronary Artery Bypass Graft
CAHPS	Consumer Assessment of Healthcare Providers & Systems
CHIP	Children's Health Insurance Program
CMS	The Center for Medicare and Medicaid Services
DO	Doctor of Osteopathy
EHR or EHRs	Electronic Health Record(s)
EP or EPs	Eligible Professional(s)
FFS	Fee-For-Service
FOBT	Fecal Occult Blood Test
FP	Family Practice
GDP	Gross Domestic Product
GYN	Gynecology
HbA1C	Hemoglobin A1C Test
HEDIS	Healthcare Effectiveness Data and Information Set
HHS	The US Department of Health & Human Services
HIE	Health Insurance Experiment
IM	Internal Medicine
LDL	Low Density Lipoprotein
MACRA	The Medicare Access and CHIP Reauthorization Act of 2015
MD	Medical Doctor
MEI	Medicare Economic Index
MEPS	Medical Expenditure Panel Survey
MGMA	The Medical Group Management Association
MIPS	Merit-Based Incentive Payment System
MMR	Measles, Mumps, Rubella Vaccination

MU	Meaningful Use
NBER	The National Bureau of Economic Research
NCQA	The National Committee for Quality Assurance
NHE	National Health Expenditure
OECD	The Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
PCI	Percutaneous Coronary Intervention
PCMH	Patient Centered Medical Home
PCP	Primary Care Physician
Peds	Pediatrics
PFS	Physician Fee Schedule
PHO	Physician Hospital Organization
PQRS	Physician Quality Reporting System
RBRVS	Resource Based Relative Value Scale
Rx	Prescription
SCP	Specialty Care Physician
SGR	Sustainable Growth Rate
URI	Upper Respiratory Infection
VBPM	Value Based Payment Modifier
VZV	Varicella Zoster Vaccine (Chicken pox)
wRVU	Physician Work Relative Value Unit