Measuring the Cost of Undiagnosed Depression

DEPRESSION AFFECTS AS MANY AS 9.5 percent of all Americans, but only about one-third of those affected seek treatment, according to the National Institutes of Health. A 2005 study found that in 2004 no more than 33 percent of insureds with major depressive disorder and 37 percent of insureds with dysthymia (chronic depression) reported receiving treatment during that same time period from a mental health specialist.

The health care, employer, and societal costs of depression, sadly, are considerable. Based on 2000 data, the total annual cost of depression was estimated to be $83.1 billion, with $26.1 billion (31 percent) being spent on medical costs, $5.4 billion (7 percent) related to suicide (death) costs, and $51.5 billion associated with workplace expenses, including absences and loss of productivity.

Despite its high cost and prevalence, depression often goes undiagnosed or isn't diagnosed in a timely manner. Results from a survey conducted between 2001 and 2003 show that the median delay from the onset of depression to the beginning of treatment was estimated to be eight years for major depression and seven years for dysthymia. While the post-diagnosis costs of depression have been studied widely (including research we completed on the high costs of insureds with co-morbid chronic medical conditions and depression) the literature isn't as robust on the costs for health care and absence from work during the period between the initial onset of the disease and its subsequent diagnosis. A better picture of those costs can point to potential areas for savings in the realm of behavioral health care.

Hidden Costs

To estimate the cost differences of people with undiagnosed depression , we studied the excess health care and work-absence costs during the two-year period leading up to an initial diagnosis. Our study relied upon data from MarketScan, a large national database containing multiple years of sequential health care and absence-from-work data. We used a matched-case control study to quantify the differences in health care and absenteeism costs between a set of insureds who were diagnosed with depression and a matched set of insureds who were similar in terms of demographics and health status but for whom we saw no evidence of treated depression in the claims database. We focused on total inpatient, outpatient, and pharmacy costs as well as on hours of absence from work.

The results are presented separately depending on whether the insureds first were identified with depression based on antidepressant use or through an ICD-9 (International Statistical Classification of Diseases and Related Health Problems) depression diagnosis code. Antidepressant use indicates treatment was most likely for depression (barring off-label uses). Depression diagnosis codes indicate the presence of depression for insureds who may or may not have received treatment. We also separated the results for those with a higher-than-average risk score (high-risk group) and those with an average or lower-than-average risk score (low-risk group). The costs are presented by calendar quarter and cover the two-year period leading up to the date of depression diagnosis or the beginning of treatment.

The most prominent finding of our study was that undiagnosed depressed insureds cost on average $3,386 per patient more over the two-year period prior to their depression diagnosis than a group of insureds with similar age, gender, state of residence, and health status but without evidence of depression. We found that the difference between these costs for undiagnosed depressed insureds and insureds who weren't depressed increased over time, with the highest difference in costs occurring in the calendar quarters closest to the date of diagnosis and/or treatment (although the results fluctuated somewhat). The excess costs overall broke down into approximately 45 percent excess health care costs and 55 percent excess absence-from-work costs. For the low-risk group,

Note: In Figures 1 through 15, Quarter 1 refers to the first quarter in the two-year study period prior to the diagnosis of depression; Quarter 8 refers to the quarter immediately prior to the diagnosis of depression.

**Sources for all figures:**
Melek, S., Halford, M.

FIGURE 1
Cost Differences for People With Undiagnosed Depression by Quarter Prior to Diagnosis

Cost Category	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Total
Excess Health Care Cost	$151.61	$167.37	$134.93	$138.05	$126.46	$111.37	$132.65	$528.60	$1,491.04
Excess Absence-From-Work Costs	160.47	170.68	147.90	246.23	305.64	275.75	314.15	274.34	1,895.17
Total Excess Cost	312.08	338.05	282.83	384.28	432.10	387.12	446.80	802.94	3,386.21

absence from work contributed a larger share than health care costs to the excess. For the high-risk group, health care costs contributed a larger share to the total excess costs.

To measure the cost differences of people with undiagnosed depression, we studied direct health care expenditures and absentee data preceding a diagnosis of depression. To estimate the costs associated with absence from work, we used the Census Bureau's 2007 estimates of hourly productivity in dollars by age and sex and trended them to 2009. We trended the health care cost data to 2009 as well to get all costs consistent with that calendar year.

The total excess health care (allowed dollar basis) and absence costs for the two-year period leading up to the diagnosis/treatment of depression are shown in the table in Figure 1. The results are shown by calendar quarter leading up to the date of depression diagnosis.

FIGURE 2
Cost Differences for People With Undiagnosed Depression Prior to Diagnosis
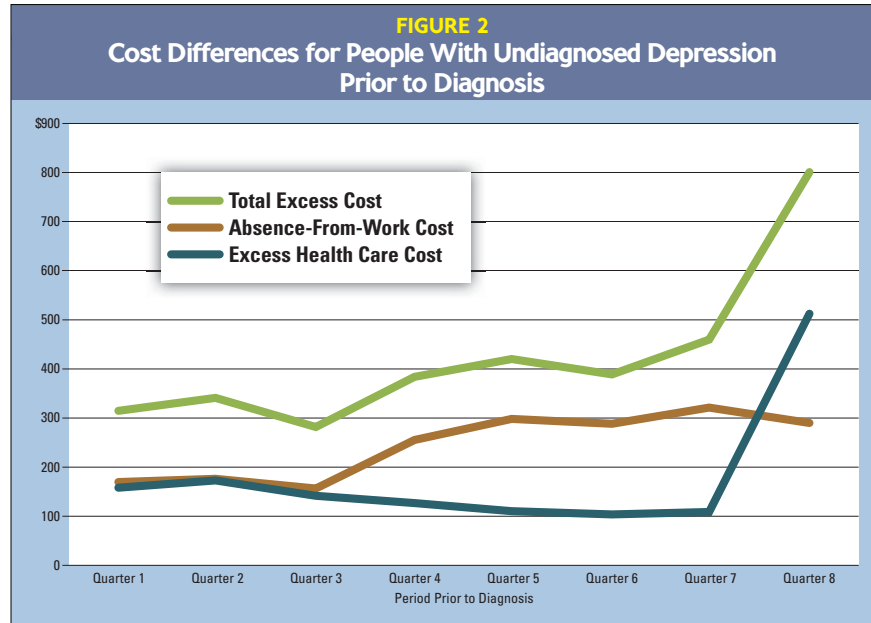
(For a graphic display of the results, see Figure 2.)

As Figure 1 shows, the total excess health care and absence-from-work costs for people with undiagnosed depression over the two-year period leading up to the diagnosis were approximately $3,386 per individual, with approximately 45 percent of these costs being health care costs and approximately 55 percent being absence-from-work costs. The magnitude of excess costs generally increased as the date of depression diagnosis approached.

In an effort to further understand the differences in health care costs and absence-from-work costs, we stratified our population in two ways:

■ Diagnosis—We segmented the population by the way depression was

Cohort	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8	Total
FIGURE 3									
Cost Differences for People With Undiagnosed Depression by Quarter Prior to Diagnosis									
Grand Total (all cohorts, all risk classes)									
Excess Health Care Cost	$151.61	$167.37	$134.93	$138.05	$126.46	$111.37	$132.65	$528.60	$1,491.04
Excess Absence-From-Work Costs	160.47	170.68	147.90	246.23	305.64	275.75	314.15	274.15	1,895.17
Total	312.08	338.05	282.83	384.28	432.10	387.12	446.80	802.94	3,386.21
Diagnosis Cohort—High-Risk Cohort									
Excess Health Care Cost	—	—	—	—	$337.99	—	$553.16	$710.07	$1,601.22
Excess Absence-From-Work Costs	—	—	—	—	180.99	143.45	233.17	226.59	784.20
Total	—	—	—	—	518.97	143.45	786.33	936.66	2,385.41
Diagnosis Cohort—Low-Risk Cohort									
Excess Health Care Cost	$194.09	$245.14	$152.83	$185.05	—	—	—	$112.29	$ 889.41
Excess Absence-From-Work Costs	206.19	255.26	265.93	334.08	368.73	349.99	408.94	324.61	2,513.72
Total	400.28	500.40	418.76	519.13	368.73	349.99	408.94	436.90	3,403.12
Rx Cohort—High-Risk Cohort									
Excess Health Care Cost	—	—	—	—	$245.234	$379.76	$371.14	$1,427.79	$2,423.93
Excess Absence-From-Work Costs	115.40	112.93	82.93	199.91	225.81	196.04	292.04	258.05	1,483.12
Total	115.40	112.03	82.93	199.91	471.05	575.80	663.18	1,685.84	3,907.05
Rx Cohort—Low-Risk Cohort									
Excess Health Care Cost	$236.88	$239.97	$224.67	$209.87	$101.96	$ 78.23	—	$312.44	$1,404.03
Excess Absence-From-Work Costs	190.89	183.05	135.13	268.87	333.10	297.24	279.24	259.34	1,946.85
Total	427.76	423.3	359.80	478.74	435.06	375.47	279.24	571.77	3,350.88

FIGURE 4
Quarterly Health Care Costs and Cost Differences—High-Risk Diagnosis Cohort

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8
Mean Quarterly Health Care Costs (IP, OP, RX)								
Diagnosis Cohort: Cases of Depression	$1,374.40	$1,159.02	$1,218.28	$1,374.06	$1,588.03	$1,413.57	$1,712.18	$1,852.53
Diagnosis Cohort: Controls	1,263.32	1,149.42	1,229.55	1,293.91	1,250.04	1,278.85	1,159.92	1,142.46
P Value	*0.179*	*0.463*	*0.461*	*0.250*	*0.003*	*0.121*	*<0.001*	*<0.001*
Raw Difference								
Diagnosis Cohort—Cases Minus Controls	111.08	9.60	−11.27	80.15	337.99	134.72	553.16	710.07
Statistically Significant (5%) Results								
Diagnosis Cohort—Cases Minus Controls	Not Significant	Not Significant	Not Significant	Not Significant	337.99	Not Significant	553.16	710.07

FIGURE 5
Quarterly Health Care Costs and Cost Differences—High-Risk Rx Cohort

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8
Mean Quarterly Health Care Costs (IP, OP, RX)								
Rx Cohort: Cases of Antidepressant Usage	$1,250.37	$1,340.43	$1,297.35	$1,386.48	$1,524.16	$1,672.63	$1,685.15	$2,602.11
Rx Cohort: Controls	1,189.99	1,275.41	1,261.10	1,265.41	1,278.92	1,292.87	1,314.00	1,174.32
P Value	*0.209*	*0.212*	*0.322*	*0.064*	*0.002*	*<0.001*	*<0.001*	*<0.001*
Raw Difference								
Rx Cohort—Cases Minus Controls	60.38	65.02	36.25	121.07	245.23	379.76	371.14	1,427.79
Statistically Significant (5%) Results								
Rx Cohort—Cases Minus Controls	Not Significant	Not Significant	Not Significant	Not Significant	245.23	379.76	371.14	1,427.79

identified in the claims data. A person was identified as depressed either by presence of an ICD-9 diagnostic code (the diagnosis cohort) or by the prescription of an antidepressant (the Rx cohort).

■ Medical Risk Severity—We assigned a risk score to each individual using his or her cumulative medical risk based on ICD-9 codes present in the medical claims data. Members were stratified as high risk (worse than average) and low risk (average or better than average). This separation allowed us to understand whether there was a greater opportunity for cost reduction in one group compared with the other.

The table in Figure 3 shows the results for each stratification as well as aggregate results by quarter. (Statistically insignificant results aren't displayed.)

While the excess health care and absenteeism costs for people with undiagnosed depression over the two-year period preceding diagnosis were approximately $3,386 per undiagnosed depressed member, certain cohorts had the largest cost differences in absence costs. In the low-risk diagnosis cohort, for example, approximately 74 percent of the total excess costs were due to absence from work. In the low-risk Rx cohort, the absence-from-work costs were approximately 58 percent of the total. Other cohorts had the largest excess cost differences in health care costs. In both the high-risk diagnosis and high-risk Rx cohorts, excess health care costs were the dominant contributor to total excess costs, constituting between 62 percent and 67 percent of the total.

Health Care Costs and Depression

Figures 4, 5, 7, and 8 compare the quarterly total health care cost (inpatient, outpatient, and pharmacy) between cases and controls, with Figures 4 and 5 detailing the results for high-risk groups in the diagnosis and Rx cohorts and Figures 7 and 8 showing the results for the low-risk groups in the diagnosis

FIGURE 6
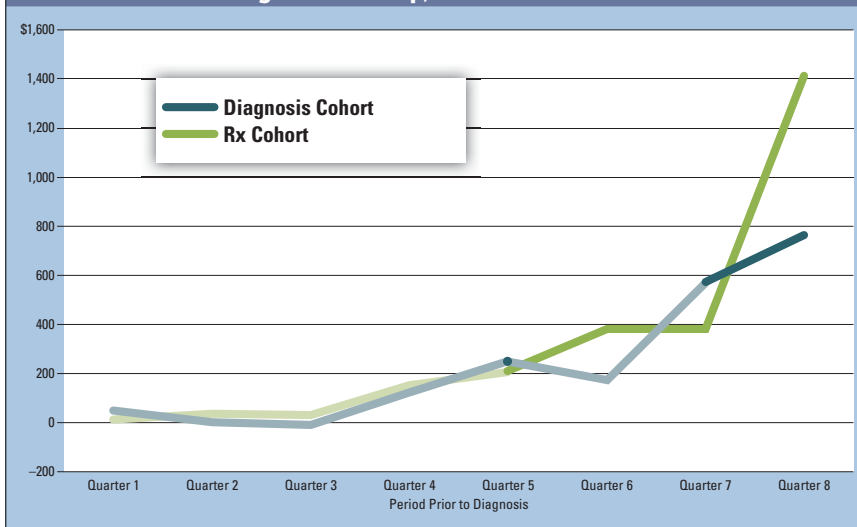**Significant Differences Between Cases and Controls: High-Risk Group, Health Care Costs**

FIGURE 7

Quarterly Health Care Costs and Cost Differences—Low-Risk Diagnosis Cohort

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8
Mean Quarterly Health Care Costs (IP, OP, RX)								
Diagnosis Cohort: Cases of Depression	$663.52	$671.69	$629.79	$611.43	$501.21	$473.42	$532.62	$605.61
Diagnosis Cohort: Controls	469.43	426.55	476.96	426.38	458.80	531.20	514.63	493.32
P Value	<0.001	<0.001	<0.001	<0.001	0.114	0.067	0.325	0.002
Raw Difference								
Diagnosis Cohort—Cases Minus Controls	194.09	245.14	152.83	185.05	42.42	−57.77	17.98	112.29
Statistically Significant (5%) Results								
Diagnosis Cohort—Cases Minus Controls	194.09	245.14	152.83	185.05	Not Significant	Not Significant	Not Significant	112.29

FIGURE 8

Quarterly Health Care Costs and Cost Differences—Low-Risk Rx Cohort

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8
Mean Quarterly Health Care Costs (IP, OP, RX)								
Rx Cohort: Cases of Antidepressant Usage	$724.65	$731.73	$720.43	$721.94	$598.95	$560.05	$588.81	$855.60
Rx Cohort: Controls	487.77	491.76	495.75	512.07	496.98	481.82	544.25	543.16
P Value	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	0.094	<0.001
Raw Difference								
Rx Cohort—Cases Minus Controls	236.88	239.97	224.67	209.87	101.96	78.23	44.56	312.44
Statistically Significant (5%) Results								
Rx Cohort—Cases Minus Controls	236.88	239.97	224.67	209.87	101.96	78.23	Not Significant	312.44

and Rx cohorts. The "Raw Difference" lines show the difference in costs without applying any statistical significance testing, and the "Statistically Significant Results" lines show results that are statistically significant. All quarterly health care costs were capped at $20,000 to remove the effect of outliers. Figures 6 and 9 plot both the diagnosis and Rx cohorts in the period leading up to a diagnosis of depression for the high-risk groups and low-risk groups, respectively. The faded lines/points show statistically insignificant results, while the solid lines/points show statistically significant results.

Cost differences between cases and controls were statistically significant for both high-risk cohorts in the year preceding the depression diagnosis—but not any earlier. The size of the cost difference was lower in the earlier quarters and increased up to the time when depression was diagnosed. The published literature states that the median delay from onset of depression to a diagnosis is seven to eight years. Our results indicate that the statistically significant effect of depression on a high-risk insured's health care costs started appearing up to a year before diagnosis.

For the low-risk cohorts, as shown in Figures 7 and 8, there are statistically significant cost differences as early as two years prior to a diagnosis of depression. These differences have the potential for continuing beyond the measurement period. For the diagnosis cohort, several of the more recent cost differences were small in magnitude and insignificant statistically. But for the Rx cohort, the cost differences were statistically significant in seven out of the eight quarters.

Work Absence and Depression

We analyzed the cost of absenteeism in the same way we analyzed health care costs—by quarter. We didn't apply any outlier handling to the absence hours, and we excluded absence hours indicated in the data as recreational because we were interested in absence from work that was less elective in nature. We were more interested in hours lost because of longer-than-normal hospital stays,

FIGURE 9

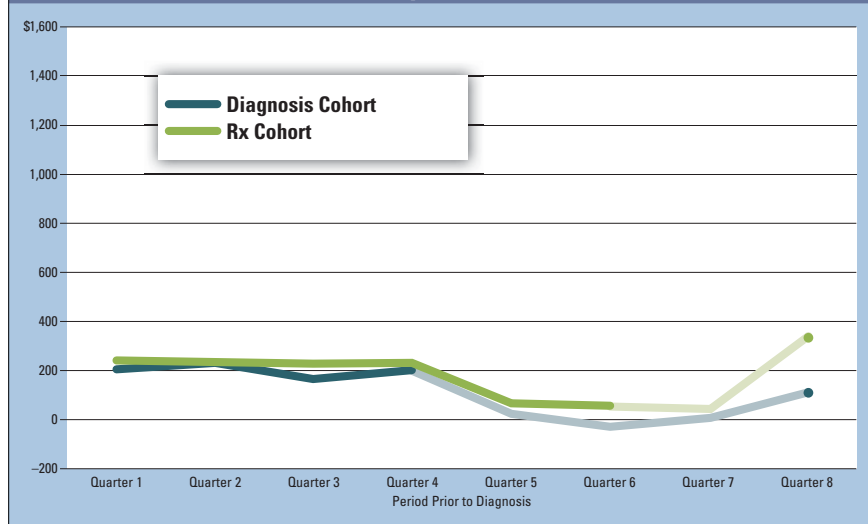**Significant Differences Between Cases and Controls: Low-Risk Group, Health Care Costs**

FIGURE 10
Quarterly Absence Hours and Differences—High-Risk Diagnosis Cohort

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8
Mean Quarterly Absence Hours								
Diagnosis Cohort: Cases of Depression	15.68	16.99	18.24	22.28	23.53	24.21	27.77	24.36
Diagnosis Cohort: Controls	14.26	16.39	17.92	19.36	17.88	19.73	20.49	17.29
P Value	*0.199*	*0.370*	*0.441*	*0.103*	*0.003*	*0.024*	*<0.001*	*<0.001*
Raw Difference								
Diagnosis Cohort—Cases Minus Controls	1.42	0.60	0.32	2.91	5.65	4.48	7.28	7.07
Statistically Significant (5%) Results								
Diagnosis Cohort—Cases Minus Controls	Not Significant	Not Significant	Not Significant	Not Significant	5.65	4.48	7.28	7.07

FIGURE 11
Quarterly Absence Hours and Differences—High-Risk Rx Cohort

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8
Mean Quarterly Health Care Costs (IP, OP, RX)								
Rx Cohort: Cases of Antidepressant Usage	16.96	18.08	18.75	24.29	26.01	25.71	26.15	22.72
Rx Cohort: Controls	13.36	14.55	16.16	18.05	18.96	19.59	17.03	14.67
P Value	*0.001*	*0.002*	*0.035*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Raw Difference								
Rx Cohort—Cases Minus Controls	3.60	3.53	2.59	6.24	7.05	6.12	9.12	8.06
Statistically Significant (5%) Results								
Rx Cohort—Cases Minus Controls	3.60	3.53	2.59	6.24	7.05	6.12	9.12	8.06

for instance, than hours lost because of leisure activities. It's possible that recreational absence was correlated with depression, but our study didn't investigate that correlation.

To assign a value to the hours missed from work, we used 2007 census estimates of hourly productivity by age and gender. We applied a 3 percent trend, which is consistent with average inflation in the United States and is recommended by the Public Health Service's Panel on Cost-Effectiveness in Health and Medicine to estimate productivity as of 2009. We then adjusted the average hourly productivity for our study population's specific age and gender mix to arrive at an estimate of $32 as the hourly productivity of an average insured member in our study.

The tables in Figures 10 and 11 show the quarterly differences in absence hours between high-risk cases and controls. Figure 12 plots the absentee hours for both the diagnosis and Rx cohorts in the period leading up to depression diagnosis.

Note that the high-risk members in the diagnosis cohort had statistically significant increases in absence hours in the four quarters leading up to a diagnosis of depression. The high-risk Rx cohort had statistically significant differences over the full two-year period leading up to a diagnosis of depression, with absenteeism generally increasing with time. In the six months preceding a depression diagnosis, the average depressed insured member in our study missed a full additional working day per quarter.

The tables in Figures 13 and 14 show the same results for the low-risk cohorts. Figure 15 plots both the diagnosis and Rx cohorts in the period leading up to a diagnosis of depression.

The difference in absenteeism between cases and controls is statistically significant over the entire two-year period in the low-risk group, while the high-risk diagnosis cohort (see Figures 10 and 11) shows statistical significance only for a one-year period. The magnitude of the differential in absence hours

FIGURE 12
Significant Differences Between Cases and Controls:
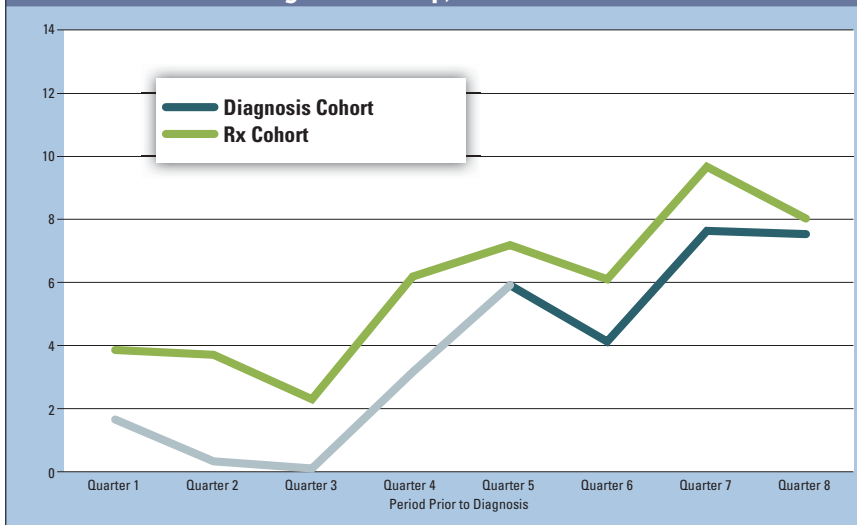**High Risk Group, Hours Absent**

FIGURE 13 Quarterly Absence Hours and Differences—Low-Risk Diagnosis Cohort								
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8
Mean Quarterly Absence Hours								
Diagnosis Cohort: Cases of Depression	14.77	17.47	17.63	19.73	21.65	21.21	22.98	19.29
Diagnosis Cohort: Controls	8.34	9.50	9.33	9.31	10.14	10.28	10.21	9.16
P Value	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Raw Difference								
Diagnosis Cohort—Cases Minus Controls	6.44	7.97	8.30	10.43	11.51	10.93	12.77	10.13
Statistically Significant (5%) Results								
Diagnosis Cohort—Cases Minus Controls	6.44	7.97	8.30	10.43	11.51	10.93	12.77	10.13

FIGURE 14 Quarterly Absence Hours and Differences—Low-Risk Rx Cohort								
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6	Quarter 7	Quarter 8
Mean Quarterly Absence Hours								
Rx Cohort: Cases of Antidepressant Usage	14.42	15.43	14.37	19.16	20.98	19.81	19.10	17.70
Rx Cohort: Controls	8.46	9.72	10.15	10.77	10.58	10.53	10.39	9.61
P Value	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
Raw Difference								
Rx Cohort—Cases Minus Controls	5.96	5.71	4.22	8.39	10.40	9.28	8.72	8.10
Statistically Significant (5%) Results								
Rx Cohort—Cases Minus Controls	5.96	5.71	4.22	8.39	10.40	9.28	8.72	8.10

in the low-risk group also was higher than in the high-risk group. Again, there was a general upward trend in the magnitude of the differences as we got closer to the diagnosis date, with some fluctuations.

Implications for Employers and Insurers

Our study clearly shows that a significant differential exists in excess health care and absenteeism costs between depressed people prior to their diagnosis and comparable non-depressed insureds. As we noted above, the low-risk group had a larger difference in absence hours between cases and controls than the high-risk group. One explanation could be that the high-risk group tends to go through its available work leave faster because of other medical needs. Some absences that are the result of other co-morbid conditions may be covered by short-term disability, which was not fully captured in our data. It's possible we may not be seeing the complete picture in our data for absences in the high-risk group. We also noticed that the magnitude of excess costs increased during the two years prior to diagnosis to a highest level in the quarter right before diagnosis. One

possible explanation for the increasing costs could be a deepening depression that leads to a significant adverse medical event that finally triggers a diagnosis of depression.

What do our findings mean for employers? To put our study in perspective, consider an employer with 1,000 employees. We estimated that people with undiagnosed depression cost such an employer nearly $132,560 over a two-year

period. We developed our estimate based on the following information:

The estimated prevalence of depression in the United States is approximately 9.5 percent.

Based on our analysis of the MarketScan nationwide claims data for commercially insured working-age people, we saw a prevalence of diagnosed/treated depression to be 5.0 percent.

This would indicate a prevalence of

FIGURE 15
Significant Differences Between Cases and Controls:
Low-Risk Group, Hours Absent
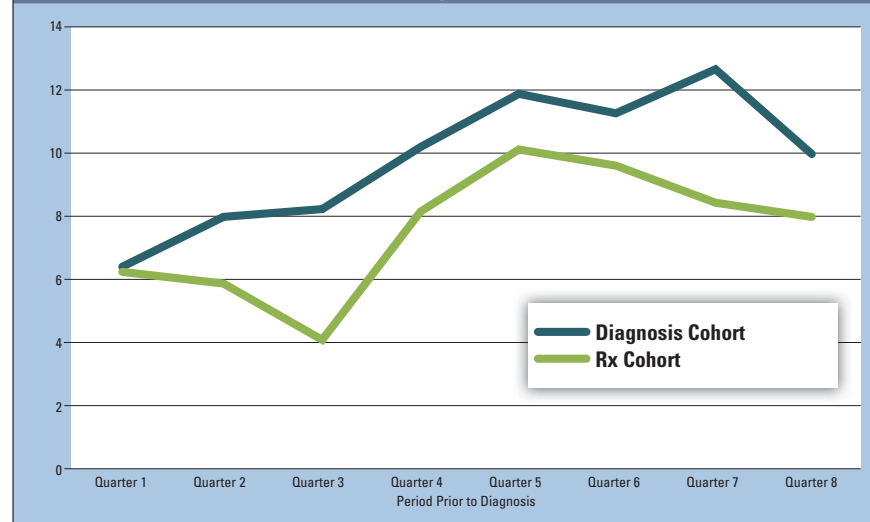
undiagnosed depression of approximately 4.5 percent (9.5% -5.0%) for an average employer. Tying all the numbers together, an estimate of the cost of undiagnosed depressed people for this employer could be 4.5% * 1,000 * $3,386 * 0.87 = $132,560 over a two-year period on a paid dollar basis.

Approximately 45 percent of this cost is the result of excess health care costs, and the other 55 percent comes from excess days missed from work. Self-funded employers incur the excess health care costs directly, while fully insured employers incur the health care costs indirectly through higher health insurance premiums. This estimate doesn't include excess costs associated with employees attending work while sick (presenteeism) or with a disability, the health care costs of undiagnosed depressed adult dependents, or the excess health care costs associated with dependents who might be affected adversely by a depressed family member. Our estimate, accordingly, should be viewed as a lower bound.

For an insurer, our findings represent a potential opportunity for health care cost savings. We estimate that an insurer with 1,000 covered members incurs on average $58,373 in excess health care costs over a two-year period for people with undiagnosed or untreated depression. This estimate doesn't include the potential costs incurred by dependents whose family member is depressed. As a result, our estimate (again) should be viewed as a lower bound. Absenteeism will not affect an insurer directly, so potential direct savings would be limited to excess health care costs. With 4.5 percent undiagnosed depressed members from 1,000 covered insureds, this represents 4.5% * 1,000 * $1,491 * 0.87 = $58,373 over a two-year period on a paid dollar basis.

A practical follow-up to our study would be to determine how much of this pool of potential savings can be realized. There are two main factors to consider. First, how many people can we accurately identify who have depression but have yet to be diagnosed? If we can identify some percentage of undiagnosed depressed members, then we can get closer to estimating the potential savings that can be realized through early diagnosis. Second, what portion of the cost differential can be altered by effective intervention? Research conducted in 2006 on the second question indicates that an employer who implements a "minimal level of enhanced care for employees' depression" could realize $2,298 in savings over a five-year period per 1,000 employees. Further research on both of these questions would be beneficial.

We are currently working on research that estimates the percentage of people that can be accurately identified as depressed prior to their diagnosis through other diagnosis codes and health care utilization patterns. If we randomly select people to screen for depression, we can expect to find approximately 5 percent to 8 percent as actually depressed (which is roughly the prevalence of treated depression). We are building a predictive model to increase by several times our odds of finding depressed people based on readily available claim data. □

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Resources

All About Depression.com, "What is depression?" http://www.allaboutdepression.com/gen_01.html

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Wang, Phillip S., Patricia Berglund, Mark Olfson, et al., "Failure and Delay in Initial Treatment Contact After First Onset of Mental Disorders in the National Comorbidity Survey Replication," *Archives of General Psychiatry*, June 2005. http://archpsyc.ama-assn.org/cgi/reprint/62/6/603

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Wang, Philip S., Amanda Patrick, Jerry Avorn, Francisca Azocar, Evette Ludman, Joyce McCulloch, Gregory Simon, Ronald Kessler, "The Costs and Benefits of Enhanced Depression Care to Employers," *Archives of General Psychiatry*, December 2006. http://archpsyc.ama-assn.org/cgi/content/full/63/12/1345

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Research Limitations

The methods for this study detect correlations between variables such as depression and certain cost outcomes. Retrospective claims analysis does not allow for random assignment of study members to a treatment cohort and therefore cannot directly measure causation.

The cohort of insureds who were assumed to be depressed based on the presence of an antidepressant prescription may include people who are not actually depressed but were prescribed antidepressants for off-label use to treat other conditions. The extent of off-label use of antidepressants may affect our study's ability specifically to draw correlations between costs and depression.

The research did not attempt to study the cost of employees attending work while sick. Presenteeism has been found to be a significant portion of the overall costs of undiagnosed depression to an employer. As a result, our results should be viewed as a lower bound of the overall estimated excess costs.