Estimating Angina Prevalence in a Managed Care Population

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Abstract

Estimations of angina prevalence were calculated using managed care administrative data and applying 3 angina-related definitions. The definitions comprised angina pectoris diagnosis codes, diagnosis and procedure codes signifying the broader condition of coronary artery disease (CAD), including angina pectoris, and diagnosis codes for the symptom of chest pain. Prevalence rates were calculated in 2000, 2001, and the combined period of 2000 and 2001 for each definition based on the number of members with at least 1 day of eligibility in each period. Results were compared with published estimates and projected to the US population.

The prevalence rates per 1000 people for angina pectoris in 2000, 2001, and 2000-2001 were 12.3, 14.0, and 17.5, respectively. The prevalence rate is higher in the combined 2-year period primarily because there is little duplication in patients with angina who appear in both years, but there is significant overlap in the overall (denominator) population eligible in both years. For CAD the rates were 52.2, 59.9, and 65.4, respectively, and for chest pain they were 63.4, 75.8, and 93.4, respectively. Rates were higher in men versus women and in each successive age group. These gender and age results were observed in the projections to the US population. By comparison, the American Heart Association (AHA) estimates angina pectoris prevalence to be 35 per 1000 in 2001. The lower managed care rate for angina pectoris may reflect differences in data capture (ie, self-reported data for AHA vs claims submitted for reimbursement for managed care). AHA estimates are higher for women versus men while the managed care estimates show the opposite trend.

Prevalence of angina in the United States is substantial. With the aging of the US population, numbers of patients with angina presenting to the healthcare system can be expected to increase, further adding to the cost burdens facing managed care.

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Coronary artery disease (CAD), which includes myocardial infarction, angina pectoris (chest pain), and atherosclerosis of the coronary arteries, is estimated to affect approximately 13.2 million people in the United States. Angina, a manifestation of CAD, occurs in approximately 6.8 million people.[1] Healthcare resource utilization and costs in this patient population are significant, with angina cited as the first-listed hospital discharge diagnosis in 82 000 hospitalizations and associated with 910 000 physician office visits in 1999.[2] An estimated 516 000 coronary artery bypass surgery procedures and 571 000 percutaneous transluminal coronary angioplasties were performed in 2001. The angioplasty figures represent an increase of 266% from 1987. When total angioplasties (with and without stent) for 2001 are combined, more than 1 million procedures were performed in 2001. The mean charges for bypass are $60 853 and $28 558 for angioplasty.[1] With the aging of the US population as a whole and the epidemics of obesity and diabetes affecting children and adults alike, the total numbers of patients with angina and the corresponding service utilization will increase, further straining a healthcare system already struggling to manage costs.

Against this background, this article provides additional insight by estimating angina prevalence rates in a managed care population through the use of administrative claims data, comparing these results with published national statistics, and projecting the results to the US population. Administrative claims are an important resource within managed care organizations. These data represent the population of patients who seek care from the system. This population is typically a subset of the total population of patients who actually have a disease or condition. Demographic trends can be quantified, providing information for managed care to use in developing strategies to better target and manage patients.

Table 1. Angina Definitions

Angina Pectoris	Coronary Artery Disease			Chest Pain
ICD-9-CM Diagnosis Codes	*ICD-9-CM* Diagnosis Codes	*ICD-9-CM* Procedure Codes	*CPT-4* Procedure Codes	*ICD-9-CM* Diagnosis Codes
413	410.xx	36.0x	33140	786.50
413.0	411.xx	36.1x	33141	786.51
413.1	412	36.2	33510-33523	786.59
413.9	413	36.3x	33533-33536	
	413.0		33572	
	413.1		92975	
	413.9		92980-92984	
	414.xx		92995	
	429.2		92996	
	429.5		93540	
	429.6		G0290	
	429.7x		G0291	
	996.03		S0340-S0342	
	V45.81		S2205-S2209	
	V45.82			

ICD-9-CM indicates *International Classification of Diseases, Ninth Revision, Clinical Modification; CPT-4, Current Procedural Terminology*; xx, any subcodes.

Data Source. The study data source includes longitudinal, member-linked data on medical services provided through commercial health maintenance organizations, preferred provider organizations, Medicare risk, and other indemnity products. Derived from more than 25 different managed care organizations throughout the United States, this private benefit plan information includes 30 million members over time and approximately 11 million members annually. Health insurance eligibility information is available for 100% of the membership. Data for the private benefit plans are complete and available for paid non-inpatient professional, non-inpatient facility, and inpatient facility claims. For the subset of the population that also has drug benefit coverage, non-inpatient pharmacy claims are available. Data fully comply with the Health Insurance Portability and Accountability Act of 1996 (HIPAA) and meet the requirements for de-identification of protected health information as specified in Section 164.514 of the HIPAA privacy standard.

The database contains patient demographic and eligibility information, inpatient and non-inpatient diagnoses by *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* codes, inpatient and non-inpatient procedure information, non-inpatient drugs dispensed, and dates of service for drug and medical information.

Claims Definition of Angina. In determining prevalence of angina, choice of diagnosis and procedure codes will have an impact on the number of patients identified with the disease. The particular disease the code is intended to signify is usually obvious by the code's text description. In submitting claims for reimbursement, however, it does not necessarily follow that a physician will use these codes in all instances of a patient presenting with the disease. For example, the *ICD-9-CM* codes most specific for angina pectoris are 413, 413.0, 413.1, and 413.9. However, a patient with angina also has CAD, and, thus, a physician may select this broader code or may opt to code for only the symptom (ie, chest pain). We estimated angina prevalence using 3 related definitions (**Table 1**). Although it is likely that "chest pain" by itself will be too broad a term to define angina, we included it as a reference

Table 2. Prevalence Estimates per 1000 Members by Angina Definitions

	2000			2001			2000-2001 Combined		
Member Characteristic	Angina Pectoris	CAD	Chest Pain	Angina Pectoris	CAD	Chest Pain	Angina Pectoris	CAD	Chest Pain
All	12.3	52.2	63.4	14.0	59.9	75.8	17.5	65.4	93.4
Women	10.3	40.0	63.5	11.7	45.7	76.3	14.9	51.9	93.9
Men	14.5	65.9	63.3	16.5	75.9	75.3	20.4	80.4	92.8
35-44 years	2.2	7.4	36.3	2.9	9.7	46.4	3.3	10.7	54.5
45-54 years	6.8	25.3	55.2	8.6	31.7	69.2	10.0	33.1	82.1
55-64 years	16.2	68.6	76.6	19.3	82.0	94.4	23.3	53.4	114.9
65-74 years	33.7	145.5	107.7	34.8	155.1	113.9	46.2	169.3	151.1
75+ years	47.1	223.8	139.9	47.6	231.7	144.2	66.9	239.1	200.4

CAD indicates coronary artery disease.

point because angina prevalence is often estimated using self-reported data from questionnaires that query on chest pain. These definitions are not necessarily mutually exclusive (eg, angina pectoris codes are included in the CAD definition).

Identification of Patients. Applying the 3 code definitions, we reviewed diagnosis and/or procedure claims in 3 separate time windows: calendar year 2000, calendar year 2001, and calendar years 2000-2001 combined. Thus, patients with claims only in 2000 are represented in the counts for 2000 and 2000-2001 combined. Similarly, patients with claims only in 2001 are represented in the counts for 2001 and 2000-2001 combined. Patients with claims in both years are represented in each single year and also in 2000-2001 combined, where they are counted only once. Within each time window, we identified patients who had at least 1 claim containing any of the specified codes for a particular definition, were at least 35 years of age, and were eligible for medical benefits for at least 1 day during the time window.

Managed Care Prevalence Estimates for Angina. Prevalence estimates per 1000 members using each of the 3 disease definitions are presented in **Table 2**. Prevalence is calculated overall, by gender, and by age group. Regardless of definition, prevalence estimates increased from 2000 to 2001. Increases might be the result of a number of factors. In addition to actual increases in clinical disease, greater patient awareness and improved screening may impact prevalence. The higher numbers observed in the combined 2000-2001 time window are likely because of the availability of longer time frames during which a claim with the appropriate diagnosis may be submitted for reimbursement.

For the angina pectoris and CAD definitions, prevalence estimates were greater for men than women across all time windows. One explanation for this finding may be a genuinely higher prevalence rate among men, particularly in the younger age ranges. The incidence of CAD in women lags 10 years behind that of men, attributable to the positive effects of endogenous estrogen in premenopausal women.[1] Although it may be true that angina is more prevalent among men than women, other explanations are possible. In particular, physicians may have a tendency to more aggressively pursue certain diagnoses in males, supporting the false historical notion that heart disease is a "man's disease." This gender gap is particu-

Table 3. Prevalence Estimates per 1000 Members for Angina Pectoris by Gender/Age

Member Characteristic	2000	2001	2000-2001 Combined
Women			
35-44 years	1.7	2.2	2.6
45-54 years	5.3	6.8	7.9
55-64 years	12.0	14.3	17.7
65-74 years	28.3	29.0	38.9
75+ years	41.9	42.7	60.2
Men			
35-44 years	2.8	3.6	4.2
45-54 years	8.5	10.7	12.2
55-64 years	20.8	24.9	29.3
65-74 years	39.7	41.3	54.2
75+ years	54.9	55.0	76.8

larly evident in the CAD definition, supporting the hypothesis that screening for specific diseases may be more likely to occur in men. The gap is narrowed using the angina pectoris definition, for which patients actively presenting with symptoms consistent with angina are likely to be diagnosed, regardless of gender. The prevalence estimates using the chest pain definition did not reflect the men:women pattern observed with the other 2 definitions. Estimates were generally the same in both genders, with a slight female predominance. Given the nonspecificity of this definition, these results are difficult to interpret. The diagnosis of chest pain can represent pain or discomfort of cardiac or noncardiac origin. The lack of gender differentiation in the chest pain category may represent how men and women are evaluated equally at initial presentation, but men are more likely to undergo more aggressive diagnostic evaluation for an underlying cardiac etiology. However, the absence of a difference between men and women again suggests that a patient presenting with a specific symptom is likely to have that symptom recorded on the claim, regardless of gender.

Estimates for all 3 definitions showed increased prevalence with each succeeding age group, consistent with the natural history of the disease.

Table 3 presents results for the angina pectoris definition, broken out by age within gender. The trends did not change, with prevalence rates greater for men than women for each age range and with increased prevalence with increasing age.

Developing claims-based algorithms that identify patients with angina and balance sensitivity and specificity is challenging. Broader definitions based on CAD or chest pain will identify patients who may not actually have angina. Using the angina pectoris definition provides the more specific definition, but will not identify all cases. For example, of the 107 933 patients with angina pectoris with drug coverage in the 2000 through 2001 time window, 33 636 (31.2%) patients had a prescription for short-acting nitroglycerin (sublingual, translingual, or buccal tablet or spray), the only medical treatment for an acute angina attack. If we review the claims history of all patients in this time window eligible for drug coverage, regardless of whether they were identified using the angina pectoris definition, we identify a total of 94 351 patients with a short-acting nitroglycerin prescription. Thus, 60 715 patients with short-acting nitroglycerin use did not have a claim with an angina pectoris *ICD-9-CM* diagnosis code and, thus, were not captured by this angina definition. Because many patients with chest pain of uncertain cause are given a prescription for short-acting nitroglycerin as a so-called "therapeutic trial," it is unrealistic to assume that all of these 60 715 do indeed have angina. Nevertheless, it is probable that a portion of these patients have angina. Some may have a past history of angina or CAD but no symptoms in the study period and would therefore not be captured as cases. Thus, the prevalence rates emanating from the angina pectoris diagnosis-based definition are likely an underestimate. Similarly, the usage of short-acting nitroglycerin by patients with angina (31.2%) is likely an underestimate since patients may have had access to nitroglycerin obtained prior to the study period.

Managed Care Prevalence Estimates for Specific Services and Drugs. Angina management options include both revascu-

larization procedures—coronary artery bypass grafting and percutaneous transluminal coronary angioplasty with or without stenting—and drug therapy with nitrates, beta-blockers, and/or calcium channel blockers. Although beta-blockers and calcium channel blockers can be used for indications other than angina, this is not generally the case with nitrates. Thus we opted to measure the rate of nitrate use, both long-acting and short-acting, within the most specific definition of angina, *ICD-9-CM* diagnosis code 413 and all subcodes, to serve as an indicator of medical management of angina. Nitroglycerin patches were included in the definition of long-acting nitrates. We also measured the occurrence of claims consistent with revascularization procedures to serve as an indicator of interventional management of angina.

Similar to the prevalence estimates for angina, comparison between genders in most instances demonstrated higher rates for men across service and drug. Whereas the long-acting nitrate rates were higher in women than in men (**Table 4**), this trend was not evident after stratifying by age within gender, except at the greater age ranges (**Table 5**). The revascularization rates were consistently higher in men versus women, particularly in the younger age ranges.

The use of long-acting nitrates increased with each succeeding age group, regardless of gender. Revascularization rates increased until age 74 years in women and age 64 in men, and then declined. These findings are not unexpected because contraindications to surgical intervention are more likely to exist as the patient gets older.

Comparison With Published National Statistics. **Table 6** presents prevalence estimates for angina from the American Heart Association (AHA),[1] together with the managed care estimates from this study. These estimates differ in 2 important respects. First, the managed care estimates for the total study population are somewhat lower than those reported by the AHA for the total US population. The AHA estimates are derived from the National Health and Nutrition Examination Survey III (NHANES III [1988-1994]), Centers for Disease Control and Prevention/National Center for Health Statistics. A portion of the NHANES data is self-reported, whereas the managed care data are derived from claims submitted by providers and thus represent patients who sought care. This may partially explain the difference between the 2 estimates. Differences in the lower age boundary for angina between the 2 estimates may also impact the results. The AHA estimates are based on a lower age boundary of 20 years of age while the managed care estimates have a lower age boundary of 35 years of age.

Second, the AHA estimates show a higher prevalence in women than in men versus the managed care data where prevalence is higher in men than in women. As noted previously, one hypothesis is a physician's tendency to more aggressively screen and treat men than women. Self-reported data would not reflect this tendency, but might instead reflect cultural differences in the propensity of men and women to report symptoms (eg, chest pain) or diseases (eg, angina or CAD).

Projections to the US Population. The managed care results were weighted to adjust for differences in characteristics between the claims database population and the US population. Specifically, a set of

Table 4. Prevalence Estimates per 1000 Members for Service and Drug Utilization Within the Angina Pectoris Population

Member Characteristic	2000	2001	2000-2001 Combined
		Revascularization	
All	149.4	144.4	168.5
Women	97.6	92.4	108.3
Men	191.1	185.8	217.8
		Long-acting nitrates	
All	275.8	256.0	274.8
Women	285.5	258.8	277.8
Men	268.4	253.8	272.3
		Short-acting nitrates	
All	286.3	265.6	311.6
Women	259.5	242.0	283.9
Men	306.8	284.2	333.7

Table 5. Prevalence Estimates per 1000 Members for Service and Drug Utilization by Gender/Age Within the Angina Pectoris Population

Member Characteristic	Long-acting Nitrates			Revascularization		
	2000	2001	2000-2001 Combined	2000	2001	2000-2001 Combined
Women						
35-44 years	71.5	72.2	70.2	46.2	41.6	46.1
45-54 years	152.2	131.4	135.9	87.5	75.7	86.5
55-64 years	222.4	192.7	207.0	113.9	109.7	124.4
65-74 years	301.9	265.3	289.4	121.6	108.8	131.1
75+ years	437.1	416.2	441.3	81.4	86.2	102.0
Men						
35-44 years	96.5	77.7	84.9	128.0	97.4	114.6
45-54 years	172.6	159.7	166.6	207.0	196.3	223.2
55-64 years	237.2	230.7	241.9	235.3	225.6	266.3
65-74 years	299.7	284.1	309.5	199.5	200.2	236.3
75+ years	426.0	401.7	429.9	134.4	136.1	165.6

weights based on age, gender, and region were constructed as the ratio of the 2000 US population in each age/gender/region cell to the number of members in the claims database population that also fell into the same age/gender/region cells. These cell-specific weights were then applied to the claims database population and the rates were recalculated.

The differences in prevalence estimates based on gender that were observed in the managed care results were also observed in the projected results. Thus, these differences cannot be explained by underlying differences in gender distribution of the overall managed care population versus the US population. The same was true of the findings relative to successive age groups (**Table 7**).

Table 6. AHA and Managed Care Prevalence Results

Population group	AHA	Managed Care Data
	No. of Patients in United States With Angina in 2001	No. of Patients in Study Data With Angina in 2001
Total population	6.8 million (3.5%)	74 923 (1.4%)
Total men	2.6 million (2.7%)	41 711 (1.7%)
Total women	4.2 million (4.3%)	33 212 (1.2%)

Managed care angina data are based on the angina pectoris definition. The denominator includes all members with at least 1 day of eligibility in 2001. AHA estimates are derived from NHANES III data. The denominator for NHANES is the US population.
AHA indicates American Heart Association; NHANES III, National Health and Nutrition Examination Survey III.

Discussion

The managed care data presented here suggest that angina is a significant concern to managed care organizations in terms of the total numbers of patients who require management. A comparison with estimates from the AHA indicates that the size of the angina population may be larger than that identified by managed care using conventional patient identification algorithms and that not all patients who actually have angina actively seek care.

The managed care prevalence estimates presented in this study represent a high-level examination of CAD, angina, and chest pain based on the submission of a single claim with a diagnosis or procedure code indicating one of the conditions. Further work that examines the use of hierarchical definitions that combine diagnosis, procedure, and drug markers of disease is needed. More complex algorithms might require the presence of a hospitalization for angina, or 2 or more claims with different dates of

service each with a diagnosis code for angina, or 2 or more nitrate prescriptions submitted on different days. This greater complexity can provide an increased level of certainty that the claims algorithms are indeed identifying a patient with the sought after condition.

Although results were not adjusted for variables other than gender and age, trends relating to gender differences in diagnosis and management suggest the need for further investigation using a more rigorous approach. The higher medical and surgical treatment rates in men versus women across almost all age groups suggest gender differences in patterns of care relating to the decision to treat. The differences are most striking in the revascularization rates, further suggesting differences in types of therapeutic decisions.

These findings are not unexpected, because gender differences in diagnosis, treatment, and outcomes of diseases have previously been cited in the literature.[1,3-11] Differences have been found in the referral of women versus men and blacks versus whites for cardiac catheterization in chest pain, with women and blacks being less likely to be referred.[7] Lower rates of revascularization in women have also been noted.[3] Gender differences in short-term management versus long-term management of myocardial infarction have also been observed, with women less likely than men to receive thrombolytic therapy within 60 minutes and aspirin within 24 hours of arrival at the hospital and more likely to receive angiotensin-converting enzyme inhibitors.[8] Gender differences have been found in the screening and treatment of dyslipidemia[10] and also in noncardiovascular conditions.[11] Questions have been raised as to whether gender is an independent risk factor relative to management and outcomes or whether other variables may impact decisions regarding care and resulting patient outcomes.[9] Further study is needed in these areas.

The use of administrative claims data has inherent limitations. Physicians may not code for the precise diagnosis or may not code for a diagnosis at all. The number of diagnoses on claims is restricted. However, these data represent a ready source of information that are relatively inexpensive to use and that are viewed by managed care as representing "real-world" patterns and costs, and it is therefore important to analyze and understand these data.

Table 7. Projections to the US Population: Prevalence Estimates per 1000 People

Characteristic	2000	2001	2000-2001 Combined
By angina definition			
All angina pectoris	13.7	14.6	19.2
Women	12.6	13.1	17.7
Men	15.0	16.2	20.9
All CAD	61.2	65.2	75.1
Women	51.8	53.8	64.9
Men	71.8	77.9	86.5
All chest pain	64.1	74.0	92.9
Women	66.7	77.0	96.6
Men	61.2	70.6	88.6
Revascularization in the angina pectoris population			
All	133.6	140.6	153.8
Women	88.0	96.4	101.8
Men	176.7	180.7	203.1
Long-acting nitrates in the angina pectoris population			
All	290.4	278.9	294.9
Women	297.8	285.6	300.2
Men	283.6	272.9	289.9
Short-acting nitrates in the angina pectoris population			
All	274.7	275.3	307.6
Women	252.2	253.5	283.7
Men	295.0	294.6	329.7

By 2010, an estimated 40 million Americans will be age 65 years and older.[1] Given the implications to the healthcare system in terms of angina prevalence and corresponding healthcare costs, managed care organizations will need to give careful consideration to strategies that can be implemented to care for these patients in a cost-efficient manner that preserves quality of care.

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