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VALIDATION OF EMPLOYER-FOCUSED ACTUARIAL MODEL FOR MEASURING THE ECONOMIC BURDEN OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Objective: To demonstrate the economic relevance of Chronic Obstructive Pulmonary Disease (COPD) for employers as well as using employer-specific data to test the validity of an actuarial burden of illness, Employer Impact Model.

Methods: Working with their Disease Management (DM) vendor, benefit administrators, and health and benefit consultants, the employer (International Truck & Engine [IT&E]) facilitated the gathering and analysis of unique and connectable data sets related to the utilization and cost of employee medical and pharmacy benefits, absences, workers' compensation, and disability. The data was used to refine and provide validation for an actuarial model based on previously published, but less specific, national prevalence and cost data.

Results: The prevalence of COPD for the employer was 3.4%. When totaling medical, prescription, workers' compensation and absence costs (including disability), the total cost of COPD averaged $19,705 annually compared to $8,039 for employees without COPD.

Conclusions: COPD is a relevant medical condition in economic terms, suggesting that employers should seek ways to better manage as well as prevent this costly condition through appropriate actions, including offering benefits that facilitate treatment for those with this condition in order to minimize lost productivity. This study provides a discrete component to the return on investment (ROI) equation needed to make the business case for taking action.

KEYWORDS: COPD, actuarial model, disease management, treatment adherence, ROI

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INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a persistent and progressive disease characterized by airflow limitation that is not fully reversible. It is the fourth leading cause of death and second leading cause of disability after heart disease.[1]

The Centers for Disease Control and Prevention (CDC) estimate, however, that only 50% of patients have been diagnosed, which requires confirmation by spirometry.[2] According to the Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD) Report 2006[3], there are achievable goals to ameliorate the impact of COPD. Those goals include aggressive management of risk factors such as smoking, exercise tolerance, and the use of pharmacotherapy.

A variety of publications have reviewed the research on the prevalence and cost of COPD.[4,5,6,7] A major difficulty is identifying utilization related to conditions that are made worse by the presence of COPD, likely resulting in underestimates of the full cost.[6] Most cost studies have focused on direct healthcare costs for nations or individuals with the disease.

The employer sector has not focussed on this issue, even though employers shoulder a large portion of the costs for COPD patients. Darkow, et al. (2007)[8] examined absence costs related to COPD; Goetzel, et al. (2004)[9] examined healthcare, absence and reduced productivity ("presenteeism") costs for a variety of conditions, including COPD; and Hnizdo, et al. (2002)[10] examined COPD prevalence by industry and occupation.

The purpose of this study was to use the experience of one employer to provide validation for an employer-focused actuarial burden of illness model developed using available national prevalence and cost data. This not only included direct

healthcare costs, but the indirect costs of various types of absences and lost productivity.

This study measured cost differences between employees with COPD and those without to determine the significance of this disease from an employer viewpoint. No attempt was made to isolate costs directly related to COPD from those related to problems indirectly related to COPD. While other related academic studies have estimated the general economic burden of illness of COPD, this study sought to understand the impact of COPD on employers.

The general Employer Impact Model (EIM) or employer burden of illness model was developed by a multidisciplinary health benefits team with data from a variety of published sources and default values coming from the U.S. Chamber of Commerce study for selected industry, 2005. Key cost data input categories included average salary, total benefits as a percentage of average salary, drug and medical, sick leave, short-term disability, long-term disability, and other benefits offered by an employer but unrelated to health, such as pension.

The EIM output using a 10,000-employee population showed a $7,092 cost for an average employee, and $37,018 for an employee with COPD.

KEY DATA FINDINGS

The prevalence of COPD is 3.4% of all employees (298 out of 8,792). The mean age of employees with COPD is 53.8 years compared with 45.0 years for other employees. The percentage of males with COPD, 78.5%, is almost identical to that for all other employees, 78.3%.

Medical costs for employees with COPD are more than triple those for other employees. While their general absence rate is only slightly higher (3%) than other employees, the number of days lost on short-term disability is more than 2.5 times that for other employees. While employees with COPD make up 3.4% of the workforce, they account for 7.9% of the medical, prescription and absence costs.

Employees with COPD reported that they missed more days of work due to health reasons (9.0% reported missing 11 days or more, compared with 3.5%), and felt less productive while at work (2.7% reported reduced productivity most or all of the time, compared with 1.2%).

DATA COLLECTION AND SOURCES

These analyses focused on active full-time employees so that cost factors other than health insurance claims could be included. The total count of active full-time employees used throughout this analysis came from eligibility data in the database used by the employer for warehousing utilization, and cost data from different sources for its specific population.

Benefit costs identified, collected and utilized in the analysis included the following:

- Medical benefit expenses
- Pharmacy benefit expenses
- Absence information
- Short-term disability (STD)
- Long-term disability (LTD)
- Workers' compensation (WC)
- Health Risk Assessment (HRA)

Details for each of the data components identified are as follows:

Medical benefit expenses. These data came from the Medstat system. Costs were based on the allowed amounts on non-prescription claims incurred during calendar year 2005. To be included, an employee needed to have both medical and prescription coverage for at least 11 months of 2005.

Pharmacy benefit expenses. These data came from the Medstat system. Costs were based on the allowed amounts on prescription claims incurred during calendar year 2005. To be included, the employee needed to have both medical and prescription coverage for at least 11 months of 2005.

Absence. These data were provided directly by IT&E, representing about 43% of all employees. As a result of the employee populations at the work sites covered by this internal source, absence data for 63% of employees with COPD were available for analysis. The absence data covered all absences, including STD, LTC and WC. Since data on all absences was provided, including such reasons as holidays, vacation and union activities, only the following types of absences were counted:

- Injury Off Duty
- Injury On Duty
- Paid Absence Allowed
- Paid Tardy
- Personal Reason
- Sick
- Tardy

Mean values from this substantial sample of IT&E employees were calculated and applied to the total population. For this analysis, STD and WC days were removed from the absence data to measure rates of other types of absences, such as general sick days (including time off for physician visits) that do not turn into STD days. Data limitations prevented removal of LTD days from other absence days. The data were provided as hours absent, which were then converted to days for fractional days.

Short-term disability. These data were provided directly by IT&E. The STD claims provided a date of accident/illness. An end date was calculated as the date of accident/illness plus the number of reported disability days. Some records showed extremely high numbers of disability days, some exceeding a year. Since STD is limited to 365 days, STD claims with more than 365 disability days were capped at 365. Absences between these two dates were counted as STD days and not counted as absence days. Any absence days identified as both STD and WC were counted as WC.

Long-term disability. These data were provided directly by IT&E. There were only 17 LTD claims reported for 2005, and only one was for an employee with COPD. LTD payments were zero on all but one claim. In addition, the length of the disability was not provided. As a result, LTD days could not be

reliably separated from other absence days and remain included as absence days in these analyses.

Workers' compensation. These data were provided directly by IT&E. The WC claims provided a date of accident. An end date was calculated as the date of accident and that date plus the number of reported days lost. Absences between these two dates were counted as WC days and not counted as absence days. Any absence days identified as both STD and WC were counted as WC.

Health survey. These data were provided by Caremark. Caremark's role, besides being the Pharmacy Benefit Manager (PBM) for IT&E, also entailed performing disease management (DM) services. As such, they were responsible for identifying and engaging employees and dependents with COPD with the goal of improving their health status.

This was an "opt-in" health risk assessment survey where data were only available for employees and dependents who volunteered to respond (this has since changed to be an "op-out" survey). Since the data were collected in early 2005, only 2004 claims were used to identify which employees in the Caremark data had COPD. Two of the survey questions used in this analysis were:

1. During the past 12 months, how much did your health problems (of self or family) affect your productivity while you were working? (No health problems; None of the time; Some of the time; Most of the time; All of the time.)

2. In the past 12 months, about how many days did you miss work because you or family members were sick, injured, or needed health care? (0 days; 1-2 days; 3-5 days; 6-10 days; 11-15 days; 16 days or more.)

COPD POPULATION

Employees with COPD were identified using medical claims data. Medstat identifies individuals as having COPD if they have claims with any of the following diagnoses: chronic bronchitis (ICD-9-CM codes 491.xx), emphysema (492.x), and unspecified COPD (496). Active full-time employees assigned to the COPD clinical category in 2005 were identified as COPD for the medical claims data For the absence data, those flagged by Medstat as COPD in 2004 were also included in the COPD group.

Only three active full-time employees in 2005 were flagged as COPD in 2004 but not 2005. For the Caremark data, since the survey was conducted in early 2005, only employees flagged as having COPD in 2004 were included in the COPD group.

RESULTS: IT&E

The results of this analysis were able to show substantial differences in integrated benefit costs to an employer for an employee with COPD.

Table 1: Employee Demographics

	Employees	Prevalence	Mean Age	Percent Male
Employees with COPD	298	3.39%	53.8	78.5%
Employees without COPD	8,494		45.0	78.3%
All Employees	8,792		45.3	78.3%

Table 1 compares the demographics of employees with COPD and those without. The 3.4% of employees with COPD are older than other employees (53.8 vs. 45.0), but they do not differ in their gender distribution (78.5% male vs. 78.3%).

Table 2 (please see page 6) compares their costs and utilization. Medical costs for employees with COPD are roughly three times those of other employees (3.3 times for medical claim costs; 2.9 times for pharmacy costs). They showed more than double the number of STD claims and STD absence days (2.2 times the number of claims and 2.6 times the number of days). They submitted 25% more WC claims but the cost of those claims was 15% (medical) to 30% (indemnity) lower. Only eight employees with COPD submitted WC claims with associated absence days.

For other absences (net of STD and WC, but including any LTD), employees with COPD only showed 3% more days than other employees. Absence days were converted to costs by taking the IT&E average salary of $52,300 (does not include benefit costs) and dividing by 250 work days per year.

Summing medical, prescription, workers' compensation and absence costs, employees with COPD averaged $19,705 annually while employees without COPD averaged $8,039. The majority of the cost impact of COPD is related to medical expenses and short-term disability.

Caremark conducted an annual employee health status survey and provided answers to their survey questions which were linked with the medical claims data. Results are shown in Table 3. Responding employees with COPD reported that they missed more days of work due to health reasons (9.0% reported missing 11 days or more, compared with 3.5%), and felt less productive while at work (2.7% reported reduced productivity most or all of the time, compared with 1.2%).

One unexpected result was that 24.1% of the employees with a medical claim for COPD in 2004 reported that they have no health problems. While this is lower than the 38.0% for non-COPD employees, it is still noteworthy that so many report that they do not feel they have any health problems.

RESULTS: IT&E vs. Employer Impact Model

To compare the results from IT&E with the EIM, IT&E input values were used in the EIM for type of industry (transportation equipment), number of employees, average salary and average

Table 2: Employee Cost and Utilization Comparisons: 2005								
	All Employees		Employees without COPD		Employees with COPD			
	(n = 8,792)		(n = 8,494)		(n = 298)			
	Amount	Mean Amount per Employee	Amount	Mean Amount per Employee	Amount	Mean Amount per Employee	Mean Amount Ratio to All Employees	Mean Amount Ratio to non-COPD Employees
Medical	$34,459,466	$3,919	$30,863,450	$3,634	$3,596,017	$12,067	3.08	3.32
Prescription Drugs	$8,950,321	$1,018	$8,124,909	$957	$825,412	$2,770	2.72	2.90
Total Medical + Rx	$43,409,787	$4,937	$38,988,359	$4,590	$4,421,429	$14,837	3.01	3.23
Inpatient Admissions	614	0.07	531	0.06	83	0.28	3.99	4.46
STD Claims with Absence	1,840	0.21	1,710	0.20	131	0.44	2.09	2.18
STD Days	38,626	4.39	35,353	4.16	3,273	10.98	2.50	2.64
STD Absence Cost	$8,080,455	$919	$7,395,797	$871	$684,658	$2,298	2.50	2.64
WC Claims	1,266	0.14	1,213	0.14	53	0.18	1.24	1.25
WC Indemnity Paid	$1,486,112	$169	$1,452,247	$171	$33,865	$114	0.67	0.66
WC Restricted Days	12,126	1.38	11,750	1.38	376	1.26	0.91	0.91
WC Medical Paid	$2,820,174	$321	$2,739,031	$322	$81,143	$272	0.85	0.84
WC Claims with Absences	323	0.04	315	0.04	8	0.03	0.73	0.72
WC Absence Days	4,280	0.49	4,087	0.48	193	0.65	1.33	1.35
WC Absence Cost	$895,441	$102	$855,040	$101	$40,401	$136	1.33	1.35
Absence Days net of STD & WC	83,496	9.50	80,578	9.49	2,919	9.79	1.03	1.03
Absence Days net of STD & WC Cost	$17,467,409	$1,987	$16,856,827	$1,985	$610,581	$2,049	1.03	1.03
Total Medical, Rx, STD, WC, Other Absence Cost	**$74,159,377**	**$8,435**	**$68,287,300**	**$8,039**	**$5,872,077**	**$19,705**	**2.34**	**2.45**

benefit costs as percentages of salary. Table 4 outlines the results.

For IT&E, the prevalence of COPD in their employee population was shown to be 3.4%, compared with 2.8% predicted by the model. This prevalence is closer to EIM-predicted prevalence for industrial machinery, 3.5%.

IT&E actual costs were $8,435 for the average employee compared to $7,845 predicted using IT&E inputs into the EIM, or 7.5% above the EIM prediction. For employees with COPD, total medical, prescription and absence costs for IT&E were $19,184, within the range predicted by the EIM ($18,805 - $36,267). Medical and absence costs were below the low end of the range predicted by the EIM, while the prescription costs were above the high end of the range.

LIMITATIONS

This study and model validation utilized only one employer's experience. Due to the collection and reporting of some benefit cost data, not all employee data were able to be included in the analyses. Absence and voluntary health survey data are specific examples where data was limited. This represents the typical natural availability of specific employee data from disparate sources of collection.

The EIM actuarial model, although incorporating all benefit cost data, provided a more static rather than dynamic reporting view of the employer impact from COPD. However, the model did provide a comparative and specific

integrated data view that was determined to be of value for use by an employer in planning benefits.

DISCUSSION

COPD is an important chronic disease that affects employers and their workforce. Each employer can have a difference in a variety of key health factors that would increase or decrease the estimated cost burden of COPD in their employee population. For IT&E, employees with COPD make up 3.4% of the workforce, but they account for a disproportionally high 7.9% of the medical, prescription and absence costs.

The similarity of the IT&E results compared with the EIM demonstrated the relative accuracy of the EIM and its utility in providing generalizable information to assist in decision-making around health plan strategy or benefit planning activities.

It is possible that the higher-than-expected prescription costs could indicate better-than-average medication compliance, resulting in reduced medical and absence costs. The authors hypothesize the lower-than-expected medical cost was also due to contracted costs for health care being lower than the national average, Caremark interventions' impact on costs, and the impact from other health-related initiatives at IT&E.

The high relative economic impact of COPD on an employer shows the importance of managing COPD as a chronic disease in an employed population. The EIM provided an objective, evidence-based framework for assessing the variety of economic costs associated with COPD that could be used in an employer setting.

This analysis suggests to employee benefit plan sponsors that the sizable economic burden of COPD is meaningful and relevant. As employers (plan sponsors) consider investing in programs for reducing risk factors for COPD (i.e., smoking cessation) and treating COPD (e.g., disease management, appropriate treatment selection, and treatment adherence, etc.), this study provides a valuable employer case study with detailed data that other employers can review.

This study provides another discrete component to the return on investment (ROI) equation needed to make the business case for taking action. JHP

Table 3: Responses to Caremark Health Survey

Important Perceptions Question 10: During the past 12 months, how much did your health problems (of self or family) affect your productivity while you were working?

		COPD Medical Claims in 2004			
		Yes		No	
	No response	4	3.6%	100	2.6%
1	No health problems	27	24.1%	1,475	38.0%
2	None of the time	41	36.6%	1,310	33.7%
3	Some of the time	37	33.0%	957	24.6%
4	Most of the time	3	2.7%	37	1.0%
5	All of the time	0	0.0%	7	0.2%
	Total	112	100.0%	3,886	100.0%

Important Perceptions Question 11: In the past 12 months, about how many days did you miss work because you or a family member were sick, injured, or needed health care?

		COPD Medical Claims in 2004			
		Yes		No	
	No response	3	2.7%	83	2.1%
1	0 days	33	29.5%	1,362	35.0%
2	1-2 days	34	30.4%	1,516	39.0%
3	3-5 days	22	19.6%	656	16.9%
4	6-10 days	10	8.9%	134	3.4%
5	11-15 days	3	2.7%	39	1.0%
6	16 days or more	7	6.3%	96	2.5%
	Total	112	100.0%	3,886	100.0%

Table 4: Comparison of IT&E Results with Employer Impact Model Using IT&E Input Values

		Employer Impact Model		
	IT&E	**Low Estimate***	**Average Estimate**	**High Estimate***
Prevalence	2.8%		3.5%	
Medical	$12,067	$12,338	$17,723	$27,475
Prescription	$2,770	$1,562	$1,823	$2,119
Absence	$4,347	$4,905	$5,660	$6,673
Total	$19,184	$18,805	$25,206	$36,267

* Based on 95% confidence interval of published factors.