Examining Costs of Chronic Conditions In a Medicaid Population

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ABSTRACT

Purpose: To compare health care costs and their components in patients with chronic illnesses.

Design. Quasi-experimental retrospective database analysis of an integrated state-Medicaid dataset.

Methods: Nine chronic illnesses and 28 two-disease combinations were evaluated in 284,060 patients. Dependent variables were total cost and the component costs (hospital, physician, home health and medical supplies, and pharmacy). Statistical analysis included analysis of variance (ANOVA) and multiple analysis of variance (MANOVA).

Results: The nine chronic illnesses studied were: psychosis, depression, cardiovascular illness, congestive heart failure, diabetes, acid peptic illness, respiratory illness/asthma, hypertension, and anxiety. Psychosis and depression patients had the highest mean yearly costs at $6,964 and $5,505, respectively. Highest component costs were mental health practitioners for psychosis and hospital costs for depression. All other conditions had significantly lower yearly costs. Component costs consisted primarily of pharmacy and hospital costs. Psychosis was a component in 5 of the 7 most costly chronic-disease concurrences. The highest disease-concurrence mean cost was for psychosis and depression ($18,318).

Conclusions: The unique resource needs of different chronic illnesses should be considered in benchmarking and evaluating chronic-disease management programs.

Key terms: comorbidity, Medicaid program, disease management, cost analysis.

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INTRODUCTION

Advancements in public health and drug therapy during the past century have altered the leading causes of death in the United States. Acute illnesses such as dysentery, respiratory infections, and tuberculosis no longer are the primary causes of mortality. Chronic illnesses such as ischemic heart disease, cancer, and cerebrovascular disease have now become the leading causes of death. The decline in mortality rates has subsequently led to a significant increase in life expectancy; the average life expectancy has increased by 20 years since 1900. The aging of the U.S. (and developed world) population is bringing about significant changes in the demand and cost of health care resources.

The treatment of chronic illnesses in an aging population is emerging as a dominant cost driver in health care. Estimates based on the 1996 National Medical Expenditure Panel Survey indicate that the total of personal health care expenditures for all ages is expected to increase from $2,400 per year in 1996 to nearly $4,700 per year in 2005. For the same time period, persons over age 65 are expected to have annual health care costs increase from $7,000 to more than $14,000.[1] Estimates based on the 1987 National Medical Expenditure Survey indicate that the total direct costs of chronic conditions amounted to $272 billion. Understanding the extent to which specific chronic condition(s) influence health costs is becoming extremely important in budgeting health care expenditures.

Additionally, chronic illnesses are not mutually exclusive occurrences. A patient who has diabetes also may be suffering from hypertension, depression, or some other chronic condition that may or may not be associated with the concurrent chronic condition. This has been one of the obstacles in implementing disease management programs. How does one carve out services for the hypertension or diabetes management patient when both conditions are occurring in the same patient?

Cost-of-illness studies have provided valuable information in modeling the costs of specific, single chronic conditions. Early studies used national surveys, and later, federal Medicare data, to provide gross estimates of expenditures of patients identified with a particular disease. Several drawbacks limited the utility of these data in trying to "cost out" specific disease states. A patient (and resultant expenditures) with more than one condition would be listed under each category individually. Gross estimates also limited the ability to understand the distribution of cost components on a per-patient basis, particularly when multiple diseases were concurrent in the same patient.

Health care costs under circumstances where chronic diseases coexist have not been widely studied. A study by Shwartz and colleagues mentioned that most of the comorbidity literature focused on mortality.[2] The results of research by Elixhauser and his team demonstrate that many comorbidity studies examining both economic and noneconomic outcomes have been performed on limited numbers of patients.[3] Detailed cost information would be valuable for health plan management of patients with single- or multiple-chronic illnesses, particularly in the development of equitable capitation.[4-7]

This study examines the health costs associated with the treatment of chronic illnesses in a Medicaid population. Health care expenditures were measured for baseline health costs (absence of chronic illness), in nine separate chronic illnesses as well as in cases where individuals suffered from two distinct and identifiable chronic illnesses. We captured all payment claims for a state Medicaid population for one year. The objectives of this research are: quantify the total health care costs per patient for chronic-disease patients by condition; identify and compare the categories of health care resources used by specific conditions; and quantify the health care costs and resources used per patient for individuals with concurrent chronic illnesses.

METHODS

Retrospective database analysis with a quasi-experimental design was used to determine health care cost differences among chronic illness groups. The claims data were supplied by the Oklahoma State Medicaid Department for fiscal year 1995 (July 1, 1994, through June 30, 1995). These data provided a comprehensive record of patient health care costs and a description of the services used during one year of the program. Patients were classified into disease states using a system requiring confirmation of chronic condition by diagnosis codes and drug inference. Health care services and products were identified and categorized into common provider groups for each patient. Outcomes measures were total cost and component-category health care cost. The chronic disease states represented the presumed cause of the cost variation.

Population and patient selection

The dataset was constructed from all Medicaid health claims paid by the state of Oklahoma in fiscal year 1995. The Medicaid program is a federal and state partnership directed toward the poor, blind, and disabled.[8] Claim information included patient demographics, services, or products provided, diagnosis codes, and prescription drug information. Medicaid recipients include patients who are very young (51 percent <20 years) or old (14 percent >69 years), female (65 percent), and white (70 percent).

All states cover pregnant patients and children up to age 6 whose family income is below 133 percent of the federal poverty level. This accounts for the high proportions of children and females. The racial composition of the recipients was: 1 percent, Asian; 3 percent, Hispanic; 8 percent, Native American; 18 percent, African-American; and 70 percent, Caucasian.

The research database contained 284,060 patients with at least one claim. These patients had 4,139,638 medical claims and 3,407,947 prescription claims — a total of 7,547,585 claims. Of the 419,013 total-eligible patients, 134,953 (32 percent) of the Medicaid-eligible patients had no health care claims. Those with no Medicaid claims during the study period were identified but not included in the study.

Identification of chronic condition(s)

Patients in the study were categorized based on the identification of a chronic illness from claims data. An existing chronic-disease classification instrument was adapted for this work.

Database algorithms to classify patients to disease states are quite common and have shown both reliability and validity.[9-10] The primary instrument of diagnostic information is the International Classification of Diseases 9th Revision, Clinical Modification (ICD-9-CM).[2,11] Although widely used, potential problems have been encountered when claims data are used for research purposes.

Insurance payment claims have been criticized in the literature, due to incomplete coding (or miscoding) of diseases by ICD-9-CM codes. Additionally, codes not necessary for payment may be omitted, and fine distinctions between diagnoses with subtle differences are not always possible with ICD-9-CM codes.[12,13] To mitigate potential disease-coding problems in this study, both the diagnosis code and drug-disease evidence system were used to identify specific illnesses.

Patients included in a chronic illness group were required to have evidence of the disease(s) by both diagnosis code and a drug-evidence indicator. In addition, study patients

could have no other chronic illness (either diagnosis or drug evidence) to the extent determined by the identification instrument.

The basis of the drug classification instrument was a validated prescription-claims-based instrument, developed by Clark and colleagues, to which refinement was added.[14] The original instrument contained a total of 27 illnesses. The modification consisted of dropping four conditions. Cystic fibrosis and liver disease had no classified patients, and pain as well as both pain and inflammation were dropped, as they were considered symptoms and not actual chronic diseases.

The disease-indicator criteria extended to those patients with existing comorbidities. Drug evidence and diagnosis evidence were required for each specific illness. Further, patients could have no indication of other chronic illnesses, using the same criteria.

Patients with evidence of disease by both diagnosis and drug evidence totaled 41,159 persons affected by 50,288 unique disease states, for an average of 1.25 disease states per patient.

Costs for each patient were identified using the following components: hospital (HOSP), physician (MD), pharmacy (RX), and home health and medical supplies (HS). An all-other-costs category was constructed to make the classification all inclusive, and components were identified in selected cases. Patients did not have to be continuously enrolled in the Medicaid program. Rather, a variable representing days in the program was included to evaluate the differential effect of eligibility time on expenditures.

A total of nine chronic diseases were selected for evaluation, based on their prevalence in the population and the sample-size requirements of this research. The following chronic diseases were evaluated:

Anxiety (ANX)
Depression (DEP)
Diabetes (DIA)
Congestive heart failure (CHF)
Cardiovascular conditions — other than CHF or HBP (CVD)
Hypertension (HBP)
Psychosis (PSY)
Respiratory illness/asthma (RES)
Acid peptic illness (STO)

In addition to an analysis of each disease state as a sole occurrence, 28 of the 36 possible unique two-disease combinations (comorbidities) were evaluated. Eight comorbidities (36 minus 28) were not analyzed due to sample sizes of fewer than 15 patients, which was the minimum required to yield a power of .80.

Cost outcome measures

The total health care cost and four categories of health services/products were examined for each patient with a chronic disease of interest. Claims were grouped into the common categories: hospital (HOSP), physician (MD), pharmacy (RX), and home health and medical supply (HS) payments. All costs were those paid by the Medicaid department during fiscal year 1995.

Establishment of baseline health costs

Baseline health costs in the absence of chronic illness need to be established to fully appreciate the impact of chronic illness on health expenditures. As it would be virtually impossible to separate "routine everyday health costs" from costs associated with any particular chronic condition in study patients, we modeled baseline health costs within the same population using *healthy* recipients (no indication of a chronic illness).

Healthy patients in this population are defined as those who use the health care system to deal with routine health problems (i.e., bacterial infections, nonspecific emergency visits, routine checkups). These patients served as the proxy for baseline health care costs.

Analysis

Data manipulation and statistical analysis were performed on a mainframe computer using SAS software (SAS Institute, Cary, N.C.). The primary analysis tool was the analysis of variance (ANOVA).

Typical health cost data are known to be right-skewed, which in small samples may violate the tenets of parametric measures that rely on normal distributions. In this study, parametric testing was chosen, because the sample sizes were generally large enough to invoke the central limit theorem, all distributions were similarly skewed, and only parametric methods have well-established multivariate tests.[15,16]

Nonparametric testing (Kruskal-Wallis) was performed on total health care costs for reliability purposes. This yielded almost identical results to ANOVA measures. The a priori significance level, α, was set at 0.05 for all comparisons.

The Scheffe Multiple Comparisons Test was employed for multiple comparisons testing to control the Type I error rate for all possible linear contrasts, not just for the pairwise contrasts. The Scheffe is conservative and will not indicate a difference unless the overall ANOVA is significant.[16] MANOVA with the Scheffe was used to analyze the components of health care costs in cases where the total health care cost between groups was significantly different.

The duration of time that a patient was a recipient in the Medicaid program could influence resource utilization and costs. Medicaid longevity was therefore viewed as a potentially significant covariate of total cost. An analysis of covariance (ANCOVA) thus was performed on the chronic disease states in order to adjust for differential longevity (number of days during the year) in the Medicaid program.

RESULTS

There were 41,159 patients in the study population. The mean age was 30 years (95 percent C.I. 29.8–30.2), over half (51 percent) of the patients were under 30 years of age, and 11 percent were at least 60 years old. The majority of the population was Caucasian (70 percent), followed by African American (21 percent), Native American (7 percent), Hispanic (2 percent), and Asian (1 percent). Females represented approximately two thirds of the patients (65 percent). Nine chronic diseases were evaluated in this population, based on prevalence and statistical power requirements.

Baseline health care costs

An approximate-sized (~1000) stratified random sample (with stratification on age) was drawn from a total of 93,936 patients identified with at least one health care claim but no record of chronic illness by either drug indicator or ICD-9-CM code. This sample yielded a group of 963 persons with a mean age of 33.4 years. The purpose of this group was to establish baseline health care costs for relatively "healthy" individuals in this population (absence of chronic illness). Diagnostic information for these patients revealed the most frequent diagnoses were for the following services: reproduction and development (774), office visits with no reported diagnosis (702), acute respiratory infections (434), disorders of the eye and adnexa (418), and diseases of the oral cavity (357).

The mean health costs for these baseline health cost patients was $612 for the year. The grand mean for patients with one of the nine chronic illnesses was $2,955 — nearly five times higher than the baseline health costs group. A comparison of baseline costs and the average for all chronic diseases is contained in Table 1.

Single chronic condition

The nine most prevalent chronic conditions among the subpopulation with a single chronic condition were respiratory illness/asthma, depression, psychosis, acid peptic illness, hypertension, diabetes, anxiety, congestive heart failure, and cardiovascular conditions (other than CHF or HBP).

Total expenditures

The ANOVA model for total cost was significant ($F=400.39$, $p<.0001$). The Medicaid expenditures for patients with a single-disease state appear in Table 2. The highest costs were associated with psychosis (mean: $6,964) and depression (mean: $5,505). Psychosis was significantly higher than all other disease states including depression ($p<.05$). Costs for depression costs were significantly higher than for the seven other disease states under study. These seven other chronic illnesses ranged from $2,320 (cardiovascular disease) to $1,334 (anxiety). Differences in expenditures for these seven conditions were not statistically significant. Cardiovascular disease, CHF, diabetes, acid peptic disease, and respiratory illness/asthma mean costs were significantly higher than the mean for baseline health costs. The lowest cost conditions, hypertension and anxiety, did not differ significantly from baseline health costs.

Longevity of the patient in the Medicaid program was a potentially significant covariate of patient cost. Days in the program (during fiscal year 1995) ranged from a mean of 344 days for psychosis to 289 days for congestive heart failure. A variable representing days in the program was analyzed using ANOVA for single-

TABLE 1 Comparison of baseline health care costs with mean for all chronic diseases

	Mean ($)	STD ($)	95% CI ($)
Baseline health costs	612	1,184	559–$665
All nine chronic diseases	2,955	6,833	2,870–$3,089

STD= Standard deviation
CI=Confidence interval

TABLE 2 Medicaid expenditures for patients with a single chronic condition

Disease	N	Mean yearly cost ($) (STD)	Median annual cost ($)	Mean age (years)	Days in Medicaid program in fiscal year 1995 (STD)
Psychosis (PSY)	2,584	6,964 (11,596)	3,144	42.8	344 (64)
Depression (DEP)	4,077	5,505 (8,560)	2,078	29.1	314 (93)
Cardiovascular disease (CVD)	209	2,320 (2,684)	1,201	58.1	305 (105)
Congestive heart failure (CHF)	242	2,318 (1,628)	2,144	69.3	289 (108)
Diabetes (DIA)	1,027	2,114 (2,560)	1,067	40.8	305 (105)
Acid peptic disease (STO)	1,628	1,811 (3,007)	961	28.5	302 (102)
Respiratory illness/asthma (RES)	13,462	1,634 (2,576)	848	12.2	311 (90)
Hypertension (HBP)	1,467	1,351 (1,845)	724	46.5	315 (94)
Anxiety (ANX)	887	1,334 (2,296)	593	33.2	310 (95)

STD=Standard deviation

TABLE 3 Least square means disease costs, adjusted for longevity in the Medicaid program

Disease state	Least square means of total cost for one year, **adjusted** for longevity (days) in the Medicaid program ($)	Mean of total cost, **unadjusted** for longevity (days) in the Medicaid program ($)	Median yearly cost ($)
Psychosis	5,867	6,964	3,144
Depression	4,956	5,505	2,078
Acid peptic illness	1,295	1,811	961
Cardiovascular illness (not hypertension or CHF)	1,115	2,320	1,201
Respiratory illness/asthma	1,048	1,634	848
Diabetes	899	2,114	1,067
Hypertension	851	1,351	724
Congestive heart failure (CHF)	562	2,318	2,144
Anxiety	350	1,334	593

disease states and for two-disease states. The nine single diseases exhibited significant differences on days in the program (F=44.99, $p<.0001$). ANCOVA was then performed to remove the influence of longevity in the program from Medicaid expenditures. The adjusted and unadjusted means for each disease state are shown in Table 3. The mean adjusted expenditures for each disease was lower than the unadjusted means; the difference was minimal, however, for the two most costly conditions — psychosis and depression. Psychosis remained significantly different from all other diseases, and depression remained significantly higher than all other seven chronic conditions, even when controlling for days in the Medicaid program.

Although chronic conditions are commonly associated with elderly persons, the most costly diseases, psychosis and depression, had mean ages of 42.8 and 29.1 years, respectively. The lowest mean age was found in the respiratory illness/asthma group (12.2 years) and the highest was within the CHF group (69.3 years).

Components of total health costs

Significant variations were found in the use of health care resource categories between several chronic conditions. Table 4 lists the mean expenditures for hospital, pharmacy, physician, home/medical supply, and the catch-all (all other costs) associated with the total (unadjusted) cost. Hospital, pharmacy, physician, and home health/medical supply expenditures and the proportion of total costs varied greatly by condition. In the chronic condition of highest cost, psychosis, the most expenditures were in the home health/medical supply category ($4,076, 58 percent of PSY costs). This was due to the inclusion of "other practitioner" in the home health /medical supply component. Mental health professionals (psychologist and social workers) are designated as "other practitioners" by Medicaid. Nonphysician mental health professionals comprised virtually all the home health/medical supply costs (98 percent) in psychosis and depression. The level of "all other medical" costs (13.1 percent of total spending) found in psychosis, consisted of special programs to provide help with everyday living (e.g., transportation, job placement, etc.).

In the depression disease state, the highest expenditures were hospital costs ($3,570, 67.9 percent of DEP). Home health (as with psychosis, primarily mental health professionals) accounted for 19.7 percent ($1,085) of depression costs. The pattern of component spending in CVD, DIA, STO, and RES were very similar, with hospital and pharmacy (RX) comprising approximately 70 percent of total cost. CHF was significantly different in its pattern of component spending ($p<.05$) with nearly 90 percent of total cost made up of HS and RX. The low expenses seen for CHF in the physician and hospital categories are most likely due to the mean age of CHF patients (69 years). These individuals are "dual-eligible" candidates and Medicare would then become the primary payer of hospital & physician expenses.

Patients with concurrent chronic conditions

One of the objectives of this study was to evaluate the impact on health costs when individuals were identified with more than one chronic condition. Using the population in the database and inclusion criteria of the study, 28 disease "pairings" were identified with a sufficient sample size for a power of at least .80. Table 5 lists these two disease combinations by total costs for the year. For inclusion, a patient labeled as having "PSY + DEP" would have drug and diagnosis evidence of both these disease states. Further, the patient could not have evidence of any other of the 27 chronic illnesses in the classification instrument. The five most prevalent

TABLE 4 Breakdown of total costs by resource component

	Disease state: Mean yearly health care cost [$ (%)]									
Cost component	Baseline n=963	PSY n=2,584	DEP n=4,077	CVD n=209	CHF n=242	DIA n=1,027	STO n=1,628	RES n=13,462	HBP n=1,467	ANX n=887
Home/medical supply (HS)	102 (16.7)	4,076 (58.5)	1085 (19.7)	204 (8.8)	862 (37.2)	231 (10.9)	95 (5.2)	127 (7.8)	115 (8.5)	193 (14.5)
Physician (MD)	145 (23.7)	75 (1)	275 (5.0)	353 (15.2)	60 (2.6)	293 (13.9)	349 (19.3)	295 (18.1)	220 (16.3)	266 (20.0)
All other (OT)	69 (11.3)	910 (13.1)	114 (2.7)	17 (0.7)	40 (1.7)	93 (4.4)	187 (10.3)	67 (4.1)	72 (5.3)	83 (6.2)
Pharmacy (RX)	64 (10.5)	991 (14.2)	424 (7.7)	761 (32.8)	1,207 (52.1)	497 (23.5)	421 (23.2)	329 (20.1)	494 (36.6)	284 (21.3)
Hospital (HOSP)	230 (37.6)	901 (12.9)	3570 (67.9)	973 (42.0)	149 (6.4)	982 (46.5)	735 (40.6)	778 (47.6)	444 (32.9)	497 (37.3)
TOTAL	$612	$6,964	$5,505	$2,320	$2,318	$2,114	$1,811	$1,634	$1,351	$1,334

concurrent diseases were depression and anxiety; diabetes and hypertension; respiratory illness/asthma and depression; depression and psychosis; and respiratory illness/asthma and acid peptic disease.

Single chronic diseases that could be described as high, moderate, or low cost were generally associated with the same level of spending in the disease co-occurrences. The two most costly chronic conditions, psychosis and depression, also created the most costly comorbid chronic illness situation (mean $18,316). Psychosis was a component in 5 of the 7 highest cost disease co-occurrences. The most costly nonpsychosis containing combination was seen with diabetes and acid peptic illness (mean $7,749).

The disease co-occurrences at the middle level of spending consisted largely of diseases in the middle level of spending when occurring as single conditions: CVD, CHF, STO, DIA and RES. Nine of the ten disease co-occurrences in this midlevel spending group contained 1 of the 5 moderate-cost single diseases, and 6 of the 10 cells included both diseases from those five.

The lowest-cost illnesses, hypertension and anxiety, were found in 9 of the last 11 disease co-occurrences. The lowest cost co-occurrence was made up of the two low-cost single diseases, hypertension and anxiety.

In the highest-cost disease concurrences, the cost drivers were hospital and nonphysician mental health provider (HS). In the low-cost and moderate-cost pairs, pharmacy and hospital costs accounted for the greatest proportion of yearly costs.

A two-way factorial ANOVA was used to determine if a statistical interaction on total cost was present in any of the 28 disease pairs. One interaction was isolated in the PSY+DEP cell of patients ($F=25.64$, $p<.0001$). MANOVA indicated the cost component responsible for the significant interaction was HOSP = $12,137. As with single occurrences of chronic conditions, longevity in the Medicaid program was considered a potential covariate. Nevertheless, longevity was not significant as a covariate in the chronic-disease concurrences.

CONCLUSIONS

Psychosis patients are cared for, in large part, by nonphysician mental health professionals rather than psychiatrists. Data are not available to determine the profession of these nonphysician providers. Psychosis patients had few physician claims, with an average physician cost of $75 (1.0 percent total). Yet these patients have mean pharmacy expenditures of $991. Explanations for prescriptions with minimal physician office visit billings include mental health clinics staffed with psychologists recommending drug therapy to an in-house physician medical director, emergency room-generated prescriptions following an acute episode, and another state program (e.g., mental health department) initiating prescription orders.

Depression is managed by mental health professionals (nonphysicians) to a lesser extent than psychosis (59 percent of spending in psychosis versus 20 percent in depression). The largest cost component for depression patients is hospital services (68 percent of spending). Physicians appear to play a greater role in treating patients for depression than psychosis in this Medicaid setting.

Medication selection and utilization in psychosis and depression has received significant attention in recent years, due to high unit costs associated with new therapeutic agents. New atypical antipsychotics and the selective serotonin reuptake inhibitors (SSRIs) are more expensive compared to the older antipsychotics and

antidepressants they superseded. Nevertheless, in this study, pharmacy cost was 14 percent of the total spending for psychosis, and pharmacy cost was 8 percent for depression. As a proportion of total expenditures, pharmacy expenditures for psychosis and depression were less than expenditures for all other diseases.

Among the moderate-cost illnesses, CHF was found with a unique resource-component cost. This is likely due to the fact that these patients, with a mean age of 69 years, are also on Medicare. CHF patients comprised the only group of patients old enough to be Medicare eligible. The largest portion of Medicaid costs for CHF patients was for drug therapy and home care. Services in the home could include medication monitoring, daily weights, exams for edema, and oxygen therapy. Additionally, Medicare does not cover prescription medications.

TABLE 5 Medicaid expenditures for patients with two concurrent chronic conditions

Concurrent disease states	No. of patients	Mean yearly cost [$ (STD)]
PSY+DEP	238	18,316 (26,374)
PSY+ANX	27	10,425 (21,590)
PSY+DIA	35	9,947 (14,225)
PSY+RES	38	9,717 (21,558)
PSY+STO	42	9,275 (16,453)
DIA+STO	30	7,749 (8,838)
CHF+CVD	34	7,294 (6,886)
RES+DEP	267	5,448 (7,100)
STO+ANX	93	5,099 (5,584)
HBP+PSY	45	5,029 (5,791)
CVD+STO	20	4,978 (4,577)
CHF+RES	86	4,672 (4,512)
CVD+DIA	34	4,658 (5,378)
DIA+DEP	48	4,523 (5,957)
CHF+DIA	19	4,260 (4,466)
STO+RES	225	4,235 (5,437)
CVD+RES	39	4,111 (3,831)
STO+DEP	136	3,034 (3,835)
DIA+RES	60	2,902 (2,456)
ANX+DEP	363	2,678 (3,584)
HBP+CHF	35	2,438 (2,041)
HBP+RES	105	2,384 (2,587)
HBP+CVD	51	2,359 (2,305)
HBP+DEP	117	2,349 (2,444)
HBP +STO	107	2,160 (2,922)
HBP+DIA	310	1,974 (1,868)
ANX+RES	85	1,587 (1,691)
HBP+ANX	53	1,095 (699)

STD=Standard deviation
ANX=anxiety; DEP=depression; DIA=diabetes; CHF=congestive heart failure (CHF); CVD=cardiovascular conditions other than CHF or HBP; HBP=hypertension; PSY=psychosis; RES=respiratory illness/asthma; STO=acid peptic illness

Interaction effects on cost were seen in only one pair of co-occurring conditions, psychosis and depression (3.6 percent of pairs). Verbrugge[17] found 16 percent of disease pairs had an interaction on the variable of disability, and Fried[18] noted "an overwhelming tendency to synergy was not observed" in her work on disability.

The presence of a chronic condition (mean $2,955) significantly increased mean health costs when compared to individuals with no indication of a chronic illness (mean $612). The diseases of mood and behavior (psychosis and depression) are by far the most costly chronic illnesses for the Oklahoma Medicaid program. These two conditions also constitute the most costly co-occurring pair of chronic conditions. Expenditures for psychosis and depression were primarily related to care provided by nonphysician mental health professionals and hospitalization costs, respectively. Drug costs, as a proportion of total expenses, play a relatively minor role. The seven other illnesses evaluated in this study (CVD, CHF, DIA, STO, RES, HBP, and ANX) were not found to significantly differ in total costs.

High-cost chronic conditions remained as such when patients were found to suffer from two chronic conditions. Psychosis and depression created the most costly combination of chronic diseases ($18,316). Psychosis was present in each of the five most costly disease concurrences. Diabetes and acid peptic illness were found to be the most costly concurrent pair of chronic diseases ($7,749) excluding psychosis.

Limitations

Health care claims databases have inherent limitations relative to their usefulness. In this study, nothing was known about a chronic condition outside of the claims submitted to Medicaid. The utilization of an algorithm requiring both a ICD-9-CM code and a drug marker worked well to correctly identify valid chronic conditions, but it could exclude cases in which drug therapy was not used. The 27 illnesses of the classification instrument captured the most prevalent chronic illnesses, according to frequency distributions of 3-digit ICD-9-CM categories. Of all Medicaid patients for whom claims data were available, 67 percent (190,124 out of 284,060) had some evidence of illness by either drug or diagnosis evidence. Nevertheless, chronic conditions might have been excluded that were outside the limits of the identification system.

The design of state Medicaid programs creates limitations in utilization and data capture. Each state determines its benefit design. In Oklahoma, patients over 21 years of age are entitled to two physician visits per month, 12 inpatient hospital days per year, and three prescriptions per month. Persons requiring greater treatment intensity may require another public program or simply go untreated if they exceed their benefit limit. Additionally, the ability to accurately generalize from the Medicaid population in Oklahoma to the general population is limited and may be subject to geographic variations in treatment or utilization.

The disease states selected for analysis were chosen on the basis of adequate sample sizes for statistical power. High-cost chronic diseases af-

fecting a small number of individuals would be excluded for analysis, due to sample size restrictions.

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