

## Improving Costs and Outcomes for Diabetic Patients with Cardiovascular Disease or ephropathy

### Evidence Points to Use of Angiotensin-Converting Enzyme (ACE) Inhibitors or Angiotensin Receptor Blockers (ARBs)

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## The Facts

The purpose of this analysis is to quantify the potential financial savings that can be achieved through improved compliance with evidence based guidelines. The savings estimates are based on results of published research and an analysis of claims data for a commercial population.

### Clinical Significance

Cardiovascular disease and diabetic nephropathy are major causes of morbidity and mortality among patients with diabetes mellitus. Approximately 70% of mortality among diabetic patients is attributable to cardiovascular causes.<sup>1,2</sup>

Diabetic patients have also been found to be at increased risk of mortality following a coronary event.<sup>3,4</sup>

Diabetic nephropathy contributes to substantial diabetes-related morbidity. Microalbuminuria alone is a marker for cardiovascular disease.<sup>5</sup> In the United States, diabetic nephropathy occurs in 20 to 30% of patients with diabetes and is the single leading cause of end-stage renal disease (ESRD).<sup>6</sup>

### Best Research Evidence

Use of angiotensin-converting enzyme (ACE) inhibitors have been shown to reduce cardiovascular risk.<sup>2,7</sup> The Heart Outcomes Prevention Evaluation (HOPE) trial found that the use of ACE inhibitors versus placebo among diabetic patients with at least one additional cardiovascular risk factor reduced myocardial infarction by 20%, stroke by 32%, and overall mortality by 16%.<sup>8</sup> Additional benefits included significant reductions in congestive heart failure, diabetic complications, revascularization procedures, and cardiac deaths.<sup>8</sup>

The role of angiotensin receptor blockers (ARBs) in improving cardiovascular outcomes is less clear. Although several trials have failed to demonstrate that ARBs are as effective as, or superior to, ACE inhibitors, the VALIANT trial showed comparable efficacy in reducing cardiovascular events and death.<sup>9</sup> In addition, ARBs improved cardiovascular outcomes in a subset of patients with diabetes, hypertension, and end-organ injury.<sup>10</sup> ACE inhibitors and ARBs have also been shown to reduce the rate of progression of microalbuminuria to overt proteinuria and the progression of renal impairment to ESRD in patients with diabetes.<sup>11,12</sup> The preservation of renal function demonstrated with these medications was independent of their blood pressure lowering effects.

# The Opportunity: Diabetes Mellitus

## Based on the finding of controlled clinical trials:

### Impact of Treatment

- Myocardial infarction can be reduced by 20% among patients taking ACE/ARB therapy, from an incidence of 12.3% to 9.9%.<sup>8</sup>
- Stroke can be reduced by 32% among patients taking ACE/ARB therapy, from an incidence of 4.9% to 3.4%.<sup>8</sup>
- Revascularization can be reduced by 15% among patients taking ACE/ARB therapy, from an incidence of 18.3% to 16.0%.<sup>8</sup>

## Based on a claims analysis of a commercial population (non-Medicare):

### Rate of Non-Compliance

In a typical health plan population,<sup>a</sup> 60% of patients with diabetes mellitus who have cardiovascular disease or nephropathy do not take or are not compliant with their ACE/ARB medication.<sup>d</sup>

### Cost of Non-Compliance

- The cost of inpatient hospital treatment for acute myocardial infarction (excluding patients who had revascularization) was roughly \$17,550 per event in 2004.
- The cost of inpatient hospital treatment for stroke was roughly \$4,400 per event in 2004.
- The cost of inpatient hospital treatment for revascularization (weighted average for bypass surgery or angioplasty) was roughly \$24,550 per event in 2004.

### Cost of Therapy

Annual cost of ACE or ARB medication for a fully adherent patient was roughly \$300 per patient in 2004.

### Potential Savings

Based on the above assumptions, increasing compliance with ACE or ARB medication could generate the following savings<sup>c</sup> reducing myocardial infarction and stroke:

Commercially insured population (estimated prevalence = 22.7 per 1,000 health plan members<sup>c</sup>):

**\$0.36**

per member  
per month (pmpm)

**\$436,000**

annually per 100,000  
health plan members

**\$641**

annually per non-compliant  
diabetic patient with  
indications

## The Solution: Symmetry EBM Connect

Symmetry EBM Connect is a software engine that uses claims and laboratory results data against evidence-based practice guidelines to identify deviations in care. With Symmetry EBM Connect, users can view the rules for a specific condition and identify specific gaps in care. The entire set of rules for diabetes mellitus is presented here, with the three rules that support this savings opportunity highlighted.

The following EBM Connect results are based on 3.4 million members with 12 months or greater medical benefit coverage (about 40% of these members did not have a pharmacy benefit). Reporting software not included with EBM Connect.

Rule Type	Measure Description	Report Rule ID	Results Flagged "Yes"	Results Flagged "No"	Rule Not Applicable	No Rx	Total Pts. W/Condition	EBM Flag	Non-Compliance Rate
R-2	Patient(s) that had at least 2 hemoglobin A1C tests in last 12 reported months.	9136001	43,410	34,406	0	NA	77,816	34,406	44.2%
R-2	Patient(s) that had an annual screening test for diabetic nephropathy.	9136002	20,666	51,851	5,299	NA	77,816	51,851	71.5%
R-2	Patient(s) that had an annual screening test for diabetic retinopathy.	9136003	23,904	53,879	33	NA	77,816	53,879	69.3%
R-1	Patient(s) with a diagnosis of proteinuria that are prescribed an ACE-inhibitor or angiotensin receptor antagonist.	9136004	216	98	47,325	30,177	77,816	98	31.2%
CP-1	Patient(s) that had an LDL cholesterol in last 12 reported months.	9139005	53,678	24,138	0	NA	77,816	24,138	31.0%
CP-R	Patient(s) with most recent LDL result >=100mg/dL.	9139006	10,573	7,541	59,702	NA	77,816	10,573	58.4%
CP-1	Patient(s) with a HDL cholesterol test in last 12 reported months.	9139007	53,710	24,106	0	NA	77,816	24,106	31.0%
CP-R	Patient(s) with the most recent HDL result <=40mg/dL.	9139008	15,800	7,030	54,986	NA	77,816	15,800	69.2%
CP-1	Patient(s) that had a triglyceride test in last 12 reported months.	9139009	53,386	24,430	0	NA	77,816	24,430	31.4%
CP-O	Patient(s) with most recent triglyceride result < 150mg/dL.	9136010	11,215	11,700	54,901	NA	77,816	0	NA
CP-O	Patient(s) with most recent triglyceride result 150 - 199mg/dL.	9136011	4,308	18,607	54,901	NA	77,816	0	NA
CP-O	Patient(s) with most recent triglyceride result 200 - 499mg/dL.	9136012	6,494	16,421	54,901	NA	77,816	0	NA
CP-R	Patient(s) with most recent triglyceride result >= 500mg/dL.	9136013	891	22,024	54,901	NA	77,816	891	3.9%
A	Patient(s) compliant with prescribed ACE-inhibitor (minimum compliance 70%).	9137014	13,752	2,080	31,807	30,177	77,816	2,080	13.1%
A	Patient(s) compliant with prescribed angiotensin receptor antagonist (minimum compliance 70%).	9137015	5,481	896	41,262	30,177	77,816	896	14.1%
A	Patient(s) compliant with prescribed biguanide (e.g. metformin) (minimum compliance 70%).	9137016	11,936	2,984	32,719	30,177	77,816	2,984	20.0%
A	Patient(s) compliant with prescribed thiazolidinedione (e.g. pioglitazone, rosiglitazone) (minimum compliance 70%).	9137017	8,420	1,626	37,593	30,177	77,816	1,626	16.2%
A	Patient(s) compliant with prescribed alpha-glucosidase inhibitor (e.g. acarbose, miglitol) (minimum compliance 70%).	9137018	136	58	47,445	30,177	77,816	58	29.9%
A	Patient(s) compliant with prescribed sulfonylurea (e.g. glipizide, glyburide, glimepiride) (minimum compliance 70%).	9137019	12,594	2,962	32,083	30,177	77,816	2,962	19.0%
A	Patient(s) compliant with prescribed meglitinide (e.g. repaglinide) (minimum compliance 70%).	9137020	321	155	47,163	30,177	77,816	155	32.6%
A	Patient(s) compliant with prescribed D-phenylalanine (e.g. nateglinide) (minimum compliance 70%).	9137021	246	139	47,254	30,177	77,816	139	36.1%

View the specific rules applied by EBM Connect.

View patient care measured by EBM Connect.

View the number of patients included.

Identify the largest opportunities for improving outcomes and savings.

## The Solution: Symmetry EBM Connect

Rule Type	Measure Description	Report Rule ID	Results Flagged "Yes"	Results Flagged "No"	Rule Not Applicable	No Rx	Total Pts. W/Condition	EBM Flag	Non-Compliance Rate
S-M	Patient(s) taking an ACE-inhibitor or angiotensin receptor antagonist that had an annual serum potassium (K+) test	9138022	15,853	6,131	25,655	30,177	77,816	6,131	27.9%
S-M	Patient(s) taking biguanide (e.g. metformin) containing medications, ACE-inhibitor or angiotensin receptor antagonist that had an annual serum creatinine (Cr) test.	9138023	21,489	8,319	17,831	30,177	77,816	8,319	27.9%
S-M	Patient(s) taking biguanide (e.g. metformin) containing medications, thiazolidinediones (Actos, Avandia) or Precose that had an annual serum ALT or AST test.	9138024	16,690	7,082	23,867	30,177	77,816	7,082	29.8%
SD-I	Male patient(s) taking biguanide (i.e. metformin) containing medications that had serum creatine results >= 1.5mg/dl.	9138025	143	3,571	43,925	30,177	77,816	143	3.9%
SD-I	Male patient(s) taking biguanide (i.e. metformin) containing medications that had serum creatine results >= 1.4mg/dl.	9138026	76	2,917	44,646	30,177	77,816	76	2.5%
CP-I	Patient(s) that had a physician assessment in last 6 reported months.	9139027	69,416	8,400	0	NA	77,816	8,400	10.8%
CP-I	Patient(s) with evidence of specific diabetic complications that had endocrinology consultation.	9139029	106	195	77,515	NA	77,816	195	64.8%
CP-I	Patient(s) taking insulin with evidence of self-monitoring blood glucose testing.	9139030	5,423	4,453	37,763	30,177	77,816	4,453	45.1%

### Rules Glossary

<b>R-1 Level 1 Research Based</b>	Based on research derived from and supported by published professional societies, specialty organizations, and national clearinghouse guidelines with the highest strength of evidence based on public research and demonstrating a beneficial effect of treatment.
<b>R-2 Level 2 Research Based</b>	Based on research derived from and supported by published professional societies, specialty organizations, and national clearinghouse guidelines.
<b>CP-I Care Pattern Informational</b>	Provides general information about health care services or may identify under-utilization of services.
<b>CP-R Care Pattern Patient Risk</b>	Identifies patients who have clinical markers or use patterns indicative of poor disease control or an increased risk of poor outcomes.
<b>CP-O Care Pattern Observational</b>	Provide additional information about patients that may be helpful in understanding disease state. Not used to identify non-compliance or gaps in care.
<b>A Medication Adherence</b>	Measure the degree to which a patient is adhering to a prescribed medication based on prescription filling patterns.
<b>S-M Safety Monitoring</b>	Identify safety issues related to monitoring for possible adverse events (e.g., laboratory abnormalities) associated with specific medications.
<b>S-DI Safety Drug Interaction</b>	Identify safety issues related to drug-drug interactions, drug-disease interactions, and drug duplication.

## Notes

- a. Excludes Medicare.
- b. Ingenix data.
- c. The prevalence of diabetes mellitus in a typical commercially insured health plan population,<sup>a</sup> is 22.7 patients per 1,000 health plan members.<sup>b</sup> The proportion of diabetic patients with nephropathy is 20 to 30% (6). The proportion with coronary artery disease is 15 to 25%, and the proportion with congestive heart failure is 5 to 10%.<sup>b</sup> For the purpose of this analysis, it is assumed that 30% of diabetic patients have at least one of these risk factors. Thus, the prevalence of diabetic patients with indications for ACE/ARB therapy is 6.8 patients per 1,000 health plan members.
- d. Among diabetic patients with diagnosed coronary artery disease or renal dysfunction, 48% do not take, and an additional 12% are not adherent to, their prescribed ACE or ARB medication (i.e., less than 70% of the prescribed medication was taken).<sup>a</sup>
- e. Savings calculation = [(Prevalence of DM with Risk Factors) \* (Percent Non-Compliance with ACE/ARB) \* (Rate of Hospitalization) \* (Reduction in Hospitalization from ACE/ARB Compliance) \* (Cost of Hospitalization Less Cost of ACE/ARB Therapy)].

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Janis Diring-Khan is an epidemiologist and specialist in physician performance assessment. She presently directs research staff in analyzing the impact of compliance with evidence-based guidelines on medical costs and patient outcomes at Ingenix. She has been a leader in the development of physician profiling, integrating complexity adjustment methodologies into utilization and cost profiling and is responsible for the development of a nationwide clinical quality improvement program.

Diring-Khan received her Master of Public Health Degree in epidemiology from the University of Michigan School of Public Health in Ann Arbor. She completed her Graduate Internship in Epidemiology at Ontario Cancer Institute in Toronto. Diring-Khan holds an Associate of Science Degree in Mathematics from Mott Community College in Flint, Michigan, as well as a Bachelor of Science Degree in Zoology from Michigan State University in East Lansing.

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Schwebke received B.A. degrees in Biology and Psychology from the University of Minnesota. She received her M.D. degree at Mount Sinai School of Medicine in New York and completed her Internal Medicine residency and Infectious Diseases fellowship programs at the University of Minnesota. She completed a Masters in Public Health, Epidemiology, in 1995.



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