OPEN

Total Health-Related Costs Due to Absenteeism, Presenteeism, and Medical and Pharmaceutical Expenses in Japanese Employers

Tomohisa Nagata, MD, PhD, Koji Mori, MD, PhD, Makoto Ohtani, PhD, Masako Nagata, MD, Shigeyuki Kajiki, MD, PhD, Yoshihisa Fujino, MD, MPH, PhD, Shinya Matsuda, MD, PhD, and Ronald Loeppke, MD, MPH

Objective: This study aimed to examine a detailed breakdown of costs (absenteeism, presenteeism, and medical/pharmaceutical expenses), of the employees in four pharmaceutical companies in Japan. **Methods:** This is a cross-sectional study. Absenteeism and presenteeism were measured by a self-administered questionnaire for workers, and their costs were estimated using the human capital approach. Presenteeism was evaluated by the degree affected quality and quantity of work. Medical and pharmaceutical expenses were obtained by insurance claims. **Results:** The monetary value due to absenteeism was $520 per person per year (11%), that of presenteeism was $3055 (64%), and medical/pharmaceutical expenses were $1165 (25%). Two of the highest total cost burdens from chronic illness were related to mental (behavioral) health conditions and musculoskeletal disorders. **Conclusion:** A total cost approach can help employers set priorities for occupational health, safety, and population health management initiatives.

Keywords: absenteeism, medical and pharmaceutical expenses, presenteeism

In Japan, the 2016 expenditure on health care was 10.9% of the gross domestic product (GDP). Among the Organization for Economic Co-operation and Development (OECD) countries, the USA had the highest health care expenditures, at 17.2% of GDP—highlighting the fact that rising medical and pharmaceutical expenses are one of the most significant issues in the world.[1] Policy makers have been concerned that more than 80% of total health care costs go toward care for people with chronic conditions—with many of those people being retirees.[2] Therefore, in order to control this growing burden of chronic illness, it is important to conduct preventive interventions for young to middle-aged persons, with one of the greatest opportunities to make this impact through workplace health initiatives.

In the workplace, the economic burden of poor health from a societal perspective is not only medical and pharmaceutical expenses but also health-related productivity loss due to sick-leave (called ''absenteeism'') and reduced performance while at work due to uncontrolled diseases or health risks (called ''presenteeism'').[3–9] Several studies have revealed that the economic burden due to absenteeism and presenteeism was much greater than medical/pharmacy expenses.[10–12] Therefore, understanding a detailed breakdown of total health-related costs (medical and pharmaceutical expenses, monetary value due to absenteeism and presenteeism) is important for policy makers.

Employers also have a strong interest in this topic of health-related productivity loss. In fact, employers are often compelled to make decisions about increasing their investments in workers' health and safety, when they see an aggregated analysis of the disease-specific burden of illness and related health-related productivity loss in their workforce. The employer studies found the top three medical and pharmacy expenses of diseases or conditions were cancer, back/neck pain, and other chronic pain, and the top three conditions leading to the highest total costs (medical/pharmacy, absenteeism/presenteeism) were depression, obesity, and arthritis.[11,12] This information has changed employers' or health care professionals' decisions as to which conditions and health care services should be conducted on a priority basis. Furthermore, several past studies in Japan have also revealed the economic impact of the loss of performance due to health-related absenteeism and presenteeism.[13,14] However, in Japan, integrating the health-related productivity data with the medical/pharmacy expense data has been lacking.

Japan had made the universal health coverage by establishment of employee-based and community-based social health insurance, and almost everyone came to be insured in 1961.[15] Large companies often built the health insurance unions, which insure all employees and their family. In this study, we were able to obtain the complete data of medical and drug expenses of employees by use of health insurance claims except for medical treatment not covered by insurance. The present study aimed to examine a detailed breakdown of expenses (medical and pharmaceutical expenses, and estimated monetary value due to absenteeism and presenteeism) by diseases or symptoms, of the employees in four pharmaceutical companies in Japan.

METHODS

We conducted this study in four pharmaceutical companies and their related health insurance unions. This is a cross-sectional study to calculate total costs due to absenteeism, presenteeism, and medical and pharmaceutical expenses during 1 year (fiscal year 2014). We obtained health data by a self-administered questionnaire for workers once in 2014 to evaluate absenteeism and presenteeism during the past 3 months. Using these data, we estimated costs due

From the Department of Occupational Health Practice and Management, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Kitakyushu, Japan (Drs Nagata, Mori, Nagata, Kajiki); Data Science Center for Occupational Health, University of Occupational and Environmental Health, Kitakyushu, Japan (Drs Ohtani, Nagata, Matsuda); Department of Environmental Epidemiology, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, Kitakyushu, Japan (Dr Fujino); Department of Preventive Medicine and Community Health, University of Occupational and Environmental Health, Kitakyushu, Japan (Dr Matsuda); U.S. Preventive Medicine, Inc, Brentwood, Tenneesse (Dr Loeppke).

This study was funded by the Collabo-Health Study Group.

The authors have no competing interests.

Address correspondence to: Tomohisa Nagata, MD, PhD, Department of Occupational Health Practice and Management, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health, 1-1 Iseigaoka, Yahatanishi-ku, Kitakyushu 807-8555, Japan (tomohisa@med.uoeh-u.ac.jp).

DOI: 10.1097/JOM.0000000000001291

to absenteeism and presenteeism for a year. We also analyzed the related claims data from April 1, 2014, to March 31, 2015, from each health insurance union to calculate medical and pharmaceutical expenses in the study populations.

Ethics

The study design was explained to employees and employers through email, intranet homepage, or committee of occupational health and safety in each company and health insurance union. Employees have the freedom to choose whether to participate the study or not. Employers cannot see each answer of self-administered questionnaire.

This study was approved by the ethics committee of University of Occupational and Environmental Health, Kitakyushu, Japan.

Self-administered Questionnaire

The self-administered questionnaire was conducted in four pharmaceutical companies (company A-D). Employees could choose to participate in the survey or not. Only researchers were able to access the results of the questionnaires, and therefore, the study employers and health care staff in those companies were not able to access the questionnaire data. Health care staff in each company sent an email to all employees to inform and encourage to participate in the confidential health survey. Health care staff in company B and D sent an email just once. On the contrary, health care staff in company A and C explained the purpose of the survey to managers before sending an email of information, and send reminder message 2 or 3 weeks later.

Table 1 summarizes sample details. In company A and C, response rate was high (86.5% and 78.6%, respectively); on the contrary, in company B and D not as high (32.7% and 33.4% respectively). The number of the total sample size in the final analysis was 12,350 employees, which was an aggregate average of 58% of the 21,293 total eligible employees across the four employers.

Presenteeism

We estimated monetary value due to presenteeism by the following steps from the self-administered questionnaire.

First, we asked they had experienced some health conditions or health risks over the past month. We reviewed as many symptoms as possible that Japanese workers may have through a national database,[16] the previous study,[11,12] and selected 34 conditions by our researchers' discussion. The 34 conditions are 1; Respiratory trouble, 2; Liver disease, 3; Diabetes, 4; Dyslipidemia, 5; High blood pressure, 6; Heart disease, 7; Cancer, 8; Anemia, 9; Osteoporosis, 10; Troubled by allergies, 11; Skin disease/Itchiness, 12; Asthma, 13; Cold, influenza, 14; Gastroenteritis, 15; Stomach ulcer, duodenal ulcer, 16; Recurrent diarrhea, constipation, 17; Heartburn, 18; Pain in arm and leg joints, lack of mobility, 19; Back pain, 20; Painful neck or stiff shoulders, 21; Headaches, 22; Tooth trouble, 23; Depression, 24; Anxiety, 25; Insomnia, 26; Insufficient sleep, 27; Menopausal symptoms, 28; Infertility treatment, 29; A sense of weariness or fatigue, 30; Hangover, 31; Deteriorating hearing, 32; Dry eye, glaucoma, etc, 33; Urine-related problems, and 34; Others. If no health problems or conditions, we estimated that productivity loss was nothing. Second, if they had some conditions, we asked which health condition out of 34 they had, and to select the one health condition that they had the biggest effect on their work. We allocated 34 conditions into International Statistical Classification of Diseases and Related Health Problems (ICD) version 10 code. Third, we asked to how many days they had experienced their symptom over the past 3 months. Fourth, we asked the degree of severity how their symptom affected quality and quantity of work, respectively. We asked the quality/quantity of work that they were able to carry out when suffering from their symptom in comparison to when they are not suffering from those conditions or symptoms. The answer was score from 0 (no productivity) to 10 (no productivity loss). We adopted the method that was used in the past study.[17,18] The construct validity of this measurement was evaluated in the past study. [18]

Finally, we calculated proportion of productivity loss and exchanged it for monetary value due to presenteeism by the following formulas.

Average payroll per person per hour was Japanese Yen (JPY) 3300 [that was 31.1483 US Dollar (USD)] in large manufacturing companies in Japan.[19] One USD was JPY 105.9448 by average exchange rate in 2014.

$$\text{Proportion of productivity loss} = 1 - \text{Quantity}(0-10) * \text{Quality}(0-10)/100$$

$$\begin{aligned}\text{Estimated monetary value due to presenteeism} &= \text{USD } 31.1483 * 8\,(\text{working hours per day}) \\ &* (\text{Proportion of productivity loss}) \\ &* (\text{days with condition per three months}) \\ &* 4\,(\text{For changing into the costs per a year})\end{aligned}$$

Absenteeism

We asked sick-leave days taken over the course of the past 3 months by the self-administered questionnaire.

We estimated monetary value due to absenteeism by following formula.

$$\begin{aligned}\text{Estimated monetary value due to absenteeims} &= \text{USD } 31.1483 * 8\,(\text{working hours per day}) \\ &* (\text{Sick-leave days over the past three months}) \\ &* 4\,(\text{For changing into the costs per a year})\end{aligned}$$

Medical and Pharmaceutical Expenses

The health insurance unions have the data of medical and pharmaceutical expenses based on compensation claims. We

TABLE 1. Sample Details in Four Pharmaceutical Companies

Company	Number of Eligible Employees	Number of Valid Questionnaire Respondents	Response Rate (%)	Number of Missing Data	Number of Sample in Final Analysis
Company A	6,932	5,997	86.5	369	5,628
Company B	5,159	1,688	32.7	90	1,598
Company C	5,261	4,136	78.6	107	4,029
Company D	3,941	1,316	33.4	221	1,095
Total	21,293	13,137	61.7	787	12,350

TABLE 2. Health risk definitions and health risk distribution of this study and the past study

	Health Risk Definitions (Loeppke et al[22])	People and Overall Population (12,350) With High Risk in this study		People and Overall Population (7,804) With High Risk in US study	
		N	%	*N*	%
Alcohol	More than 14 drinks per week or binge drinking once or more in past month	2,392	20	901	12
Blood pressure	Systolic, >139 mm Hg or Diastolic, >89 mm Hg	1,132	10	923	12
Body mass index	27.8 (men) 27.3 (women)	943	8	3,338	43
Cholesterol	Total cholesterol > 239 mg/dL	1,151	10	836	11
Existing medical problems	Heart problems, cancer, diabetes, or stroke	751	6	910	12
Fasting blood glucose	Fasting glucose borderline high (≥100 and < 126 mg/dL) or high (≥126 mg/dL)	2,155	18	1,616	21
HDL cholesterol	HDL cholesterol < 35 mg/dL	131	1	328	4
Perception of health	Fair or poor	1,397	11	842	11
Smoking	Current smoker/tobacco user	2,644	22	489	6

received inpatient claims (including medical and pharmaceutical expenses), outpatient medical claims, and outpatient pharmaceutical claims of all samples from April 1, 2014, to March 31, 2015. These claims do not include dental treatment. Inpatient claims and outpatient medical claims had name of patient, name of illness or injury, and medical or pharmaceutical expenses, so we were able to calculate the expenses by ICD10 code. On the contrary, outpatient pharmaceutical claims did not have the name of the illness or injury, so we just obtained the total outpatient pharmaceutical claims expenses.

Health Risks

To reveal the characteristics of sample in this study, we evaluated the health risks of the study populations. Edington did significant research establishing 15 health risks of individuals and he revealed that a high-risk category is associated with higher medical expenses.[20,21] We used the high-risk definitions of the comparable nine health risks among 15 health risks that have been utilized in many prior studies.[20–23] The high-risk definitions are described in Table 2.

Alcohol, existing medical problems, perception of health, and smoking was evaluated by the self-administered questionnaire. Blood pressure, body mass index (BMI), cholesterol, and high-density lipoprotein (HDL) cholesterol was evaluated by health checkup data in 2014. In Japan, employers have to conduct annual health checkup and employees have to get it by legal requirement.[24] We took serum total cholesterol (TC) as cholesterol. In the absence of TC data, we took "low density lipoprotein cholesterol + HDL cholesterol + triglyceride (TG)/5" as TC if TG was less than 400 mg/dL.[25]

We compared the proportion with each health risk in our sample to that in the past study.[22]

Statistical Analysis

All data analyses were performed using IBM SPSS Statistics 22.0 software (SPSS, Inc., Chicago, Illinois). To reveal workers with symptoms or not by sex, age, and occupation, we used Chi-square tests for sex and occupation and used a Chi-square test for trend to assess a linear trend in proportions across the categories of age. All tests were two-tailed, with differences reported as significant if *P* value was less than 0.05.

RESULTS

The number of total sample in final analysis was 12,350, 9224 male (75%), and 3126 female (25%). The characteristic in this study is summarized in Table 3. Our sample consisted of 1372 (11%) as 19 to 29 years old, 2779 (23%) as 30 to 39 years old, 4359 (35%) as 40 to 49 years old, 3462 (28%) as 50 to 59 years old, and 378 (3%) as more than 60 years old. Three thousand nine hundred thirty-five (32%) were Sales, 2473 (20%) were Research and Development, 2258 (18%) were Manager, 2215 (18%) were Production line, 1449 (12%) were Clerical and administrative support, and 20 (0.2%) were others.

Health risk definitions and health risk distribution of this study is summarized in Table 2. Top three high health risks were smoking (2644 out of 12,262, 22%), alcohol (2392 out of 12,257, 20%), and fasting blood glucose (2155 out of 11,745, 18%).

Demographic distributions with symptoms or not and the degree of the symptoms are described in Table 4. Twenty-five percent of male and 34% female had some symptoms. Fifty to 59-year-old workers had the highest prevalence of symptoms (31%).

TABLE 3. The Sample Characteristic of This Study

	N	%
Gender		
Male	9,224	74.7
Female	3,126	25.3
Age, years		
19–29	1,372	11.1
30–39	2,779	22.5
40–49	4,359	35.3
50–59	3,462	28.0
≥60	378	3.1
Occupation		
Manager	2,258	18.3
Clerical and administrative support	1,449	11.7
Sales	3,935	31.9
Research and development	2,473	20.0
Production line	2,215	17.9
Others	20	0.2
Total	12,350	100

TABLE 4. Demographic Distributions With Symptoms or Not, and the Degree of the Symptoms

	No Symptoms		With Symptoms			With Symptoms				
						PL = 0%	0%<PL≤20%	20%<PL≤40%	40%<PL≤60%	60%<PL≤100%
	N	%	*N*	%	*P*	%	%	%	%	%
Gender										
Male	6,950	75.3	2,274	24.7	<0.001*	4.4	5.6	5.3	4.3	5.0
Female	2,077	66.4	1,049	33.6		6.8	8.1	7.2	4.7	6.7
							0.0	0.0	0.0	0.0
Age, years							0.0	0.0	0.0	0.0
19–29	1,117	81.4	255	18.6	<0.001†	1.7	3.2	4.2	3.6	5.8
30–39	2,124	76.4	655	23.6		3.6	4.7	5.3	4.4	5.6
40–49	3,131	71.8	1,228	28.2		5.2	6.7	6.2	4.5	5.5
50–59	2,374	68.6	1,088	31.4		6.8	8.0	6.6	4.9	5.3
≥60	281	74.3	97	25.7		8.7	8.2	3.2	2.4	3.2
							0.0	0.0	0.0	0.0
							0.0	0.0	0.0	0.0
Occupation							0.0	0.0	0.0	0.0
Manager	1,652	73.2	606	26.8	<0.001*	5.3	7.4	6.5	4.2	3.5
Clerical and administrative support	1,008	69.6	441	30.4		6.0	7.8	7.5	4.1	5.1
Sales	2,941	74.7	994	25.3		4.0	5.1	5.0	4.5	6.8
Research and development	1,830	74.0	643	26.0		4.8	6.2	6.3	4.4	4.3
Production line	1,583	71.5	632	28.5		6.2	6.4	4.7	4.7	6.5
Others	13	65.0	7	35.0		5.0	5.0	5.0	10.0	10.0
							0.0	0.0	0.0	0.0
Total	9,027	73.1	3,323	26.9		5.0	6.3	5.8	4.4	5.4

PL, proportion of productivity loss due to presenteeism.
*Chi-square test.
†Chi-square test for trend.

The monetary value due to presenteeism per person per year was $3055 USD. The symptoms with greater productivity losses were painful neck or stiff shoulders, insufficient sleep, back pain, dry eye, glaucoma, and depression (Table 5).

In total costs, the monetary value due to absenteeism was $520 USD per person per year (11%), that due to presenteeism was $3055 USD (64%), medical (outpatient) expenses were $607 USD (13%), pharmaceutical (outpatient) expenses were $357 USD (8%), and medical and pharmaceutical expenses (inpatient) were $201 USD (4%) in Fig. 1.

In total health-related costs, the two health conditions with the largest burden were Mental and behavioral disorders, and Diseases of the musculoskeletal system and connective tissue, with a large portion of the cost burden being due to presenteeism, as noted in Fig. 2. In mental and behavioral disorders, costs of presenteeism were $ 948,276 USD per 1000 full-time equivalent per year, medical (outpatient) expenses were $19,569 USD, and medical and pharmaceutical expenses (inpatient) were $1683 USD, and in Diseases of the musculoskeletal system and connective tissue, costs of presenteeism were $ 833,327 USD per 1000 full-time equivalent per year, medical (outpatient) expenses were $43,935 USD, and medical and pharmaceutical expenses (inpatient) were $10,228 USD.

DISCUSSION

We revealed total burden of absenteeism, presenteeism, and medical and pharmaceutical expenses in four pharmaceutical companies in Japan. The monetary value due to presenteeism was a relatively large burden to employers, especially in mental/behavioral and musculoskeletal conditions.

Comparison With the Past Studies

Japanese national survey named Comprehensive Survey of Living Conditions has been conducted every year to research basic subjects of living conditions such as health, medical care, and other factors.[16] As for the Large-scale survey 2013, the Health questionnaire covered whole households (234,383 households) in Japan who were randomly sampled in 5440 districts from the National Census in 2005. The survey revealed that the proportion of persons with symptoms was 27.7% in male and 34.5% in female, and that rises with age (16.9% in 20s, 21.4% in 30s, 23.4% in 40s, and 27.1% in 50s for males, 25.8% in 20s, 30.1% in 30s, 32.6% in 40's, and 36.6% in 50s for females) in the Japanese general population. The proportion in our study was almost the same: 24.7% for male and 33.6% for female in working population. Our study also revealed that the top four health conditions are first: Painful neck or stiff shoulders, second: Back pain, third: Insufficient sleep, and fourth: Eye symptom (Dry eye, etc) for male, and first: Painful neck or stiff shoulders, second: Headaches, third: Eye symptom (Dry eye, etc), and fourth: A sense of weariness or fatigue for female. That denoted almost the same tendency of the national survey: top three health conditions was first: back pain, second: stiff shoulders, and third: nasal discharge and congestion for male, and first: stiff shoulders, second: back pain, and third: pain in arm and leg joints for female. However, our study had much persons with eye symptoms and insufficient sleep. That may be related to workers in our study populations spent a significant amount of their working time using computers, with long working hours that could have shortened their sleeping hours.

In regard to the economic impact of loss of performance due to presenteeism, the top five health conditions in our study were painful neck or stiff shoulders, insufficient sleep, back pain, eyes

TABLE 5. The List of 34 Health Conditions, the Number With Each Symptom, and Estimated Monetary Value Due to Presenteeism per Person per Year by Each Condition With ICD10 Code and Classification Headings

Health Conditions	ICD10 Code	Classification Headings of ICD10	*N*	Monetary Value Due to Presenteeism per Person per Year (USD)
Painful neck or stiff shoulders	M00M99	Diseases of the musculoskeletal system and connective tissue	420	$432.92
Insufficient sleep	F00F99	Mental and behavioral disorders	266	$341.58
Back pain	M00M99	Diseases of the musculoskeletal system and connective tissue	283	$264.17
Eyes symptom (Dry eye, etc)	H00H59	Diseases of the eye and adnexa	266	$253.20
Depression	F00F99	Mental and behavioral disorders	127	$247.99
A sense of weariness or fatigue	R00R99	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	235	$234.85
Anxiety	F00F99	Mental and behavioral disorders	165	$230.45
Headaches	G00G99	Diseases of the nervous system	215	$143.95
Others	Z00Z99	Others	206	$141.00
Pain in arm and leg joints, lack of mobility	M00M99	Diseases of the musculoskeletal system and connective tissue	158	$136.24
Insomnia	F00F99	Mental and behavioral disorders	126	$128.26
Recurrent diarrhea, constipation	K00K93	Diseases of the digestive system	97	$84.17
Skin disease / Itchiness	L00L99	Diseases of the skin and subcutaneous tissue	98	$77.12
Cold, influenza	J00J99	Diseases of the respiratory system	105	$35.06
Menopausal symptoms	N00N99	Diseases of the genitourinary system	70	$34.28
High blood pressure	I00I99	Diseases of the circulatory system	56	$33.15
Deteriorating hearing	H60H95	Diseases of the ear and mastoid process	43	$31.01
Heart disease	I00I99	Diseases of the circulatory system	40	$28.10
Troubled by allergies	J00J99	Diseases of the respiratory system	55	$23.13
Cancer	C00D48	Neoplasms	23	$19.31
Asthma	J00J99	Diseases of the respiratory system	30	$17.63
Respiratory trouble	J00J99	Diseases of the respiratory system	23	$17.47
Gastroenteritis	K00K93	Diseases of the digestive system	36	$15.70
Diabetes	E00E90	Endocrine, nutritional, and metabolic diseases	29	$13.58
Stomach ulcer, duodenal ulcer	K00K93	Diseases of the digestive system	24	$12.18
Anemia	D50D89	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	16	$11.07
Heartburn	K00K93	Diseases of the digestive system	23	$10.58
Tooth trouble	K00K93	Diseases of the digestive system	26	$10.44
Liver disease	K00K93	Diseases of the digestive system	15	$9.74
Urine-related problems	N00N99	Diseases of the genitourinary system	20	$8.46
Infertility treatment	N00N99	Diseases of the genitourinary system	6	$5.32
Dyslipidemia	E00E90	Endocrine, nutritional, and metabolic diseases	16	$2.15
Hangover	R00R99	Symptoms, signs, and abnormal clinical and laboratory findings, not elsewhere classified	5	$0.45
Osteoporosis	M00M99	Diseases of the musculoskeletal system and connective tissue	0	$0.00
Total			3323	$3,054.71

ICD, International Statistical Classification of Diseases and Related Health Problems.

symptom (dry eye, etc), and depression. After we sorted health conditions into ICD10 code, a large part of the burden (38.3%) was caused by ''Mental and behavioral disorders'' and ''Diseases of the musculoskeletal system and connective tissue.'' That coincided with the Japanese past study, which concluded the burden of presenteeism of ''depression, anxiety, or emotional disorders'' and ''back or neck disorders'' were biggest.[13]

From the national database,[26] estimates of national medical care expenditure per person for all age and sex was $ 3031 USD in 2014, which was composed of 37.4% medical and pharmaceutical expenses (inpatient), 34.3% medical expenses (outpatient), 17.9% pharmaceutical expenses (outpatient), 6.8% dental expenses, and others. All expenditures were increasing with age. Average medical expenses (outpatient) per person per year were $ 292 USD in aged 20 to 24 years, $ 429 USD in 30 to 34 years, $ 556 USD in 40 to 44 years, $ 850 USD in 50 to 54 years, and $ 1314 USD in 60 to 64 years. With our sample, the expenses were $ 607 USD, and were equivalent to the average expenses in 40 to 49 years. Average pharmaceutical expenses (outpatient) per person per year in Japan were $ 127 USD in aged 20 to 24 years, $ 199 USD in 30 to 34 years, $ 274 USD in 40 to 44 years, $ 413 USD in 50 to 54 years, and $ 640 USD in 60 to 64 years. With our sample, the expenses were $ 357

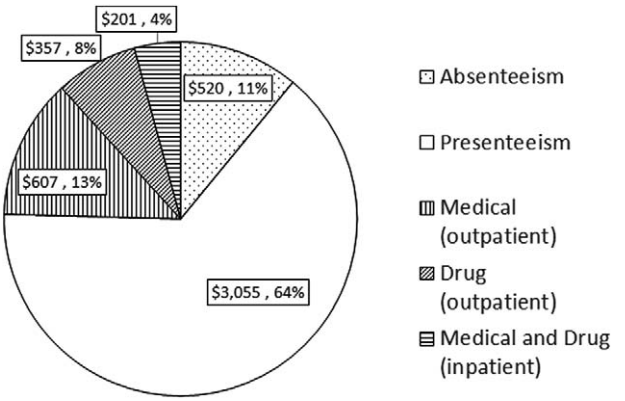

FIGURE 1. The $USD costs per person per year of absenteeism, presenteeism, and medical (outpatient), pharmaceutical (outpatient) and medical and pharmaceutical inpatient) expenses, and the proportion in total.

USD, and were equivalent to the average expenses in 45 to 54 years. In contrast, average medical and pharmaceutical expenses (inpatient) per person per year were $ 193 USD in aged 20 to 24 years, $ 328 USD in 30 to 34 years, $ 389 USD in 40 to 44 years, $ 681 USD in 50 to 54 years, $ 1274 USD in 60 to 64 years. With our sample, the expenses were $ 201 USD, and were equivalent to the average expenses in 20 to 29 years old. Lower medical and pharmaceutical expenses of inpatient may have been due to healthy worker effect.[27]

The past study in the USA revealed that the top 10 health conditions by costs (medical and pharmaceutical expenses, absenteeism and presenteeism) were depression, obesity, arthritis, back/neck pain, anxiety, GERD (gastroesophageal reflux disease), allergy, cancers (other than skin), other chronic pain, and hypertension in descending order.[11] It was difficult to compare it to our study because the specific categories of health conditions were somewhat different, but the results were similar, especially related to mental health conditions showing a high burden of total cost—with very high proportion of presenteeism. In our sample of pharmaceutical companies, the mental health status of workers might have affected the intellectual nature of their work, especially among research and development workers as well as in communication with customers. The total cost of musculoskeletal disorders such as back and neck pain was huge in both countries, but the breakdown of the cost was somewhat different. While in USA almost half of the costs was composed of medical expenses, in Japan, almost all the cost was due to presenteeism.

It is notable that the ratio of health-related productivity costs (absenteeism and presenteeism) to medical/pharmaceutical costs is 3 to 1 in this study of Japan employers/employees and is similar to the 2.3 to 1 ratio revealed in the past study of U.S. employers/employees.[11]

The health risk factor comparison between the USA and Japan reveals some differences, especially among BMI and smoking, as summarized in Table 2.

In fact, the prevalence rates of the top three individual health risk factors, which were high risk in our study, were as follows: smoking (22%), alcohol (20%), and fasting blood glucose (18%)—and those compared with prevalence rates of high risks in smoking (6%), alcohol (12%), and fasting blood glucose (21%) found in the past study.[22]

One of the major differences between this Japan study and the prior U.S. study on total health-related costs was with obesity. National Health and Nutrition Survey of Japan in 2014 revealed that the proportion whose BMI was more than 25 kg/m^2 was 28.8% in males and 21.3% in females.[28] In our sample, overweight high risk workers by the Edington health risk criteria (BMI of >27.8 for males and >27.3 for females) was just 8.0%. In spite of the lower proportion of obesity, diabetes mellitus was still one of big issues in Japan. Those who are highly suspected to have diabetes (those who have hemoglobin Alc level of 6.1% or more, or those who answered ''to be on medication of diabetes'' in a questionnaire) was 15.5% in male and 9.8% in female. Therefore, there should be a high priority on nutrition and exercise interventions for workers in Japan.

Implications to Practice

These data of the total health-related cost burden of health conditions can help employers set priorities on population health management and develop effective workplace health and human capital investment strategies. In Japan, mental health is a critical issue and various measures have been implemented. Absenteeism has been drawing attention in Japan and the guidance for helping workers return to work due to mental health problems was published

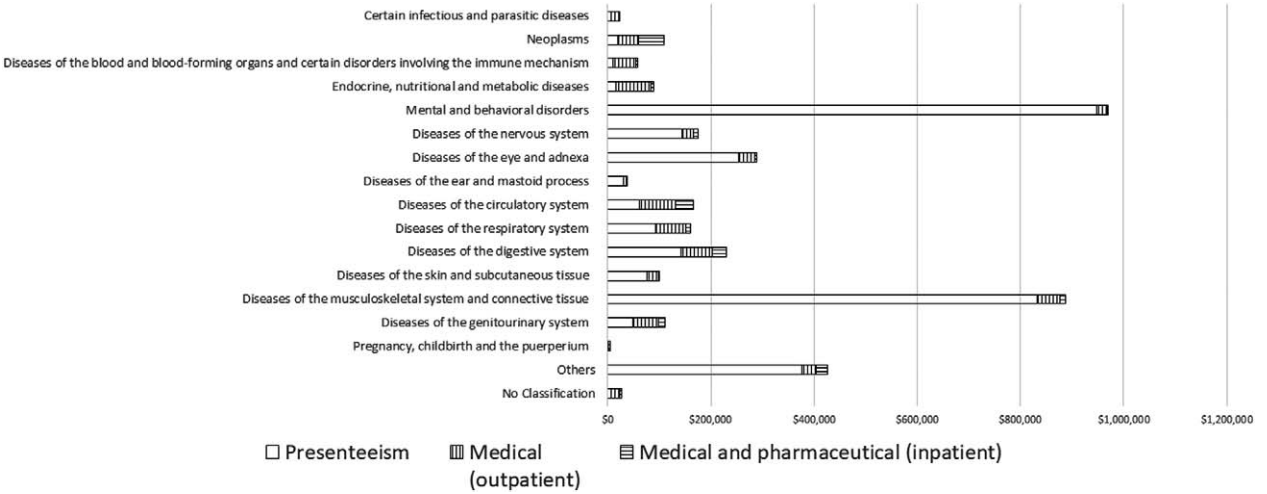

FIGURE 2. The $USD costs per 1,000 full-time equivalent per year of presenteeism, medical (outpatient), and medical and pharmaceutical (inpatient) expenses classified by International Statistical Classification of Diseases and Related Health Problems version 10 code (ICD 10).

in 2004.[29] Our study revealed that health-related productivity loss for mental health problems was huge, and this fact indicates that occupational health staff should take care not only of sick-leave workers but also of workers with symptoms of depression, anxiety, and sleep. However, the typical countermeasures for sleep disorders (such as insufficient sleep and insomnia) do not adequately address the broader mental/behavioral health disorders such as depression, anxiety substance abuse, and other common mental health conditions. In addition to that, the typical countermeasures to address neck and back pain have been insufficient. To support employers in setting workplace health priorities and strategies, it would be beneficial to analyze the cost-effectiveness and/or the cost benefits of workplace health initiatives from a total (productivity and medical/pharmaceutical) cost perspective. In prior articles, cost estimation tools for occupational health services[30] and calculated costs of each occupational health activity in Japanese manufacturing companies were described.[31] To compare the effectiveness of workplace health initiatives, assessing an employer's total cost burden of health conditions and health risks would provide the baseline information for a pre-post impact analysis.

Furthermore, this study confirms the importance of occupational health professionals considering these total health-related costs to employers when considering not only the return on investment (ROI) but also the broader value of the investment (VOI)[32] in occupational health, safety, and population health management initiatives for employers.

Strengths and Limitations

This is the first study in Japan to reveal total burden of medical and pharmaceutical expenses, and monetary value due to absenteeism and presenteeism by health conditions. Our study has several strengths. First, we used complete medical and pharmaceutical claims by the national health insurance system in Japan, so medical and pharmaceutical expenses were mutually exclusive and collectively exhaustive. Second, we estimated the monetary value due to presenteeism to meet the actual situation. In the calculating formula of productivity loss, we used duration of health problems or symptoms. With recall bias in mind, we asked workers how many days they had experienced their symptom over the past 3 months. Third, our sample size was large (12,350) and the overall response rate was high (61.7%). All workers were in pharmaceutical companies, so this result was easily interpreted.

Our study has several limitations. First, medical and pharmaceutical claims do not contain dental claims. The dental expenses were just 6.8% in total medical care expenditure,[26] so total burden was not influenced a great deal by lack of dental expenses. In addition to that, pharmaceutical claims were based on the prescription of doctors, so the expenses of over-the-counter drugs were not included. Second, we conducted self-administer questionnaire just once. Chronic health conditions were not greatly affected; however, seasonal conditions such as allergy to pollen, influenza, and so on depend on the season of the survey. In actual, the survey was conducted in summer, so hay fever and influenza were at a low prevalence rate. This should be considered in interpretation of the result. Third, the absenteeism and presenteeism measure were self-reported with possibility of recall bias. To minimize the influence, we had asked the situation of the past three months. We set 3 months as recall period because we thought 6 months were too long to recall the situation, and 1 month was too short to represent the situation of 1 year. Fourth, the response rate was different among the four companies in the study. The response rate was high in company A (86.5%) and company C (78.6%), whereas it was not as high in company B (32.7%) and company D (33.4%). We described the cause in Methods section. In company B and D, health-minded workers might answer self-administered questionnaire. In order to verify this, we had analyzed health checkup data and compared smoking rate of respondents of questionnaire to that of nonrespondents. In company B, smoking rate of respondents was 21.5%, whereas that of nonrespondents was 23.2% ($P = 0.195$). In company D, the rate was 27.2% and 24.3% in turn ($P = 0.066$). Sampling bias appears to have little to no impact on the result. Fifth, those who had been absent themselves from work due to health conditions during the survey period might not have been able to participate in the study survey. However, we set long survey period (about 1 month) to reduce that influence. The four companies involved in the study were all large-scale pharmaceutical companies, so our results may not accurately represent small- and medium-scale companies or other categories of business. Further study would be needed to verify the generalizability.

CONCLUSION

The monetary value due to absenteeism was $520 per person per year (11%), that of presenteeism was $3055 (64%), and medical/pharmaceutical expenses were $1165 (25%) [which included outpatient medical expenses of $607 (13%), outpatient pharmaceutical expenses of $357 (8%), and inpatient medical and pharmaceutical expenses of $201 (4%)]. Two of the highest total cost burdens of chronic illness were mental (behavioral) health conditions and musculoskeletal disorders.

It is notable that the ratio of health-related productivity costs (absenteeism and presenteeism) to medical/pharmaceutical costs is 3 to 1 in this study of employers/employees in Japan and is similar to the 2.3 to 1 ratio revealed in the past study of U.S. employers/employees.[11]

This study further confirms the importance of considering these total health-related costs to employers when considering not only the ROI but also the broader VOI[31] in occupational health, safety, and population health management initiatives for employers.

REFERENCES

1. Organisation for Economic Co-operation and Development. OECD.Stat: Health Expenditure and Financing 2016. Available at: http://stats.oecd.org/index.aspx?DataSetCode=SHA. Accessed January 12, 2018.
2. Partnership for Solutions National Program Office. *Chronic Conditions: Making the Case for Ongoing Care. September 2004 Update*. Baltimore, MD: Partnership for Solutions, John Hopkins University; 2004.
3. Aronsson G, Gustafsson K, Dallner M. Sick but yet at work. An empirical study of sickness presenteeism. *J Epidemiol Community Health*. 2000;54:502–509.
4. Dew K, Keefe V, Small K. 'Choosing' to work when sick: workplace presenteeism. *Soc Sci Med*. 2005;60:2273–2282.
5. Loeppke R, Hymel P. Health and productivity enhancement, Chapter 16. In: Moser R, Jr, editor. Effective Management of Health and Safety Programs: a Practical Guide, 3rd Edition. Beverly Farm, MA; 2008; pp. 265–290.
6. Hymel P, Loeppke R, Baase C, et al. Establishing a research agenda in health and productivity. *J Occup Environ Med*. 2004;46:518–520.
7. Kessler RC, Ames M, Hymel PA, et al. Using the WHO Health and Work Performance Questionnaire to evaluate the indirect workplace costs of illness. *J Occup Environ Med*. 2004;46:S23–S37.
8. Loeppke R, Hymel PA, Lofland JH, et al. Health-related workplace productivity measurement: general and migraine specific recommendations from the ACOEM Expert Panel. *J Occup Environ Med*. 2003;45:349–359.
9. Johns G. Presenteeism in the workplace: a review and research agenda. *J Organ Behav*. 2009;31:519–542.
10. Brady W, Bass J, Moser R, Anstadt GW, Loeppke R, Leopold R. Total corporate health costs. *J Occup Environ Med*. 1997;39:224–231.
11. Loeppke R, Taitel M, Haufle V, Parry T, Kessler RC, Jinnett K. Health and productivity as a business strategy: a multiemployer study. *J Occup Environ Med*. 2009;51:411–428.
12. Loeppke R, Taitel M, Richling D, et al. Health and productivity as a business strategy. *J Occup Environ Med*. 2007;49:712–721.
13. Wada K, Arakida M, Watanabe R, Negishi M, Sato J, Tsutsumi A. The economic impact of loss of performance due to absenteeism and presenteeism caused by depressive symptoms and comorbid health conditions among Japanese workers. *Ind Health*. 2013;51:482–489.

14. Wada K, Moriyama M, Narai R, et al. The effect of chronic health conditions on work performance in Japanese companies. *Sangyo Eiseigaku Zasshi*. 2007;49:103–109.
15. Ikegami N, Yoo BK, Hashimoto H, et al. Japanese universal health coverage: evolution, achievements, and challenges. *Lancet*. 2011;378:1106–1115.
16. Ministry of Health, Labour and Welfare, Japan. *Comprehensive Survey of Living Conditions.* Tokyo, Japan: Ministry of Health, Labour and Welfare, Japan; 2013.
17. Hoeijenbos M, Bekkering T, Lamers L, Hendriks E, van Tulder M, Koopmanschap M. Cost-effectiveness of an active implementation strategy for the Dutch physiotherapy guideline for low back pain. *Health Policy*. 2005;75:85–98.
18. Brouwer WB, Koopmanschap MA, Rutten FF. Productivity losses without absence: measurement validation and empirical evidence. *Health Policy*. 1999;48:13–27.
19. Ministry of Health, Labour and Welfare, Japan. *Basic Survey on Wage Structure.* Tokyo, Japan: Ministry of Health, Labour and Welfare, Japan; 2013 , Available at: http://www.mhlw.go.jp/toukei/list/chinginkouzou.html. Accessed January 12, 2018.
20. Edington DW. Emerging research: a view from one research center. *Am J Health Promot*. 2001;15:341–349.
21. Edington DW. *Zero Trends: Health as a Serious Economic Strategy.* Ann Arbor, MI: Health Management Research Center, University of Michigan; 2009.
22. Loeppke R, Edington D, Bender J, Reynolds A. The association of technology in a workplace wellness program with health risk factor reduction. *J Occup Environ Med*. 2013;55:259–264.
23. Loeppke R, Edington DW, Beg S. Impact of the prevention plan on employee health risk reduction. *Popul Health Manag*. 2010;13:275–284.
24. Ministry of Health, Labour and Welfare, Japan. *Industrial Safety and Health Act, Article 66.* Tokyo, Japan: Ministry of Health, Labour and Welfare, Japan; 1972.
25. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clin Chem*. 1972;18:499–502.
26. Ministry of Health, Labour and Welfare, Japan. *Estimates of National Medical Care Expenditure.* Tokyo, Japan: Ministry of Health, Labour and Welfare, Japan; 2014.
27. Shah D. Healthy worker effect phenomenon. *Indian J Occup Environ Med*. 2009;13:77–79.
28. Ministry of Health, Labour and Welfare, Japan. *National Health and Nutrition Survey.* Tokyo, Japan: Ministry of Health, Labour and Welfare, Japan; 2014.
29. Ministry of Health, Labour and Welfare, Japan. 'The guidance for helping workers return to work due to mental health problems' (in Japanese). Tokyo, Japan: Ministry of Health, Labour and Welfare, Japan; 2004. Available at: http://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0000186066.html. Accessed January 12, 2018.
30. Nagata T, Mori K, Aratake Y, et al. Development of cost estimation tools for total occupational safety and health activities and occupational health services: cost estimation from a corporate perspective. *J Occup Health*. 2014;56:215–224.
31. Nagata T, Mori K, Aratake Y, et al. Establishment of reference costs for occupational health services and implementation of cost management in Japanese manufacturing companies. *J Occup Health*. 2016;58:323–332.
32. Loeppke R. The value of health and the power of prevention. *Int J Workplace Health Manag*. 2008;1:95–108.

