

*White Paper and
Technical Specifications*

**Pay-for-Performance
for COPD**

September 2009

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**Whitepaper and Technical Specifications:
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About Discern

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Executive Summary

Recent attempts to improve health quality through physician pay-for-performance (P4P) programs have focused on chronic conditions such as diabetes and cardiovascular diseases. In this paper, we make the case for expanding P4P programs to chronic obstructive pulmonary disease (COPD), and propose measures and processes to use in such a program.

Though it has received less public attention than other chronic disease, COPD is among the leading causes of death in this country. As of 2006 12.1 million Americans have been diagnosed with the disease, and estimates suggest there could be an additional 12 million undiagnosed cases. In 2007, the total estimated cost of COPD nationwide ranked third among chronic diseases, at \$42.6 billion.

Similar to other chronic diseases, poor outcomes and costs associated with COPD could be reduced through improved health care management. COPD patients nationwide often are not receiving the care they need. A recent study found that COPD patients receive recommended care only about half of the time. When COPD patients receive poor quality care there is a corollary increase in complications related to their disease. Increased complication rates have a direct relationship to increased cost of care.

Early experiments with pay-for-performance have shown that physicians are able to improve the quality of care they deliver, and that increased payment can be a motivation to do so. Examples of measures that could be used to assess a

physician's quality of care for COPD patients include:

- Documentation of spirometry
- Prescription of bronchodilators for patients with poor lung function
- Documentation of smoking status
- Smoking cessation intervention
- Prescription of long-term continuous O2 for certain patients
- Administration of pneumococcal vaccine
- Administration of influenza vaccine

Analysis shows that the average annual cost of medical complications for a

COPD patient is almost \$3,000. Reducing the complication rate could yield significant savings and improved quality of life for

COPD patients. The savings generated could be used to fund P4P payments to physicians while also creating a dividend for health care purchasers sponsoring the P4P program.

This white paper contains the details necessary for a health care purchaser to adopt COPD as a new P4P program, or to add it to existing P4P efforts. As P4P programs become more established and mainstream, it will be important for health care purchasers to expand their scope to include the wide range of clinical challenges affecting patients. Given its prevalence and impact on patient health, COPD is an appropriate candidate for pay-for-performance.

In 2007, the total estimated cost of COPD nationwide ranked third among chronic diseases, at \$42.6 billion.

Background on Chronic Disease and COPD

Chronic disease continues to take a heavy toll on the health of our nation while inflating our already steep \$2.2 trillion health care bill.¹ Despite chronic conditions accounting for 75% of health costs,² the health care delivered to patients afflicted with such conditions remains far below optimal.³

Relative to other chronic conditions, such as diabetes and cardiovascular disease, Chronic Obstructive Pulmonary Disease (COPD) has received less attention from policymakers and health care purchasers seeking to address the crisis in chronic care management. Yet the prevalence and costs of COPD are on the rise, and as of 2006 12.1 million Americans were estimated to have the disease⁴ and estimates show there could be millions of undiagnosed cases.⁵

As defined by the American Thoracic Society in a 2004 report, COPD is a preventable and treatable disease state characterized by airflow limitation that is not fully reversible.⁶ COPD often includes presence of chronic bronchitis and emphysema. Because it is not a disease that appears suddenly, signs of COPD vary and are often persistent in nature. Symptoms include:

- Persistent cough
- Increased mucus production
- Shortness of breath, especially during physical activities
- Wheezing

- Chest tightness
- Frequent respiratory infections⁷

Depending on the severity of these symptoms, the disease state can be classified into one of four phases: mild, moderate, severe or very severe.⁸

The primary risk factor for COPD is smoking, which accounts for 80-90% of COPD deaths. A second major risk factor for COPD is exposure to air pollutants, including those found in occupational settings. Studies have shown that 19.2% of COPD cases were caused by exposure to dust and chemicals while at work.⁵

Another risk factor is age, as most diagnoses occur after age 40. There is also

ongoing research into genetics as an influencing factor for COPD.⁹

While COPD most often develops after long-term exposure to pollutants, the disease does affect America's

working population. Of the estimated 24 million people with some degree of impaired lung function, only 30% are actually above the age of 65.¹⁰ These figures put the prevalence of COPD close to diabetes, a disease that receives considerably more attention in this country. The National Institute of Health estimates the prevalence of diabetes in the U.S. to be about 23.6 million (both diagnosed and undiagnosed).¹¹

Burden of COPD

A disease's impact can be assessed in any number of ways, but perhaps the ultimate indicator of severity is a disease's death rate. COPD has become the nation's

. . . the prevalence and costs of COPD are on the rise, and as of 2006 12.1 million Americans have been diagnosed with the disease . . .

fourth leading cause of death.⁵ Of the 6 major causes of death from 1970-2002, COPD was one of only two whose rate rose; the mortality rate for COPD increased by 102% while diabetes only rose 3.2%.¹² In 2005, the disease was also responsible for 721,000 hospital discharges – higher than any previous recorded year.⁴ Partly due to current trends in diagnosis, COPD is often not caught until it has reached moderate and severe stages. For this reason, those with COPD suffer from a poorer quality of life as it can limit even the slightest the amount of activity a person is able to handle.

A second component in gauging the true burden of COPD is the economic costs associated with the disease. In 2007, the total estimated cost of COPD nationwide was \$42.6 billion. Direct medical costs were \$26.7 billion, while indirect morbidity and mortality costs were \$8 and \$7.9 billion respectively.⁴

It can no longer be assumed that the economic burden of COPD falls only to Medicare, as the stereotype of the elderly, white male COPD patient is losing its basis in reality. Numbers indicate that about 70% of the 24 million Americans exhibiting signs of COPD are below the age of 65, while the number of women dying from COPD has surpassed that of men.^{10,5} COPD is also greatly affecting America's working population and in turn employer's balance sheets, as over 62% of the working population* receives employment based health insurance.¹³ In fact, a 2007 study found that per person health care costs for those with COPD who are actively employed were \$8,559, as compared with \$5,443 for those without COPD.¹⁴

* Working age population includes those between the ages of 18 and 64.

Employers may be surprised to learn that while they spend a considerable amount of time and resources addressing diabetes in its working population, they could be ignoring a disease that just as many, if not more, of their employees may be suffering from. The prevalence and demographic data for COPD make it clear that perceptions need to change and employers must take notice of this growing health issue.

Compounding employer's health insurance expenses is the cost of lost productivity and absenteeism associated with COPD, which accounts for 58 million lost work days each year. Eight percent of those with chronic bronchitis and 70 percent of those with emphysema reported that their conditions have limited the amount of work they can do.¹⁵ The National Business Group on Health reported that indirect costs from lost productivity and disability due to COPD totaled \$16.3 billion in 2004.¹⁶ In light of this, employers can be sure the total economic burden of COPD is much higher than their direct medical expenses would initially suggest.

Current research and data paint an alarming picture of COPD in this country today. First, COPD is a very common yet under diagnosed disease. In addition to a prevalence rate that is even higher than what is currently known, statistics show that COPD is becoming increasingly deadly and now ranks with the most prolific causes of death in America. All of this has made treatment of the disease extremely expensive with high health care utilization burden. The fact that the majority of COPD cases are among patients under 65 years old invalidates the myth that this is an elderly person's disease (**Figure 1** on page 7 provides a summary of the myths and

corresponding facts surrounding COPD). It is becoming more and more likely that the economic burden of COPD will fall on employers. Organizations seeking to gain a competitive advantage and reduce their expenses would be wise to take a proactive approach to employee chronic health issues in general, and COPD in particular.

Opportunities for improved diagnosis and care

In 2008, the Global Initiative for Chronic Obstructive Lung Disease (GOLD) published updated COPD care guidelines. According to those guidelines, optimal care of COPD consists of four main components:

- Assess and monitor the disease
- Reduce risk factors
- Manage stable COPD
- Manage exacerbations⁸

Some key aspects of care identified in the guidelines include the use of spirometry[†] for assessment; smoking cessation for reducing risk factors; bronchodilator medications for the symptomatic management and improvement in quality of life; and inhaled bronchodilators for treatment of exacerbations. Additional information, including details on the full spectrum of COPD treatment can be found at <http://www.goldcopd.org>.

[†] Spirometry is a test of the air capacity of the lung. The test utilizes a machine called a spirometer to measure the volume of air inspired and expired by the lungs. (Source: www.medterms.com)

Despite the advances in COPD care and the evolution of treatment guidelines, COPD patients nationwide often are not receiving the care they need. A study in the journal *Chest* reports that COPD patients receive recommended care only about half of the time. What's worse, delivery of proper care that could prevent hospitalization is severely lacking. The same study found that patients are provided only 46% of correct routine, preventative care while they receive only 60% of recommended care with more severe symptoms.¹⁷

As with chronic diseases like diabetes, when COPD patients receive poor quality care there is a corollary increase in complications related to their disease. Increased complication rates have a direct relationship to increased cost of care. When one considers that the average COPD

patient only receives half of the care that is recommended, there exists a huge opportunity to improve the quality of COPD care delivered. Such improvements can reduce the overall number of COPD complications and in turn reduce the costs associated with COPD.

Using methods developed for the Prometheus™ Episode Case Rate (ECR) methodology[‡], we can estimate the cost of care for treating chronic disease and the potential savings associated with reducing complications of the disease. For the purpose of this white paper, Prometheus™ conducted an analysis to estimate complication rates for the average COPD patient and the associated additional costs

[‡] See www.prometheuspayout.org

(details of the analysis can be found later in this paper and in **Appendix E**). These costs represent an estimate of the savings that could be achieved by reducing avoidable complications of COPD, or providing “good” care versus “poor” care. The results of the analysis showed the annual cost of avoidable COPD complications for an average patient to be \$2,849. When applied to the 12.1 million Americans with COPD, one can estimate that through improved care there is potential for savings of almost \$34.5 billion nationally. Of course eliminating all complications for COPD is an impossible task, but if complication rates can be improved there is still the potential for payers to realize significant cost savings, and for many patients to experience better outcomes and an improved quality of life.

P4P Background

Better quality is a common theme of many health care reform efforts, especially in light of the growing evidence base that suggests quality care is often far from ideal. For example, a recent report issued by the Commonwealth Fund states:

“Every family wants the best care for an ill or injured family member. Most are grateful for the care and attention received. Yet, evidence in the National Scorecard on U.S. Health System Performance, 2008, shows that care typically falls far short of what is achievable. Quality of care is highly variable, and opportunities are routinely missed to prevent disease, disability, hospitalization,

and mortality. Across 37 indicators of performance, the U.S. achieves an overall score of 65 out of a possible 100 when comparing national averages with benchmarks of best performance achieved internationally and within the United States.”¹⁸

In response to concerns, many providers and purchasers have verbally committed to improving the quality of health care delivered in this country. Stating a commitment to quality improvement is a good first step, but those improvements will not happen on their own as it takes a concerted effort from every player in the health care game to make quality care a reality. There are many organizations that should be applauded for their significant efforts in this arena. Organizations like the Leapfrog Group, Bridges to Excellence (BTE), the National Business Coalition on Health, as well as many innovative stakeholders have all developed great programs working to improve health care quality.

One quality reform movement gaining traction has been the establishment of pay for performance (P4P) systems that reward providers offering higher quality health care. In a 2006 report, the Agency for Healthcare Research and Quality estimated that there were over 100 P4P initiatives in the U.S. sponsored by health plans, employer coalitions, and public insurance programs. The same report defines a P4P program as, “any type of performance-based provider payment arrangements including those that target performance cost measures.”¹⁹ P4P programs are designed to

address a fundamental flaw in our health care system: payment is often not aligned with optimal performance, but instead rewards high volume and high intensity services.

Existing P4P programs cover a range of treatment areas. In California, the Integrated Healthcare Association runs a successful program that includes quality measures for preventive and chronic care management, patient satisfaction, and the use of IT to promote better care.²⁰ Public payers are also pioneering the use of P4P. Medicare has piloted and implemented several programs, including its Physician Quality Reporting Initiative, and has begun a process to evaluate its physician payment policies. Additionally, as of July 1, 2006 more than 50% of state Medicaid programs were running P4P programs.²¹ Bridges to Excellence, a not-for-profit health care quality organization created by employers, physicians, and other industry experts currently has programs in markets across the country. To date, Bridges to Excellence has rolled out programs to reward quality physician care of diabetes, cardiac disease, chronic back pain, and depression.²²

As one of the major purchasers of health care in this country, employers are in the unique position of possessing both the motivation to lower costs and improve quality of care, as well as the influence to do so. Large companies may have enough resources and influence to design and implement their own P4P strategies aimed at improving the health of their employees and the value of their health care dollar. Other employers have formed coalitions that combine their purchasing power in an

effort to influence health plans to implement value based initiatives like P4P. The National Business Coalition on Health is one example of this, having nearly 60 local employer-led coalitions throughout the country. As noted earlier, COPD is a disease whose impact is on the rise, and in many ways it is employers who are going to bear the brunt of the costs of this disease.

A P4P program is one way for employers and payers to align financial incentives with evidence-based quality care. In effect, P4P helps ensure that payers are not just spending money for more care, but instead *quality* care. P4P has the potential to effectively address both the issues of quality improvement and cost efficient spending.

A P4P program is one way for employers and payers to align financial incentives with evidence-based quality care.

Supporting the development of a COPD P4P strategy is one way in which employers can proactively address the problem for their employees and

dependents suffering from COPD.

Figure 1: Overview of COPD Facts and Figures

<p>1) Is COPD really affecting the working population? As an employer, shouldn't I worry more about diabetes and other cost drivers I hear more about?</p>
<p>COPD should not be ignored. It has a burden among the highest of any disease, including diabetes. COPD is the 4th leading cause of death in the U.S., has prevalence estimated to be comparable to diabetes, and incurs costs of over \$42.6 billion per year.⁵</p> <p>Myth: COPD only affects the elderly and Medicare population. Fact: 70% of people exhibiting symptoms of COPD are under the age of 65, and the majority of this population receives health coverage through their employer.^{10,13}</p>
<p>2) I've heard COPD has no cure, and that beyond getting someone to quit smoking, cannot be treated.</p> <p>While COPD damage is not reversible and there is no cure, the disease is very treatable. Physicians can, and in fact should, provide an array of treatments that can significantly improve a patient's quality of life and help to avoid complications associated with the disease. Treatments include smoking cessation programs, lifestyle changes, immunizations, and drug and oxygen therapy which can allow someone with COPD to lead a productive and healthy lifestyle.⁸</p>
<p>3) With advances in medicine and technology these days, doctors must already be providing the best care possible for diseases like COPD. A pay for performance program seems costly and unnecessary.</p> <p>Empirical research shows that despite providers' efforts, patients often do not get the recommended care for chronic diseases. It has been found that a COPD patient typically receives about half of the recommended COPD care. Unfortunately, better care is usually received at the exacerbation stage rather than the preventative stage, with studies showing the average patient only receiving 46% of recommended routine care as opposed to 60% of exacerbation care.¹⁷ Additionally, COPD is often misdiagnosed and treated as asthma. Another study found that 50% of COPD patients sampled had been misdiagnosed with asthma.²³ This can be very dangerous because although asthma treatments may alleviate some of the short-term symptoms of COPD, the consequences of this error are extremely detrimental to the long-term health of the patient. Treating COPD as asthma may result in even more treatment and expensive hospitalizations. With proper routine COPD care patients can remain healthy and avoid exacerbations.</p> <p>Pay for performance programs have been shown to effectively align physician's financial incentives with evidence based care guidelines, leading to improved routine care for chronic disease and better health of the patient. Correct preventative care is relatively cheap and can greatly reduce the number of expensive acute exacerbations and hospitalizations</p>
<p>4) What is the expected ROI for employers investing in such a COPD P4P program?</p> <p>Characteristic of chronic disease, the chief benefit of treatment is witnessed in patient outcomes and reduced hospitalization over the long-term. With the interventions included in this blueprint, a patient's day-to-day quality of life will improve relatively quickly. Potential financial return on investment would be realized through reduction of acute exacerbations and hospitalizations, the extent of which have not yet been implemented, and therefore measured.</p>

COPD P4P Program Blue Print

In light of the very real burden COPD is creating and the benefits a P4P program can offer, we propose a new strategy for building P4P to improve care of COPD. The strategy covers the development of new P4P programs specifically aimed at improving COPD treatment and the inclusion of COPD treatment as a new goal of existing P4P programs.

In both development of a new program and adding to existing programs, the strategy emphasizes several important aspects that this paper brings to light:

- The prevalence of COPD, particularly in the under-65 population
- The deficiencies in the current state of treatment and potential for improvement – moving from delivering 50% of recommended COPD care towards 100%
- The cost savings to be realized from improving treatment so that it meets existing guidelines

To ensure a medically appropriate and economically viable measurement and rewards structure, we employed the help of several medical and P4P experts and created the following blueprint for both a new COPD P4P program and inclusion in existing programs. The blueprint is organized around three main components:

- Quality measures
- Measurement process
- Scoring and rewards

Quality Measures

To evaluate and select the measures to include in the P4P program, a physician expert panel was assembled. To select the panelists, recommendations on potentially interested physicians were sought from professional medical organizations (i.e. AAFP, ABIM) and physician leaders present on the BTE Board. Participation on the panel was completely voluntary. Candidate physicians were informally evaluated for participation on the panel based upon their professional background, clinical expertise, involvement in standard-setting trials in the field, and relative familiarity with pay for performance and

performance assessment.

As a part of this process three candidates were evaluated and ultimately accepted to make-up the COPD physician advisory panel. The 3 members of the advisory

panel were internal medicine physicians, specializing in critical care and pulmonary disease. All are faculty members at notable institutions including Duke University, National Jewish, and Cleveland Clinic. Finally, all have over 20 years of experience as practicing physicians in the field and have been heavily involved with cutting-edge research and important clinical trials including the NETT and LOTT trials. Each advisory panel member agreed to the project scope of the work provided, which included:

- Selection of final program measures
- Development of program rules (e.g. patient and physician eligibility)
- Development of scoring rules (e.g. measures weights and criteria)

The blueprint is organized around three main components:

- *Quality criteria*
 - *Measurement process*
 - *Scoring and rewards*
-

- Defining the Program Levels

The measure selection process occurred in two phases: Compiling an inventory of existing candidate measures and selection of core program measures for inclusion.

Compile Inventory of Measures: The availability of existing, endorsed measures helps promote the idea of a COPD performance assessment and rewards program. It avoids the necessity to develop an entirely new set of measures, an even longer process than approving existing ones, and offers instant credibility. In identifying proposed measures for inclusion in a COPD P4P program, we began by looking at quality measures already in place. Credible health care quality organizations including the Agency for Healthcare Research and Quality (AHRQ), the American Medical Association (AMA), NCQA and the National Quality Forum (NQF) have already created and tested measures related to COPD care. Our search was conducted through the National Quality Measures Clearinghouse, a service provide by the U.S. Department of Health and Human Services. The National Quality Measures Clearinghouse supplies an extensive list of publicly available quality measures covering the entire spectrum of health care, and includes a detailed breakdown of each. Our search for existing COPD measures returned 25 measures relevant to a P4P program (**Appendix B**). Specifications for each quality measure can be found by visiting <http://www.qualitymeasures.ahrq.gov>. Of the 25 candidate measures, 15 were removed from consideration for any of at least one of the following reasons: the measure represented weak link to final patient outcome; and/or the measure

targeted inpatient care processes rather than outpatient care. The final 10 measures were presented to the physician expert panel for review.

Selection of Core Program Measures: The advisory panel evaluated the measures based upon clinical impact (i.e. strength of link to improved outcomes), consistency with COPD best practices (as reflected by their alignment with guideline recommendations) and finally data collection burden. Upon conclusion of this evaluation the panel decided to retain 7 of the 10 measures and modify another. The panel chose to supplement the 7 measures with an additional 3 new COPD measures (**Figure 2**). The new measures were included as a means of addressing certain important clinical issues related to COPD care, otherwise not captured or fully addressed amongst the candidate measures such as:

- Documentation of exacerbation: Marker of disease severity
- Prescription of medication therapy for history of exacerbation or hospitalization: Reflects need to “ramp-up” medication therapy for those COPD patients with more severe illness as judged by presence of exacerbations or hospitalization
- O2 saturation assessment for COPD: Makes explicit what is implied as part of measure related to prescription for long-term O2. Documentation of O2 saturation is a key marker by which severity of illness can be evaluated with or without the presence of active symptoms or exacerbations.

The 3 new measures were developed based upon national guidelines including GOLD, ATS, ACP and AACVPR. For more info see GOLD Guidelines: www.goldcopd.com; ATS Guidelines: www.thoracic.org; ACP Guidelines: http://www.acponline.org/clinical_information/guidelines/current/#acg; and AACVPR Guidelines: <http://www.aacvpr.org/>.

The physician expert panel also developed program rules concerning physician and patient eligibility. For physician eligibility, it was agreed that the program should be made available to all physicians irrespective of specialty, who are playing the role of primary caregiver for their patient's COPD condition. However, the majority of COPD patients would be cared for by the following class of physicians: General Internal Medicine, Family Practice, Primary Care, Pulmonologists, and Allergy and Immunology physicians. Patient eligibility was determined to include patients 18-75 years old with a diagnosis of COPD for at least 12 months.

Specifications including measure numerator and denominator currently exist for the 7 established measures. Links to these specifications are provided in **Figure 2** on the following page, while specification summaries can be found in **Appendix C**.

Specifications did not exist for the three new measures listed here. Bridges to Excellence continued to work with the physician expert panel and experts in the field of P4P to develop these specifications.

Figure 2. COPD Quality Measures	
Existing Measures	Specifications
Documentation of spirometry ²⁴	http://www.qualitymeasures.ahrq.gov/summary/summary.aspx?ss=1&doc_id=9038
Prescription of 1 or more inhaled bronchodilators (long-acting preferred if persistent symptoms) if FEV/FVC < 0.70 & dyspnea ²⁵	http://www.qualitymeasures.ahrq.gov/summary/summary.aspx?ss=1&doc_id=9042
Documentation of smoking status (by inquiry) at every visit ²⁶	http://www.qualitymeasures.ahrq.gov/summary/summary.aspx?doc_id=14560
Smoking cessation intervention ²⁷	http://www.qualitymeasures.ahrq.gov/summary/summary.aspx?ss=1&doc_id=9041
Prescription of long-term continuous O2 for patients with resting O2 sat ≤ 88% ²⁸	http://www.qualitymeasures.ahrq.gov/summary/summary.aspx?ss=1&doc_id=9044
Administration of pneumococcal vaccine ²⁹	http://www.qualitymeasures.ahrq.gov/summary/summary.aspx?ss=1&doc_id=9049
Administration of latest influenza vaccine ³⁰	http://www.qualitymeasures.ahrq.gov/summary/summary.aspx?ss=1&doc_id=9047
New	Specifications
Documentation of exacerbation frequency in last year	Appendix C
Prescription of at least 1 long-acting bronchodilator and /or an inhaled corticosteroid for patients with a history of exacerbation	Appendix C
O2 saturation assessment for COPD	Appendix C

Measurement

After identifying which measures will be used to assess performance, the second major component to a P4P program is conducting the actual measurement of care. The process of measurement involves deciding what data is necessary to measure compliance, identifying the source of that data, and analyzing that data to score performance against measure thresholds. The result of this process then determines a physician's performance and whether or not they are eligible for rewards under the P4P program.

There currently exist many health care measurement organizations that routinely carry out the role of measuring provider performance. As part of our COPD P4P strategy, we sought to identify potential organizations capable of performing this task. The National Committee for Quality Assurance (NCQA), American Board of Internal Medicine (ABIM), Minnesota Community Measurement, and MassPro are organizations that, to varying degrees, expressed interest in carrying out this function of a COPD P4P strategy. In examining potential for fit with our P4P program, we needed to assess each organization based on several aspects (credibility being a prerequisite), including:

1. Capability
2. Interest
3. Geographic reach

Figure 3 is a summary of the results of conversations with each potential performance measurement organization.

The National Committee for Quality Assurance (NCQA) is a national non-profit performance measurement organization, dedicated to health care quality improvement. NCQA currently operates accreditation, certification, and physician recognition programs across a wide spectrum of conditions. In addition, NCQA publishes a widely used list of quality measures titled *The Healthcare Effectiveness Data and Information Set (HEDIS)*, and is a preferred measuring organization for existing Bridges to Excellence (BTE) P4P programs. While we are optimistic about the prospect of having the COPD P4P program eventually adopted by NCQA as part of its suite of physician recognition programs, NCQA has no current plans to move forward with COPD P4P measurement (or any other new physician recognition program).

We were able to involve the American Board of Internal Medicine (ABIM) at several stages in the development of our COPD P4P strategy, and the organization is also a potential partner to

Figure 3. Quality Measurement Organizations			
Organization	Capability	Geographic reach	Current plans involving COPD?
NCQA	Yes	National	No
ABIM	Yes	National*	Yes
MN Community Measurement	Yes	Minnesota (possibly national)	No
AHQA	Yes	National**	No
MassPRO	Yes	National**	Yes
*Program scope is limited to physicians undergoing Board recertification			
**Due to Medicare regulations, QIOs can only measure performance outside their own state			

carry out the measurement function. ABIM is a non-profit organization offering various certifications nationwide to physicians in internal medicine. In addition to certifying 1 out of every 3 physicians in the U.S.,³¹ ABIM offers performance improvement modules aimed at helping physicians improve their practice for a variety of diseases. ABIM is currently engaged in expanding the scope of their efforts surrounding COPD, and was very enthusiastic about the creation and measurement of a COPD measure set. They expect to complete work on their P4P module by mid-year 2009. Because of their established credibility and reputation, forming a partnership with ABIM along with more inclusive performance measurement organizations shall remain a goal moving forward.

Another performance measurement organization with potential for inclusion in our COPD P4P strategy is Minnesota Community Measurement. The non-profit organization currently limits its market to only Minnesota, but is considering offering its services outside of the state. They intend to fuel this growth through their existing BTE partnership with a focus on P4P programs, and are even beginning to design their own measures. Given their capabilities and aspirations, Minnesota Community Measurement showed interest and wishes to track the project moving forward. As of the completion of this paper, Minnesota Community Measurement has no specific plans to move forward with COPD P4P measurement. Until then, they may be a potential partner for a local pilot demonstration in a Minnesota market.

AHQA represents a member network of 40 Quality Improvement

Organizations (QIOs) who are working to advance healthcare quality throughout the country. Its member QIOs reach every state in the U.S. and are involved in a wide variety of health care quality improvement activities, including evaluation of care delivery, information management, and statistical analysis. In conversations with AHQA, they confirmed that P4P measurement was a function their QIOs routinely performed. However, each QIO essentially acts as individual consulting organization so they could not confirm interest from any specific QIOs. Any single QIO has the potential to conduct measurement on a national scale but because QIOs contract with Medicare for performance assessment, conflict of interest regulations prevent them from measuring within its own state borders. AHQA did express some interest and could be kept in mind as a possible partner for performance measurement organizations, but as of the completion of this paper there are no specific plans to move forward with measurement for a COPD P4P program.

BTE does have an existing partnership with MassPRO, a QIO based in Massachusetts. MassPRO is one of the leading performance improvement organizations in the U.S. and is a trusted partner of not only BTE, but also CMS and the Massachusetts Office of Medicaid. The result of dialogue with MassPRO was very positive, and they expressed great interest in the measurement of a COPD P4P program. They currently intend to expand their scope to specialists and new physician groups, specifically COPD.

In evaluating a potential program, MassPRO prefers that its structure and measures are grounded in evidence, it is replicable and scalable, and that data

collection for the measures have a realistic level of burden. This provides a good fit between the proposed COPD pay-for-performance program and MassPRO, as our P4P program was constructed from the beginning using these criteria as a foundation. In addition, COPD represents a new area for MassPRO to expand its measurement scope. As of completion of this paper, MassPRO does have specific aspirations to begin measurement for a COPD P4P. Pending the completion of our blueprint that will provide more details about the program, formalizing a measurement partnership will be pursued.

Scoring and Rewards

BTE and the physician expert panel were assigned to develop the program scoring methodology. The panel was given the following instructions for their work:

- The sum total of points for the program shall be 100 points, with the attainment of 60 points or greater qualifying the physician for recognition
- The program scoring shall follow a continuous scoring strategy, which allows for physicians to receive partial credit.
- Three program levels shall be developed with each subsequent level representing a higher level of excellence in the delivery of care to COPD patients. A different per patient reward amount is given depending on

which level of recognition physicians achieve.

- Level II and III may include composite/bundled measures as part of the make-up of Level II and III of the program

Based upon the above parameters the panel proceeded with its work, first determining the weights to be allotted to each program measure. Increasing weight is granted to those measures judged to have the strongest clinical impact (i.e. link to improved patient outcomes). From this, the scoring methodology was then developed. (Appendix D provides a grid detailing the weights and scoring methodology.)

Increasing weight is granted to those measures judged to have the strongest clinical impact (i.e. link to improved patient outcomes).

Level I: Focusing on a physician-centric[§] view of measurement, level I looks at individual metrics summed to produce a final score. Using each individual measure, the physicians are scored based on the percentage of patients who meet or comply with the measure multiplied by the total number of points assigned to the measure. For example, if 80% of a physician's COPD patients have documentation of spirometry and there are 10 total points assigned for the spirometry measure, the physician would receive 80% of the 10 points [0.80 x 10 = 8.0] or 8 points for the measure. The physician's final score is calculated by summing the score of all the individual measures. If the

[§] Physician centric refers to performance assessment involving evaluation of physician performance based upon discrete measures (i.e. Documentation of influenza vaccine). The results provide a picture of a physician's performance on a given measure across his or her eligible patient panel. Since the process leads to physician-focused results it is said to be "physician-centric."

summed score is 60 or greater the physician receives a level I recognition.

Level II: Focuses on a combination of physician and patient-centric** measurements, which includes composite or bundled measures that are made up of two or more individual measures combined. In regards to the bundled measure, the physician is scored by multiplying the percentage of patients who meet or comply with each measure with the sum of total number of points assigned to measures included in the bundle. For example, let's assume 70% of a physician's COPD patients have documentation of an influenza vaccine and 90% have similar documentation for pneumococcal vaccination and the total possible points for each of the measures are 10 and 5 points. In this case the physician would receive 63% [$0.7 \times 0.9 = 0.63$] of the sum total of 15 points [$10 + 5 = 15$] or 9.45 points [$0.63 \times 15 = 9.45$] for the bundled measure. For level II, there are four bundles (with two measures each) and two remaining individual measures. Level II composite measures represent those measure bundles which were judged to be MOST important to the delivery of high quality COPD care. The physician's final score is calculated by summing the score of the bundled measures with the remaining individual measures. If the summed score

** Patient centric refers to performance assessment involving evaluation of physician performance based upon composite measures, created by combining 2 or more separate discrete measures into a single measure (i.e. combining Documentation of influenza vaccine and Documentation of Pneumococcal vaccine into 1 single measure), which is applied on a per patient basis. The results provide a picture of an individual patient's performance on a set of measures which make-up the composite measure. Since the process leads to patient-focused results it is said to be "patient-centric."

is 60 or greater the physician receives a level II recognition.

Level III: Focuses on patient-centric view of measurement, looking at the defect rate of care delivery. For level III, the physician is scored against five bundles (two measures each) with no individual measures remaining. The additional bundle in level III represent exceptional care delivery above what would be normally expected. Bundles are scored in the same manner as level II and the numbers of points earned for each bundle are totaled. A score of 60 or greater out of a total of 100 earns a level III recognition.

The bundled measure scoring strategy provides one with an advantage, allowing for a more comprehensive assessment of delivery of care for individual patients (patient-centric), rather than capturing how a physician (physician-centric) does on each individual measure. The bundles reflect measures that should be ideally paired up in patients because they share the same denominators and afford greater insights on how effectively patients are being managed.

Once the measures are selected and the scoring methodology is developed, the final step in the design of a P4P blueprint is deciding on the amount of rewards a physician can earn when participating in the program. Rewards act as the motivation for physicians to improve the quality of care. Incentives are aligned when payers administer bonus payments to physicians whose care is consistent with proper treatment guidelines, as evidenced by high scores on the program's measures. Implementation of a COPD P4P program would be sponsored by a health care payer, because whether it is a health insurance plan or self-insured employers, savings

from this P4P program accrue to payers as a result of decreased hospitalizations, and decreased hospitalizations are a result of reduced complications through better physician care.

BTE establishes recommended reward levels based on the predicted amount of savings generated as a result of quality care, which in the case of chronic disease typically results from reduced hospitalization and complication rates. When analyzing recommended reward amounts for our COPD P4P strategy, we followed the same methodology.

The first step in deducing appropriate rewards levels is to assess the cost of good COPD care in comparison to poor COPD care. To do this, BTE staff was enlisted to conduct a claims analysis on a large sample set of COPD patients provided by a national health plan. The analysis followed the Prometheus™ payment methodology, which estimates the total cost of care among all providers for certain diseases, known as Episode Case Rates

(ECR). The data sample included 97,051 cases, or “episodes”, of COPD.

In our examination, COPD care was identified by looking at episodes that included claims for complications related to COPD. (For a detailed description of the sample segmentation process, see **Appendix E**). When compared to the cost of treatment for a typical COPD patient with zero complications, we were able to extrapolate the average additional costs of treating the complications of COPD, shown to be an estimated \$2,849. This number represents the average payer costs that would be avoided if a patient experiences zero complications. Recognizing the fact that no level of COPD care can ensure the elimination of all complications, our rewards program does not assume that a physician following our measures will eliminate complications either. Instead, our recommended rewards levels are based on expected reductions in hospitalization rates for patients treated by physicians participating in BTE’s Diabetes Care Link

Figure 4: Potential Savings from Reduced COPD Complications

Expected Hospitalization Reduction	Per Patient Expected Savings (% reduction x \$2,849)	Suggested Reward (50% of savings: rounded to nearest \$5)
1%	\$28.49	\$15
2%	\$56.98	\$30
3%	\$85.47	\$45
4%	\$113.96	\$55
5%	\$142.45	\$70
6%	\$170.94	\$85
7%	\$199.43	\$100
8%	\$227.92	\$115
9%	\$256.41	\$130
10%	\$284.90	\$140
11%	\$313.39	\$155
12%	\$341.88	\$170
13%	\$370.37	\$185
14%	\$398.86	\$200
15%	\$427.35	\$215

(DCL) program. BTE estimates that those physicians who achieve level-1 recognition can reduce diabetes related hospitalizations by 3%. When this 3% reduction is applied to the average COPD complications cost of \$2,849 it translates to an annual savings of about \$90. Consistent with current BTE programs, these expected savings form the basis for our program rewards, with payers keeping 50% of savings and physicians receiving the other 50% as a reward.

The recommended reward for physicians who achieve level I recognition is \$45 per COPD patient. For 2nd and 3rd levels of recognition, BTE's DCL program employs a 6% and 10% expected hospitalization reduction rate, respectively. Using the same methodology, the recommended reward for this COPD program is \$90 for physicians who achieve level II recognition and \$140 for those achieving level III. The sponsoring payer provides the physician the reward for each of their patients with COPD who is a member of their health insurance plan.

Because predicting a future percentage reduction in hospitalizations is not an exact science, we seek to suggest these reward levels as a guideline for payers to follow. Any individual payer could adjust the level of rewards as they see fit. **Figure 4** lists suggested physician reward amounts using the same methodology, but with varying degrees of impact (measured by reduced hospitalizations) and expected savings.

Appendix A: COPD P4P Blueprint Fact Sheet

Program Measures:

- Documentation of spirometry
- Prescription of 1 or more inhaled bronchodilators (long-acting preferred if persistent symptoms) if FEV/FVC < 0.70 & dyspnea
- Documentation of smoking status (by inquiry) at every visit
- Smoking cessation intervention
- Documentation of exacerbation frequency in last year
- Prescription of at least 1 long-term bronchodilator and consideration of an inhaled corticosteroid for patients with a history of exacerbation or hospitalization
- O2 saturation assessment for COPD
- Prescription of long-term continuous O2 for patients with resting O2 sat ≤ 88%
- Administration of pneumococcal vaccine
- Administration of latest influenza vaccine

Potential Performance Assessment Organizations: NCQA, ABIM, MN Community Measurement, AHQA, MassPRO

Scoring Methodology: Three levels of recognition (Levels I, II, and III)

Level I:

- 10 distinct measures
- For each measure, points earned = % of patients meeting the measure X total possible points
- Of 100 possible points, a total score of 60 pts or more earns recognition

Level II:

- 4 measure bundles (2 each) and 2 distinct measures
- Distinct measure scoring same as level I
- For each bundle, multiply the percentage of patients who meet or comply with each composite measure, then multiply this with the sum of total number of points assigned to measures included in the bundle. So, points earned = (% for 1st composite measure X % for 2nd composite measure) X total possible points for bundle
- Of 100 possible points, a total score of 60 pts or more earns recognition

Level III:

- 5 measure bundles (2 each) and 0 distinct measures
- For each bundle, the physician's score is calculated the same as bundles in level II
- Of 100 possible points, a total score of 60 pts or more earns recognition

Rewards (paid to each physician per COPD patient enrolled in sponsor's plan)^{††}:

Level I: \$45/patient

Level II: = \$90/patient

Level III: = \$140/patient

^{††} Based on expected average program savings of 3% (vs. \$2,849 in savings associated with zero complications)

Appendix B: COPD Quality Measures

Measure	Source
Chronic obstructive pulmonary disease: Hospital admission rate*	AHRQ
Percentage of patients aged 18 years and older with a diagnosis of COPD who were assessed with COPD symptoms at least annually	AMA/PCPI
Percentage of patients 18 years and older who had spirometry evaluation results documented at least annually*	AMA/PCPI
Percentage of patients 18 years and older with a diagnosis of COPD and an oxygen saturation of less than or equal to 88% or PaO ₂ less than or equal to 55 mm Hg who prescribed long term oxygen therapy	AMA/PCPI
Percentage of patients 18 years and older with a diagnosis of COPD and dyspnea for whom exercise training was recommended	AMA/PCPI
Percentage of patients 18 years and older with a diagnosis of COPD and a FEV ₁ less than 40% of predicted value who have oxygen saturation assessed at least annually*	AMA/PCPI
Percentage of patients 18 years and older with a diagnosis of COPD and a FEV ₁ /FVC less than 70% and have symptoms who were prescribed an inhaled bronchodilator*	AMA/PCPI
Percentage of patients 18 years and older with a diagnosis of COPD identified as smokers who received a smoking cessation intervention at least annually	AMA/PCPI
Percentage of patients 18 years and older with a diagnosis of COPD who received a pneumococcus immunization	AMA/PCPI
Percentage of patients 18 years and older with a diagnosis of COPD who received an influenza immunization during current flu season	AMA/PCPI
Percentage of patients 18 years and older with a diagnosis of COPD who were assessed for pneumococcus immunization status	AMA/PCPI
Percentage of patients 18 years and older with a diagnosis of COPD who were queried about smoking at least annually	AMA/PCPI
Chronic obstructive pulmonary disease (COPD): percentage of patients 18 years and older with a diagnosis of COPD who were recommended to receive an influenza immunization annually	AMA/PCPI
Percentage of all patients in whom diagnosis has been confirmed by spirometry including reversibility testing	British Medical Association (BMA)
Percentage of patients with COPD receiving inhaled treatment in whom there is a record that inhaler technique has been checked in the preceding 15 months	BMA
Percentage of patients with COPD with a record of FeV ₁ in the previous 15 months	BMA
The practice can produce a register of patients with COPD	BMA
Chronic obstructive pulmonary disease (COPD): percentage of patients with COPD who have had influenza immunisation in the preceding 1 September to 31 March	BMA
Smoking: the percentage of patients with any or any combination of the following conditions: coronary heart disease (CHD), stroke or transient ischemic attack (TIA), hypertension, diabetes, chronic obstructive pulmonary disease (COPD), or asthma who smoke whose notes contain a record that smoking cessation advice or referral to a specialist service, where available, has been offered within the previous 15 months	BMA
Smoking: the percentage of patients with any or any combination of the following conditions: coronary heart disease (CHD), stroke or transient ischemic attack (TIA), hypertension, diabetes, chronic obstructive pulmonary disease (COPD), or asthma whose notes record smoking status in the previous 15 months	BMA
Percentage of patients with COPD whose physician inquired about smoking cessation (if patient a smoker) at every visit	Institute for Clinical Systems

	Improvement
Percentage of patients aged 18 years and older with a diagnosis of COPD who had spirometry evaluation results documented	PQRI/CMS
Percentage of patients aged 18 years and older with a diagnosis of COPD and who have a FEV1/FVC less than 70% and have symptoms who were prescribed an inhaled bronchodilator	PQRI/CMS
Percentage of health plan members 40 years of age and older with a new diagnosis or newly active COPD who received appropriate spirometry testing to confirm the diagnosis	NCQA (HEDIS)
Percentage of COPD exacerbations 40 years of age and older who had an acute inpatient discharge or ED encounter between January 1 to December 1 of the measurement year and who were dispensed a bronchodilator within 30 days of the event and a corticosteroid within 14 days of the event	NCQA (HEDIS)

*Indicates a measure endorsed by the National Quality Forum.

Appendix C: Measure Specifications

1. Documentation of spirometry²⁴

- **Latest Revision:** March 2006
- **Source:** AMA/PCPI (NQF endorsed)
- **Abstract:** [Link](#)

DESCRIPTION

- This measure is used to assess the percentage of patients who had a spirometry evaluation results documented at least annually.

RATIONALE

- According to the American Thoracic Society (ATS) and the European Respiratory Society (ERS), spirometry should be performed in all patients suspected of chronic obstructive pulmonary disease (COPD). This is necessary for diagnosis, assessment of severity of the disease and for following the progress of the disease.
- According to the National Heart, Lung, and Blood Institute (NHLBI)/World Health Organization (WHO), for the diagnosis and assessment of COPD, spirometry is the gold standard as it is the most reproducible, standardized, and objective way of measuring airflow limitation. FEV₁/FVC less than 70% and a post bronchodilator FEV₁ less than 80% predicted confirms the presence of airflow limitation that is not fully reversible.
- A patient's decline in lung function is best tracked by periodic spirometry measurements. Useful information about lung function decline is unlikely from spirometry measurements performed more than once a year. Spirometry should be performed if there is a substantial increase in symptoms or a complication.

PRIMARY CLINICAL COMPONENT

- Chronic obstructive pulmonary disease (COPD); spirometry

DENOMINATOR DESCRIPTION

- All patients aged 18 years and older with the diagnosis of chronic obstructive pulmonary disease (COPD) (see the related "Denominator Inclusions/Exclusions" field in the Complete Summary)

NUMERATOR DESCRIPTION

- All patients with documented spirometry results on the medical record (FEV₁ and FEV₁/FVC)

2. Prescription of 1 or more inhaled bronchodilators (long-acting preferred if persistent symptoms) if FEV/FVC < 0.70 & dyspnea²⁵

- **Latest Revision:** March 2006
- **Source:** AMA/PCPI (NQF Endorsed)
- **Abstract:** [Link](#)

DESCRIPTION

- This measure is used to assess the percentage of symptomatic patients who were prescribed an inhaled bronchodilator.

RATIONALE

- According to the National Heart, Lung, and Blood Institute (NHLBI)/World Health Organization (WHO), bronchodilator medications are central to the symptomatic management of chronic obstructive pulmonary disease (COPD).

PRIMARY CLINICAL COMPONENT

- Chronic obstructive pulmonary disease (COPD); inhaled bronchodilator therapy

DENOMINATOR DESCRIPTION

- All patients aged 18 years and older with the diagnosis of chronic obstructive pulmonary disease (COPD) who have forced expiratory volume in one second/forced vital capacity (FEV₁/FVC) less than 70% and have symptoms (e.g., dyspnea, cough/sputum, wheezing) (see the related "Denominator Inclusions/Exclusions" field in the Complete Summary).

NUMERATOR DESCRIPTION

- All symptomatic patients who were prescribed an inhaled bronchodilator

3. Documentation of smoking status (by inquiry) at every visit²⁶

- **Latest Revision:** January 2007
- **Source:** Institute for Clinical Systems Improvement (ICSI)
- **Abstract:** [Link](#)

DESCRIPTION

- This measure is used to assess the percentage of patients with chronic obstructive pulmonary disease (COPD) whose physician inquired about smoking cessation (if patient a smoker) at every visit.

RATIONALE

- The priority aim addressed by this measure is to increase the number of patients with chronic obstructive pulmonary disease (COPD) who receive information on the options for tobacco cessation and information on the risks of continued smoking.

PRIMARY CLINICAL COMPONENT

- Chronic obstructive pulmonary disease (COPD); smoking cessation

DENOMINATOR DESCRIPTION

- Patients with a diagnosis of chronic bronchitis: (491.8, 491.20, or 491.21) or asthma with chronic obstructive pulmonary disease (COPD) (493.2) or chronic emphysema (491.20) who have an indication in their charts that they are users of tobacco who present for a clinic visit within the reporting month

NUMERATOR DESCRIPTION

- Number of patients with any indication in the chart that the physician asked about a change in smoking status and/or readiness to quit

4. Smoking cessation intervention²⁷

- **Latest Revision:** March 2006
- **Source:** AMA/PCPI
- **Abstract:** [Link](#)

DESCRIPTION

- This measure is used to assess the percentage of smokers who received a smoking cessation intervention at least annually.

RATIONALE

- According to the United States Preventive Services Task Force (USPSTF), tobacco cessation counseling is recommended for all patients who smoke.
- According to the American Thoracic Society (ATS) and the European Respiratory Society (ERS), quitting smoking can slow the progressive loss of lung function and can reduce symptoms at any point in time.

PRIMARY CLINICAL COMPONENT

- Chronic obstructive pulmonary disease (COPD); tobacco cessation; counseling

DENOMINATOR DESCRIPTION

- All patients aged 18 years and older with the diagnosis of chronic obstructive pulmonary disease (COPD) identified as smokers

NUMERATOR DESCRIPTION

- All patients identified as smokers who received a smoking cessation intervention during one or more office visits each year

5. Prescription of long-term continuous O2 for patients with resting O2 sat ≤ 88%²⁸

- **Latest Revision:** March 2006
- **Source:** AMA/PCPI
- **Abstract:** [Link](#)

DESCRIPTION

- This measure is used to assess the percentage of patients who received long term oxygen therapy.

RATIONALE

- According to the American Thoracic Society (ATS) and the European Respiratory Society (ERS), patients whose disease is stable on a full medical regimen, with arterial carbon dioxide tension (PaO₂) less than 55 mm Hg [7.3 k Pa] (corresponding to an (SaO₂ less than 88%), should receive long term oxygen therapy (LTOT).
- Long-term administration of oxygen (greater than 15 hours per day) to patients with chronic respiratory failure has been shown to increase survival.

PRIMARY CLINICAL COMPONENT

- Chronic obstructive pulmonary disease (COPD); long-term oxygen therapy

DENOMINATOR DESCRIPTION

- All patients aged 18 years and older with a diagnosis of chronic obstructive pulmonary disease (COPD) and an oxygen saturation less than or equal to 88% or an arterial oxygen tension (PaO₂) less than or equal to 55 mm Hg (see the related "Denominator Inclusions/Exclusions" field in the Complete Summary)

NUMERATOR DESCRIPTION

- All patients who were prescribed long term oxygen therapy

6. Administration of pneumococcal vaccine²⁹

- **Latest Revision:** March 2006
- **Source:** AMA/PCPI
- **Abstract:** [Link](#)

DESCRIPTION

- This measure is used to assess the percentage of patients who received a pneumococcus immunization.

RATIONALE

- According to the Advisory Committee on Immunization Practices, Centers for Disease Control and Prevention (CDC), all patients with chronic disease of the pulmonary system should be vaccinated.

PRIMARY CLINICAL COMPONENT

- Chronic obstructive pulmonary disease (COPD); pneumococcus immunization

DENOMINATOR DESCRIPTION

- All patients aged 18 years and older with the diagnosis of chronic obstructive pulmonary disease (COPD) (see the related "Denominator Inclusions/Exclusions" field in the Complete Summary)

NUMERATOR DESCRIPTION

- All patients who are administered a pneumococcus immunization during a visit or who have already received a pneumococcus immunization

7. Administration of latest influenza vaccine³⁰

- **Latest Revision:** March 2006
- **Source:** AMA/PCPI
- **Abstract:** [Link](#)

DESCRIPTION

- This measure is used to assess the percentage of patients who received influenza immunization during current flu season.

RATIONALE

- According to the National Heart, Lung, and Blood Institute (NHLBI)/World Health Organization (WHO), influenza vaccines can reduce serious illness and death in chronic obstructive pulmonary disease (COPD) patients by about 50 percent.

PRIMARY CLINICAL COMPONENT

- Chronic obstructive pulmonary disease (COPD); influenza immunization

DENOMINATOR DESCRIPTION

- All patients aged 18 years and older with the diagnosis of chronic obstructive pulmonary disease (COPD) seen during flu season (see the related "Denominator Inclusions/Exclusions" field in the Complete Summary)

NUMERATOR DESCRIPTION

- All patients who are administered an influenza immunization during the visit or who have already received an influenza immunization during the current flu season

8. Documentation of exacerbation frequency in last year**DESCRIPTION**

- Percentage of patients aged 18 through 75 years old with a diagnosis of chronic obstructive pulmonary disease (COPD) who have documentation of the number of exacerbations in the past 12 months.

DATA SOURCE

- Electronic data (visit, lab, and claims) and/or medical record data (paper-based records or EHR). This measure requires the use of claims/encounter data or medical record data for identification of patients with COPD for the denominator, and medical record data only for documentation of exacerbation frequency information for the numerator.

EXPLANATION

- The American Thoracic Society (ATS) and European Respiratory Society (ERS) state that exacerbations are a common cause of morbidity and mortality in patients with COPD and those with frequent exacerbations are more likely to have recurrent symptoms and hospital readmission within 14 days of original episode. Identification of patients at risk for recurrent symptoms improves decisions about hospital admissions and follow-up.³² Additionally, exacerbations are the leading cause of medical visits and hospitalizations for COPD patients.³³ Clinicians who provide services for the primary management of COPD will submit this measure.

DENOMINATOR

- Patients aged 18-75 years with the diagnosis of chronic obstructive pulmonary disease (COPD). Information on the domain's denominator diagnosis can be found under the "Patient Eligibility Criteria" section of the document. Two methods are provided to identify patient's documented COPD diagnosis: claims and medical record data.

NUMERATOR

- Documentation of patient's exacerbation frequency in the past 12 months, from the last day of the reporting period.

Electronic Collection: The patient is numerator compliant if he or she has documentation of the number of exacerbations, or as indicated by an acute inpatient discharge or ED encounter with a principal diagnosis of COPD, in the last 12 months from the last day of reporting period, as evidenced through claims data. **Table 4** is a list of codes to identify exacerbation:

Table 4. Codes Identifying COPD Exacerbation			
CPT³⁴	CPT II	ICD-9-CM³⁵	UB Revenue³⁴
ED visit: 99281-99285	N/A	491.21 491.22 Codes to identify COPD: 491, 492, 496	Acute inpatient discharge: 010x, 0110-0114, 0119, 0120-0124, 0129, 0130-0134, 0139, 0140-0144, 0149, 0150-0154, 0159, 016x, 020x-022x, 072x, 0987
Sources:			
34. National Committee for Quality Assurance. HEDIS 2009 Technical Specifications for Physician Measurement. p. 1-314. http://www.ncqa.org/tabid/59/Default.aspx . Published October 2008. Accessed November 11, 2008.			
35. Primaris. DRG 088- Chronic Obstructive Pulmonary Disease ICD-9-CM Coding Guidelines. http://www.primaris.org/documents/resources/coding%20guidelines%20booklet_DRG_088.pdf . Revised March 2006. Accessed September 25, 2009.			

Steps to identify exacerbations through hospitalization:

Step 1: Identify all patients who during the Intake Period had an acute inpatient discharge or an ED visit with a primary diagnosis of COPD. Use **Table 4** to identify ED visits and acute inpatient discharges.

Step 2: Determine all COPD Episode Dates. For each patient identified in step 1, identify all acute inpatient discharges and ED visits. For ED visits that lead to an acute inpatient stay with a primary diagnosis of COPD (identified in Step 1), exclude the ED visit and include only the inpatient stay.

Step 3: Test for transfers. Exclude Episode Dates on which the patient was transferred directly to an acute or non-acute care facility for any diagnosis.

Step 4: Test for readmission. Exclude inpatient ED Episode Dates on which the patient was readmitted to an acute or non-acute care facility for any diagnosis on or seven days after discharge.

Step 5: Calculate patient inclusion criteria³⁴

Medical Record Collection: A patient is numerator compliant if he or she has at a minimum, a note indicating the number of exacerbations within the last 12 months, from the last day of the reporting period. Evidence of exacerbation may be collected through one of the following:

- A. A statement in the medical recording indicating the number of exacerbations patient experienced in the past year.
- B. Exacerbation reported to physician’s office by phone, outpatient visit, ER visit or hospitalization.
- C. Documentation of a standing self-management plan, including instructions and prescriptions for the patient to self-treat exacerbations.

FREQUENCY

- Most recent result over the last 12 calendar months from last day of the reporting period.

SCORING

- Earned Points = [numerator/denominator] x maximum available points for the measure

9. Prescription of at least 1 long-acting bronchodilator and /or an inhaled corticosteroid for patients with a history of exacerbation.

DESCRIPTION

- o Percentage of patients aged 18 through 75 years old with a diagnosis of chronic obstructive pulmonary disease (COPD) with a history of exacerbation who were prescribed at least 1 long-term bronchodilator and/or were prescribed an inhaled corticosteroid in the past 12 months.

DATA SOURCE

- o Electronic data (visit, lab, and claims) and/or medical record data (paper- based records or EHR). This measure requires the use of claims/encounter data or medical record data for identification of patients with COPD with a history of exacerbation for the denominator, and claims/encounter, pharmacy or medical record data for medication prescription information for the numerator.

EXPLANATION

- o The American Thoracic Society (ATS) and European Respiratory Society’s (ERS) clinical practice guidelines for the management of chronic obstructive pulmonary disease (COPD) state that long-acting bronchodilators improve health status as well as reduce symptoms, rescue medication use and increase the time between exacerbations.³² Also, the National Heart Lung and Blood Institute and the World Health Organization state that bronchodilator medications are central to symptomatic management of COPD, and that inhaled glucocorticosteroids reduce frequency of exacerbations in symptomatic, severe COPD patients with repeated exacerbations.⁸ Clinicians who provide services for the primary management of COPD will submit this measure.

DENOMINATOR SUBSET

- o Patients aged 18-75 years with the diagnosis of chronic obstructive pulmonary disease (COPD) AND history of exacerbation. Information on the domain’s denominator diagnosis can be found under the “Patient Eligibility Criteria” section of the document. Two methods are provided to identify patient’s documented history of exacerbation: claims and medical record data.

Electronic Collection: The patient is denominator compliant if he or she has documentation of exacerbation, or as indicated by an acute inpatient discharge or ED encounter with a principal diagnosis of COPD, in the last 12 months from the last day of reporting period, as evidenced through claims data. **Table 5** is a list of codes to identify exacerbation:

Table 5. Codes Identifying COPD Exacerbation			
CPT³⁴	CPT II	ICD-9-CM³⁵	UB Revenue³⁴
ED visit: 99281-99285	N/A	491.21 491.22 Codes to identify COPD: 491, 492, 496	Acute inpatient discharge: 010x, 0110-0114, 0119, 0120-0124, 0129, 0130-0134, 0139, 0140-0144, 0149, 0150-0154, 0159, 016x, 020x-022x, 072x, 0987
Sources:			
34. National Committee for Quality Assurance. HEDIS 2009 Technical Specifications for Physician Measurement. p. 1-314. http://www.ncqa.org/tabid/59/Default.aspx . Published October 2008. Accessed November 11, 2008.			
35. Primaris. DRG 088- Chronic Obstructive Pulmonary Disease ICD-9-CM Coding Guidelines. http://www.primaris.org/documents/resources/coding%20guidelines%20booklet_DRG_088.pdf . Revised March 2006. Accessed September 25, 2009.			

Steps to identify exacerbations through hospitalization:

Step 1: Identify all patients who during the Intake Period had an acute inpatient discharge or an ED visit with a primary diagnosis of COPD. Use **Table 5** to identify ED visits and acute inpatient discharges.

Step 2: Determine all COPD Episode Dates. For each patient identified in step 1, identify all acute inpatient discharges and ED visits. For ED visits that lead to an acute inpatient stay with a primary diagnosis of COPD (identified in Step 1), exclude the ED visit and include only the inpatient stay.

Step 3: Test for transfers. Exclude Episode Dates on which the patient was transferred directly to an acute or non-acute care facility for any diagnosis.

Step 4: Test for readmission. Exclude inpatient ED Episode Dates on which the patient was readmitted to an acute or non-acute care facility for any diagnosis on or seven days after discharge.

Step 5: Calculate patient inclusion criteria³⁴

Medical Record Collection: A patient is denominator compliant if he or she has at a minimum, a note indicating number of exacerbations within the last 12 months, from the last day of the reporting period. Evidence of exacerbation may be collected through one of the following:

- A. A statement in the medical recording indicating the patient has experienced one or more exacerbations in the past year.
- B. Exacerbation reported to physician’s office by phone, outpatient visit, ER visit or hospitalization.
- C. Documentation of a standing self-management plan, including instructions and prescriptions for the patient to self-treat exacerbations.

NUMERATOR

- o Documentation of a patient having been prescribed at least 1 long-acting bronchodilator (long-acting beta-agonist [LABA] or long-acting antimuscarinic [LAMA]) and/or at least 1 inhaled corticosteroid in the past 12 months, from the last day of the reporting period. Three methods are provided to identify patients documented inhaled bronchodilator medication prescription: pharmacy, claims and medical record data.

Electronic Collection: The patient is numerator compliant if:

- A. **Pharmacy data:** He or she was dispensed at least one inhaled bronchodilator medication (long-acting β_2 agonist and/or long-acting anticholinergic) and/or an inhaled corticosteroid in the past 12 months, from the last day of the reporting period. For a list of examples of numerator compliant inhaled bronchodilator and corticosteroid medications see **Tables 6** and **7**. This list is provided as an example but does not constitute an exhaustive list of appropriate medications.

Table 6.³⁴

Description	Prescription		
Long-acting Antimuscarinic agents	• tiotropium		
Long-acting beta 2-agonists	• budesonide-formoterol	• fluticasone-salmeterol	• salmeterol

Table 7. ³⁴

Description	Prescription
Glucocorticoids	<ul style="list-style-type: none"> • betamethasone • dexamethasone • triamcinolone

OR

- B. Claims: He or she has documentation of being dispensed at least one inhaled bronchodilator medication (long-acting β 2 agonist and/or long-acting anticholinergic) and/or an inhaled corticosteroid in the past 12 months, from the last day of the reporting period, as evidenced through claims. **Tables 8** and **9** list codes to identify the dispensing of an inhaled bronchodilator medication and/or an inhaled corticosteroid.

Table 8. Codes Identifying Inhaled Bronchodilators		
CPT	CPT II ³⁶	ICD-9-CM
N/A	4025F	N/A
Sources: 36. American Medical Association. CPT Online. https://catalog.ama-assn.org/Catalog/cpt/cpt_search.jsp?locality=MD . Published 2008. Accessed September 25, 2009.		

Table 9. Codes Identifying Inhaled Corticosteroid		
CPT	CPT II ³⁶	ICD-9-CM
N/A	4135F	N/A
Sources: 36. American Medical Association. CPT Online. https://catalog.ama-assn.org/Catalog/cpt/cpt_search.jsp?locality=MD . Published 2008. Accessed September 25, 2009.		

Medical Record Collection:

Pharmacy data: He or she was dispensed at least one inhaled bronchodilator medication (LABA or LAMA) and/or an inhaled corticosteroid in the past 12 months, from the last day of the reporting period. For a list of numerator compliant inhaled bronchodilator medications and inhaled corticosteroids see **Tables 6** and **7** under “Relevant Medication Lists for COPD CL Measurement Set.”

Medical Record Data: Patient is numerator compliant if

He or she has at a minimum a note indicating the date on which at least one inhaled bronchodilator (LABA or LAMA) and/or an inhaled corticosteroid was prescribed OR dated documentation of a prescription for at least one inhaled bronchodilator medication (β 2 agonist

and/or anticholinergic) and/or an inhaled corticosteroid from another treating physician. In either case, the document date must fall within the last 12 months from the last day of the reporting period. For a list of numerator compliant inhaled bronchodilator medications and inhaled corticosteroids see **Tables 6 and 7** under “Relevant Medication Lists for COPD CL Measurement Set.”

FREQUENCY

- Most recent result over the last 12 calendar months from last day of the reporting period.

SCORING

- Earned Points = [numerator/denominator] x maximum available points for the measure

10. O₂ saturation assessment for COPD

DESCRIPTION

- Percentage of patients aged 18 through 75 years old with a diagnosis of chronic obstructive pulmonary disease (COPD) and have either FEV₁ < 50% predicted, (2) respiratory failure or (3) right heart failure, who received an O₂ saturation assessment in the past 12 months.

DATA SOURCE

- Electronic data (visit, lab, and claims) and/or medical record data (paper-based records or EHR). This measure requires the use of claims/encounter data or medical record data for identification of patients with COPD for the denominator, and claims/encounter data or medical record data for O₂ sat information for the numerator.

EXPLANATION

- The American Thoracic Society (ATS) and European Respiratory Society’s (ERS) clinical practice guidelines for the management of chronic obstructive pulmonary disease (COPD) recommend measurement of arterial blood gases in COPD patients in both the moderate and severe stages. This includes oxygen saturation for use in initiation and trending of long-term oxygen therapy, as well as maintaining the important therapeutic goal of safe oxygen saturation levels during rest, sleep, and exertion.³² Medicare considers it necessary to initiate long-term oxygen therapy when oxygen saturation falls below 88%.³⁷ Clinicians who provide services for the primary management of COPD will submit this measure.

DENOMINATOR SUBSET

- The eligible population with a diagnosis of COPD and either (1) FEV₁ < 50% predicted, (2) respiratory failure or (3) right heart failure.

Electronic Collection: Not totally possible. Medical record data needed as shown below to establish FEV₁ < 50% predicted. With that, at least one claim or encounter with any ICD-9 code listed in **Table 10** within the past 12 months. Exclude any patient with CPT II code or HCPCS code in **Table 10**.

Table 10. Codes Identifying Respiratory Failure, Right Heart Failure or Oxygen Prescribed		
CPT II³⁶	ICD-9³⁸	HCPCS³⁹
Long-term Oxygen prescribed (4030F)	acute and chronic respiratory failure (518.84) chronic respiratory failure (518.83) congestive heart failure, unspecified (428.0) diastolic heart failure (428.3)	Oxygen, liquid or gaseous (E0443, E0434, E0435, E0439-E0444) indicating continuous supply
Sources: 36. American Medical Association. CPT Search. https://catalog.ama-assn.org/Catalog/cpt/cpt_search.jsp?locality=MD . Published 2008. Accessed September 25, 2009 38. ICD-9.chrisendres.com. Online ICD9/ICD9CM Codes. http://icd9cm.chrisendres.com/index.php?action=child&recordid=5087 . Updated 2009. Accessed September 25, 2009. 39. Noridian. DME Classification System. https://www.dmepdac.com/dmecsapp/do/hcpssearch . Updated 2008. Accessed September 25, 2009.		

Medical Record Collection: Presence of COPD in problem list AND a note indicating FEV₁ < 50% predicted, respiratory failure, or right heart failure.

NUMERATOR

- o Documentation of a patient having received an O₂ saturation assessment in the past 12 months, from the last day of the reporting period.

Electronic Collection: At least one claim or encounter with any code listed in **Table 11** within the past 12 months.

Table 11. Codes Identifying Oxygen Saturation Testing	
CPT³⁶	CPT II³⁶
82803, 82805, 83810, 83820 94760, 94761, 94762	3028F 3035F 3037F
Sources: 36. American Medical Association. CPT Search. https://catalog.ama-assn.org/Catalog/cpt/cpt_search.jsp?locality=MD . Published 2008. Accessed September 25, 2009	

Medical Record Collection: A note indicating

A. The date and O₂ saturation results, either of arterial blood gas test or pulse oximetry (SpO₂), OR dated documentation of O₂ saturation evaluation and results from another treating practitioner. In either case the document date must fall within the last 12 months, from the last day of the reporting period.

OR

B. The date and O₂ saturation results from patient’s home monitoring of pulse oximetry, sent from home monitoring device to physician electronically or via mail or fax.

OR

C. Documentation of a physical inability to perform O₂ saturation.

Exclusions to be counted for numerator compliance: Patients on O₂ for palliation. **Table 12** lists codes identifying palliative care.

CPT³⁶	CPT II	ICD-9-CM⁴⁰
99377 99378	N/A	V66.7

Sources:
36. American Medical Association. CPT Search. https://catalog.ama-assn.org/Catalog/cpt/cpt_search.jsp?locality=MD. Published 2008. Accessed September 25, 2009
40. ICD-9.chrisendres.com. Online ICD9/ICD9CM Codes. <http://icd9cm.chrisendres.com/index.php?action=child&recordid=11333>. Updated 2009. Accessed September 25, 2009.

The following is not acceptable documentation for O₂ saturation assessment for COPD:

1. Patient self-reporting or self-monitoring
2. Findings reported on progress notes or other non-laboratory documentation.

FREQUENCY

- o Most recent result over the last 12 calendar months from last day of the reporting period.

SCORING

- o Earned Points = [numerator/denominator] x maximum available points for the measure

Appendix D: COPD Quality Measures Scoring Grid

<u>Clinical Measures</u>	<u>Level I</u>	<u>Level II</u>	<u>Level III</u>
Documentation of spirometry	10	20	20
Prescription of 1 or more inhaled bronchodilators (long-acting preferred if persistent symptoms) if FEV/FVC < 0.70 & dyspnea	10	20	20
Documentation of smoking status (by inquiry) at every visit	10	20	20
Smoking cessation intervention	10	20	20
Documentation of exacerbation frequency in last year	10	20	20
Prescription of at least 1 long-term bronchodilator and / or an inhaled corticosteroid for patients with a history of exacerbation	10	20	20
O2 saturation assessment for COPD	10	25	25
Prescription of long-term continuous O2 for patients with resting O2 sat ≤ 88%	15	25	25
Admin of pneumococcal vaccine	5	5	15
Admin of latest influenza vaccine	10	10	
TOTAL POINTS	100	100	100
RECOGNITION LEVEL	60	60	60

Appendix E: Analytic Framework for the COPD Episode Case Rate

Construction of Analysis Datasets

This section outlines the steps for creating the analysis datasets for the chronic obstructive pulmonary disease (COPD) ECR modeling:

Step 1a. We identified patients with COPD using the ICD-9 “trigger codes” as outlined in tab labeled “COPD triggers” in the COPD_all_codes_08_14_08 worksheet attached. These codes need to be present in any position of a professional claim.

We did not want to trigger a COPD episode by an acute situation – either a hospitalization or an acute flare-up of COPD. So we refined the trigger to ensure only professional claims for chronic COPD are included by excluding “trigger” claims with the following codes in any position:

490 - 492.8 Chronic Bronchitis, Emphysema, COPD
493.2 - 493.22 Chronic Obstructive Asthma
496 Chronic airway obstruction, not elsewhere classified

This defined the number of COPD patients in the dataset and helped create the episode.

Step 1b: We created a 365-day long episode for COPD starting with the trigger claim for each patient. The trigger claim was the earliest claim with one of the COPD trigger codes mentioned in step 1a. The date of service of this claim started the time window for the episode. We pulled all claims with the date of service falling within the 365-day time window. This included professional, stay claims and pharmacy claims, for all conditions that included COPD.

Step 1c: True allowed amount is the chosen dependent variable. It is composed of the plan’s reimbursed amounts plus the patient’s portion in the form of co-pay, deductible, coinsurance amounts etc. This is the cost field that was generated for all claims and for all analyses.

Step 2: We verified for eligibility (continuous enrollment) for these patients for the episode time window. We selected members with continuous enrollment of at least 270 days from the date of the *trigger claim* for the time period under study. For a patient without at least 270 days of continuous enrollment from the service date of the earliest claim, but with a later claim meeting the 270-day continuous enrollment requirement, the later claim started the time window. This patient was deemed to have met the 270-day continuous enrollment requirement.

Patients without at least 270 days of continuous enrollment were excluded from further analysis. The new *N* of patients retained for further analysis was computed.

Step 3: We computed the total medical cost of the episode using the *true allowed amount* field for each claim line (detailed in step 1c). This included stay claims, inpatient professional, outpatient professional, lab, radiology and other ancillary claims but not pharmacy. This gave us the *raw cost* of the episode.

We dropped patients with the total medical cost of the episode missing, <\$20 or >\$1,000,000. At this point, we are not concerned whether the costs were for COPD or non-COPD care. We dealt with this in future steps. The new *N* of patients retained for further analysis was computed. We studied the cost distribution of professional and stay costs individually and together for these patients at the episode level.

Step 3a: We flagged each claim line with the following CCS category numbers and labels:
CCS diagnosis categories

CCS procedure categories
CCS to CPT service code categories

Step 3b: We created a modified AHRQ CCS category list by subtracting the expanded trigger codes from the medical and procedural CCS categories (see corresponding tab in the attached Excel worksheet titled COPD_all_codes_08_14_08). We ensured that the *triggers* listed in the *Expanded COPD triggers* tab are marked for retention and are not being inadvertently dropped as part of the larger CCS category in later analysis.

Step 3c: We studied the frequency (and costs) for the triggers and the modified AHRQ CCS conditions as well as the categories. This helped define the risk categories by aggregating various low volume conditions into super-conditions and procedural groups into super-groups that are fairly homogeneous and clinically meaningful. This analysis made the variables robust, and confirmed the exclusion criteria for later steps. The list of risk modifiers were defined clinically and further refined after empirical analysis. An empirical analysis of the procedural codes using the CCS for CPT classification helped determine the procedures used as modifiers.

Step 4: We excluded COPD members that met the medical exclusion criteria listed in the COPD_all_codes_08_14_08 worksheet (medical tab, column C). Among others this excluded members with HIV, pregnancy and newborn conditions. The new *N* of patients retained for further analysis was computed. We studied the cost distribution of professional and stay costs individually and together for these patients at the episode level.

Step 4a: We pulled pharmacy claims for COPD members retained from step 4 above, matching on member IDs and the prescription fill dates with the episode window for each patient. The claim and cost distribution for the pharmacy stream was studied.

This is the select group of COPD members that will be used for both the “typical” care and the potentially avoidable complications (PAC) analyses. Analysis subsequent to this step will be at the claim-level and not at the patient-level. Pharmacy steps will be detailed separately.

Step 4b: We removed inpatient stay claims with *allowed amount* missing or <\$50. These are possibly incomplete stays, or claims associated with error in payment. We studied *N* for patients dropped, *N* for claims dropped and dollars lost.

Step 5: We selected claims that carried COPD related diagnosis codes. For the COPD patients selected in the previous steps, we pulled only those *claims* with diagnosis codes identified in the tab named *Expanded COPD triggers* of the COPD_all_codes_08_14_08 worksheet.

- a. Professional claims that did not carry these codes in any position were removed from further analysis. We studied *N* for patients dropped, *N* for claims dropped and dollars lost.
- b. Hospitalizations that did not carry one of these codes in the primary position were excluded from the analysis. We studied *N* for patients dropped, *N* for claims dropped and dollars lost.
- c. Inpatient professional claims corresponding (using the STAY_SERVICE_ID) to these removed hospitalizations were removed from further analysis. We studied *N* for patients dropped, *N* for claims dropped and dollars lost.

Step 6: We further refined our analysis sample. We removed claims irrelevant to COPD care using the criteria outlined below. Irrelevant services are those that are provided to COPD patients that do not relate directly to care for COPD such as a knee replacement procedure.

- a. Professional claims: We removed those with diagnosis codes identified in column D (labeled irrelevant claims) of the *medical* tab in the attached excel worksheet called COPD_all_codes_08_14_08.
- b. Professional claims: We also removed claims with services (CPT codes) that match to the CCS procedural categories identified in column C of the tab called *proc* marked as irrelevant claims (exclude) in the file

called COPD_all_codes_08_14_08. These CCS categories map to the CPT codes using the CCS for CPT files.

- c. Inpatient claims: We removed claims for hospitalizations carrying diagnosis codes (in any position) marked irrelevant (column D of *medical* tab in COPD_all_codes_08_14_08). These map to ICD-9 diagnosis codes of the CCS medical categories.
- d. Inpatient claims: We removed claims for hospitalizations carrying procedure codes (in any position) marked irrelevant (column C of the *proc* tab in COPD_all_codes_08_14_08). These map to ICD-9 procedure codes of the CCS procedural categories.
- e. Professional claims corresponding to the time period on the irrelevant stays in sub-steps 3 and 4 above were also excluded.

We created summary statistics of patients and claims that are in the *included bucket with N* of patients and costs (average and range) at the episode level.

Step 7: For the retained COPD patients, we removed claims for *case-breaker* services. Case-breaker services are those services provided to patients with COPD but are in themselves major and suggestive that the aftermath of COPD has advanced to a level that the services provided are now for a different condition. Examples are CABG (coronary artery bypass graft) and angioplasty in COPD patients with relevant comorbid conditions. The criteria to identify and exclude these case-breaker services are outlined below:

- a. Professional claims: We removed claims for services (CPT codes) matching the CCS procedural categories (column D labeled case breaker (exclude) of the *proc_** tab in COPD_all_codes_playbook.xls). These CCS categories map to CPT codes using the CCS for CPT files.
- b. Inpatient claims: We removed hospitalizations that carry procedure codes that are case-breakers (column D of the *proc_** tab in COPD_all_codes_playbook.xls). These map to ICD-9 procedure codes of the CCS procedural categories.
- c. Professional claims corresponding to the time period of the stay were also being excluded.

We created summary statistics of patients and claims that *are* in the *included* bucket with *N* of patients and costs (average and range) at the episode level.

Step 7d: From the pharmacy claims selected in step 4a, for the selected COPD patients for the episode time window, we excluded those pharmacy claims identified in *Drugs_for_COPD* 10-13-08. For pharmacy claims, we match on member ID for patients kept in the database and with a prescription fill date that falls within the episode time window.

We are left with the *relevant Services* for COPD Patients. From the relevant services we identified patients and services for two analyses: The *typical cases* and services dataset that aggregates services provided for care of a *typical uncomplicated COPD patient*, and services related to potentially avoidable *complications* of COPD (PAC). The *typical* bucket forms the basis of the regression modeling exercise, and the PAC bucket helps determine the average cost of complications to define the allowance for potentially avoidable complications.

Step 8: Construction of the *typical cases and services* Bucket: The following criteria were used to ensure that only claims and services related to *typical* COPD care are selected for the modeling exercise.

Since a typical COPD patient should not incur any inpatient stays or ER visits, only professional and pharmacy claims were used for this analysis.

- a. We moved all stay claims during the episode time window from *typical* bucket to the PAC bucket.
- b. All corresponding inpatient professional claims during the episode time window were moved to the PAC bucket.
- c. All professional claims relating to ER visits are considered avoidable, and were moved to the PAC bucket.
- d. Claims carrying a PAC code in any position were moved to the PAC bucket.
- e. Any claim carrying diagnosis codes in any position marked in column E of the *medical* tab labeled PAC (exclude from typical regression) was moved to the PAC bucket.

- f. Any claim carrying CPT codes matching the CCS procedural categories identified in column E of the *proc* tab marked PAC (exclude from typical) in *COPD_all_codes_08_14_08* was moved to the PAC bucket.
- g. The pharmacy claims carrying NDC codes belonging to drug classes labeled typical (in spreadsheet *Drugs_for_COPD 10-13-08*) were included in the typical bucket.

We created summary statistics of patients and claims that are in the *typical* bucket with *N* of patients and costs (average and range) at the episode level with professional claims, stay claims, and pharmacy together as well as individually.

Step 9: Construction of the PAC Bucket: All relevant claims that have not been pulled into the typical bucket were aggregated into the PAC bucket. We studied the costs for reasonableness.

We verified the claims as described below were indeed in the PAC bucket.

1. All inpatient stays that carry triggers related to COPD in the primary position as identified in the *Expanded COPD triggers* tab were pulled into the PAC bucket.
2. All professional claims corresponding to the selected inpatient stays above were pulled into the PAC bucket.
3. All professional claims carrying markers for PACs in any position as identified in column G (type – PAC) of the *Expanded COPD triggers* tab C were pulled into the PAC bucket.
4. All professional claims that have diagnosis codes identified in column E (PAC – exclude form typical regression) of the *Medical* tab were pulled into the PAC bucket.
5. All professional claims identified by CPT codes that match to the CCS categories marked in column E (PAC exclude from typical) of the *proc* tab were pulled into the PAC bucket. We used the CCS for CPT file to do this matching.
6. All professional claims identified by procedure codes that match to the CCS procedure categories marked in column E as *PAC (exclude from typical regression)* were pulled into the PAC bucket. Here we used the CCS procedure categories and I-9 procedure codes to identify professional services related to care of potentially avoidable complications.
7. All pharmacy claims not in the excluded list, or not included in the *typical* bucket were pulled into the PAC bucket.

We created the summary statistics of patients and claims that are in the PAC bucket with *N* of patients and costs (average and range) at the episode level. We performed a univariate analysis of the relative frequency and costs of various risk categories in the two datasets – those with typical COPD cases and claims, and those with PAC claims.

Step 10: Risk factors for typical regression analysis: Using the CCS category labels already created in step 3, we identified risk factors that are present for every member episode. In addition, the severity of COPD classification as captured in *Expanded COPD Triggers* tab were used as modifiers in the risk-adjustment analysis. We also included select procedure codes as modifiers. We did a univariate analysis of the relative frequency and costs of various predictors, and built a multivariable regression model. The following are the details of the model.

1. Age and gender
2. Medical Risk Factors - identified in *Expanded COPD Triggers* tab – numbered in Column E and labels in column F (RF1...RF4, and M1-M36)
3. Risk categories were combined if they overlap in tab marked *Expanded COPD Triggers* and *medical* tab
4. Procedural Risk Factors –numbered in column F and labels in column G of *proc* tab (P1...P31)
5. Pharmacy Risk Factors
6. Number of Medical Risk Categories as an independent variable
7. Number of Procedural Risk Categories as an independent variable
8. Number of Pharmacy Risk Categories as an independent variable

Please note that many risk factors may have the same number in various tabs – in that case claims that carry any of these indicators were combined together to give the final count.

Step 11: The multivariable selection model: The following operating rules were adopted for performing the typical regression analysis.

1. Variables from the univariate “typical” analysis were selected if they met the following criteria:
 - a. $N \geq 30$
 - b. P-value < 0.5
2. Stepwise regression analysis performed using log-transformed model and using a criteria of $p < 0.05$ for variables to enter and exit the model
3. Variables in the multivariable regression analysis were refined using the following criteria:
 - a. $VIF < 3.0$ – select clinically the best variable
 - b. Positive sign
 - c. P-value < 0.05
 - d. Partial R-square and contribution to model (parsimonious)
 - e. Validation and test datasets confirm that the variables are stable both based on coefficients and selection by different models
 - f. Regression diagnostics confirm residuals are random and non-constant

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