THE ASSOCIATION OF
PERIPHERAL ARTERY DISEASE
WITH WORK-RELATED OUTCOMES

CWHP
THE CENTER FOR WORKFORCE
HEALTH AND PERFORMANCE

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Background

PERIPHERAL ARTERIAL DISEASE

(PAD) affects approximately 8.5 million Americans ≥40 years and prevalence increases with increasing age.[1] The most common symptom of PAD is leg pain associated with walking or other mild activities and is relieved with rest.[2] This initial stage of pain symptoms is referred to as intermittent claudication (IC) and is the result of insufficient blood supply to the extremities due to fatty plaque build-up in the vessels.[3] Symptoms of pain with walking can also occur in the buttock, hip, thigh, or calf.[4,5] Lower-extremity functioning can decrease over time and can reach a point where individuals may feel pain even at rest.[6,7] Given the disease mechanics and symptomatology, it makes sense that patients who suffer from IC have a low health-related quality of life (HRQoL) and functional impairment of their daily activities.[8,9,10]

There is a concern for patients presenting for medical attention with symptoms of IC considering the limitations that may be placed on their work and lifestyle.[11,12] Body pain and a reduction in physical functioning strongly contribute to a reduction in HRQoL in patients with PAD and the burden of this disease has been well-documented.[13,14]

There is very little published research, however, on the impact of PAD on work-related activities despite there being many patients with PAD who still work. Of the few assessments, one small study of patients diagnosed with stage II PAD, physically active at the time of disease manifestation, reported that arterial disease affected their professional activity: 45.4% (n=45); changed their activity: 28.9% (n=13); required partial suspension of their activity 26.7% (n=12); or all professional activities had ceased: 44.4% (n=20). Changes in professional activity comprised invalidity (36.2%), prolonged sick

leave (25.5%), premature retirement (14.9%), sick leave (17%), unemployment (6.4%), reduction in long-distance travel (4.3%), change of job (8.5%) or salary reduction (2.1%).[15]

Data from the 2010 European National Health and Wellness Survey (NHWS) (5EU), (N = 57,805) and the 2010 U.S. NHWS (N = 75,000) (US), both self-administered Internet surveys, showed patients with self-reported PAD had greater overall work impairment when compared with individuals who did not report having PAD (5EU: 38.27% vs. 27.48%; US: 23.89% vs. 14.26%) (both $p<0.05$). Among the HRQoL questionnaires administered in this analysis was an assessment of work productivity. This questionnaire covered four metrics: absenteeism, presenteeism, overall work productivity loss and activity impairment. Subjects who worked while diagnosed with PAD reported significantly greater levels of interruption of work activities in all the above listed domains compared with those without PAD (all categories $p<0.05$) in both the US and Europe.[16] Outside of these studies, very little is known about the effect of PAD on rates of work productivity loss.

Peripheral Arterial Disease symptoms are expected to affect the patient's ability to function at a high capacity in the work environment. Muscle cramps, pain and movement difficulty may affect performance on the job and a pose increased safety risks in certain occupations. Attendance may also suffer as individuals use sick leave while their symptoms resolve or for provider visits to access treatment. If a major event such as stroke or heart attack does occur, we can expect periods of work disability in which the individual recuperates before being able to return to work. In all cases, whether job performance declines, lower attendance or periods of work disability, these outcomes represent the employee's lowered function in the workplace and, accordingly, are associated with additional costs above and beyond the cost of treatment (or lack thereof) to the employer.

Study Approach

THIS STUDY WILL DESCRIBE
the association of PAD severity with work-related outcomes including short-term work disability incidence and duration. If the incidence and/or duration of short-term work disability can be lessened, we would expect costs related to work disruption and wage replacement to also decrease. These broader outcomes have benefits for both employers (lower business costs) and employees (lower lost wages).

The study aims to describe the relationship between work-related outcomes among the following two groups: 1) Mild cases — People with a PAD diagnosis only but no PAD procedures/treatment, 2) Moderate/severe cases — People with a PAD diagnosis and PAD procedures/treatment. Mild and moderate/severe cases are defined as outlined in Figure 1.[17,18,19,20]

FIGURE 1: DIAGNOSTIC, DRG AND PROCEDURE CODES RELATED TO MILD AND MODERATE/SEVERE PAD

"MILD PAD" DEFINED BY ANY OF FOLLOWING ICD-9 CM FIELDS:	
ICD-9CM CODES	**DESCRIPTION**
440.2X	Atherosclerosis of native arteries of the extremities
440.4	Chronic total occlusion of the artery of the extremities
440.3X	Atherosclerosis of bypass graft of the extremities
440.8	Atherosclerosis of other specified arteries (NOT)
440.9	Generalized and unspecified atherosclerosis (NOT)
443.1	Thromboangiitis obliterans
443.9	Other unspecified peripheral artery disease
785.4	Gangrene
249.70, 249.71, 250.70, 250.71, 250.72, 250.73	Diabetes with peripheral circulatory disorders
729.5*	Pain in limb
707.1, 707.10, 707.13, 707.14, 707.15, 707.19, 707.9*	Ulcer of lower limb
440.22,440.23,440.24	Atherosclerosis (with rest pain, gangrene, or ulceration)

*accompanied by 440.20, 440.21, 440.22, 440.23, 440.24

Continues next page

FIGURE 1, CONTINUED

MODERATE/SEVERE PAD DEFINED BY ANY OF ABOVE DIAGNOSTIC CODES PLUS ANY OF FOLLOWING DRG OR PROCEDURE CODES:	
DRG CODES	**DESCRIPTION**
299	PAD
300	PAD
301	PAD
PROCEDURE CODES ICD-9CM	**DESCRIPTION**
38.08	Incision of lower limb arteries
38.18	Endarectomy of lower limb arteries
38.38	Resection of lower limb arteries with anastomosis
38.48	Resection of lower limb arteries with replacement
39.29	Other peripheral vascular shunt or bypass
39.56	Repair of blood vessel with tissue patch graft
39.57	Repair of blood vessel with synthetic patch graft
39.58	Repair of blood vessel with unspecified type of patch graft
39.50	Angioplasty of other noncoronary vessel(s)
39.90	Insert of non-drug-eluting peripheral vessel stent(s)
84.3X	Revision of amputation stump
84.1X	Amputation of Lower Limb
84.91	Amputation not otherwise specified

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FIGURE 1, CONTINUED

PROCEDURE CODES CPT-4	DESCRIPTION
27889	Ankle disarticulation
27886	Amputation, leg, through tibia and fibula; re-amputation
27880	Amputation, leg, through tibia and fibula;
27882	Amputation, leg, through tibia and fibula; open, circular (guillotine)
28820	Amputation, toe; metatarsophalangeal joint
28825	Amputation, toe; interphalangeal joint
28810	Amputation, metatarsal, with toe, single
27598	Disarticulation at knee
27596	Amputation, thigh, through femur, any level; re-amputation
35686	Creation of distal arteriovenous fistula during lower extremity bypass surgery (non-hemodialysis) (List separately in addition to code for primary procedure)
35565	Bypass graft, with vein; iliofemoral
35539	Bypass graft, with vein; aortofemoral
35540	Bypass graft, with vein; aortobifemoral
35537	Bypass graft, with vein; aortoiliac
35558	Bypass graft, with vein; femoral-femoral
35556	Bypass graft, with vein; femoral-popliteal

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FIGURE 1, CONTINUED

35516	Bypass graft, with vein; subclavian-axillary
35508	Bypass graft, with vein; carotid-vertebral
35521	Bypass graft, with vein; axillary-femoral
37220, 37221, 37222, 37223, 37224, 37226, 37228, 37229, 37230, 37231, 37232, 37233, 37234, 37235	Revascularization, endovascular, open or percutaneous, iliac artery, unilateral, initial vessel; with transluminal angioplasty or stent placement.
93668	PAD rehabilitation services
78445	Non-Cardiac Imaging

Data and Sample Selection

DATA FOR THE STUDY COME FROM a custom database from Truven Health Analytics, an IBM company (Truven), including their commercial claims (medical and pharmacy claims) and health and productivity management data. These data include all employers between 2008 and 2012 that provided Truven any health and productivity management data. In addition, benefit eligibility files are available to establish both the incidence of PAD in these employee populations, the prevalence of service system use and the incidence of work disability.

Among those eligible for both medical benefits and short-term work disability benefits during 2008 to 2012, two study groups were identified as described below.

1) Mild PAD: This group has an ICD-9CM diagnostic code for PAD and PAD-related conditions occurring at any time between 2008 and 2012 as outlined in Figure 1 in the online appendix but no evidence of PAD-specific treatments.

2) Moderate/Severe PAD: This group has a PAD diagnosis as outlined above, but also has DRG, procedure or CPT-4 codes indicating treatment such as revascularization, amputation or other procedures associated with moderate to severe PAD occurring at any time between 2008 and 2012 as outlined in Figure 1 in the online appendix.

Individuals with less than one year of medical history prior to the index event (a PAD diagnosis) were excluded from the study. Among 30,987 individuals identified with a PAD diagnosis between 2008 and 2012, 1,589 were categorized as moderate/severe and 29,398 as mild PAD cases.

Measurement and Methods

THE PRIMARY OUTCOME OF INTEREST was short-term work disability (STD). Two sources of data are used to establish STD experience: 1) the benefits eligibility file establishes whether the individual was eligible to receive benefits in any given month between calendar years 2008 and 2012 and 2) the STD claims file establishes whether a claim was filed (incidence established by date of claim) and the length of the claim in days (date claim closed). We tracked incidence of disability and duration for each disability episode for each of the years 2009-2012 subsequent to the index year 2008. STD incidence is

a 1/0 dichotomous variable where "1" indicates that an individual filed an STD for any cause during the referenced time frame and "0" indicates that an STD was not filed. STD duration represents the number of days that an individual is on short-term work disability in the referenced year.

Models of STD incidence rely on the full sample and utilize logistic regression modeling to predict the incidence of the dichotomous "1/0" STD incidence variable. Models of STD duration rely on sub-samples of those individuals who have experienced an STD incident and utilize multivariate regression analysis to model the continuous STD duration variable measured in days. A final set of analyses models the cumulative sum of STD days between the referenced data years.

The primary explanatory variable of interest is whether an individual has mild or moderate/severe PAD. Statistical control is used in multivariate regression models to account for the effects of age, sex and comorbidities on short-term work disability. Three age groups were constructed representing ages 18 to 34, ages 35 to 49 and ages 50 and over. Comorbidity, ranging between 1 and 16, was measured as a count of major diagnostic categories associated with each individual's medical utilization over the study period.

Descriptive Results

TABLE 1, ON THE FOLLOWING PAGE DISPLAYS OVERALL DESCRIPTIVE STATISTICS AND significant differences between the mild PAD group compared with the moderate/severe PAD group.

TABLE 1: OVERALL DESCRIPTIVES BY MILD AND MODERATE/SEVERE PAD GROUP

	OVERALL (N=30,987)				MILD PAD (N=29,398)				MODERATE/SEVERE PAD (N=1,589)			
VARIABLE	MEAN	SD	MIN	MAX	MEAN	SD	MIN	MAX	MEAN	SD	MIN	MAX
moderatePAD5yr	0.05	0.22	0	1								
age18to34*	0.16	0.37	0	1	0.16	0.37	0	1	0.14	0.35	0	1
age35to49	0.52	0.50	0	1	0.52	0.50	0	1	0.52	0.50	0	1
age50plus	0.31	0.46	0	1	0.31	0.46	0	1	0.33	0.47	0	1
malerecode**	0.57	0.50	0	1	0.57	0.50	0	1	0.66	0.48	0	1
maxMDC0812**	6.52	2.38	1	16	6.48	2.37	1	16	7.25	2.49	1	16
ANYSTD2009**	0.13	0.33	0	1	0.12	0.33	0	1	0.18	0.39	0	1
ANYSTD2010**	0.13	0.34	0	1	0.13	0.34	0	1	0.20	0.40	0	1
ANYSTD2011**	0.14	0.34	0	1	0.14	0.34	0	1	0.19	0.39	0	1
ANYSTD2012**	0.14	0.35	0	1	0.14	0.35	0	1	0.19	0.40	0	1
DAY-SABSstd2009**					6.94	31.51	0	919	11.89	37.88	0	398
DAY-SABSstd2010**					7.73	33.78	0	913	13.48	51.12	0	989
DAY-SABSstd2011**					8.58	36.42	0	933	13.85	46.93	0	426
DAY-SABSstd2012**					8.52	33.64	0	767	13.41	44.52	0	677

* mean difference significant at p<= .05

** mean difference significant at p<= .0001

Among the three age groups there were fewer individuals ages 18 to 34, more males and a higher degree of comorbidity in the moderate/severe PAD group compared with the mild PAD group. Across all STD incidence and duration measures there were significant differences between the mild PAD group compared with the moderate/severe PAD group. Incidence of STD ranges between 12% and 14% year-by-year for the mild PAD group compared with 18% to 20% for the moderate/severe group. STD durations ranged between 7 and 9 days year-by-year for the mild PAD group compared with 12 to 14 days for the moderate/severe PAD group.

Table 2 displays overall descriptive statistics across the STD outcome by year.

TABLE 2: OVERALL DESCRIPTIVES BY STD EXPERIENCE

	OVERALL (N=30,987)			
VARIABLE	MEAN	SD	MIN	MAX
moderatePAD5yr	0.05	0.22	0	1
age18to34	0.16	0.37	0	1
age35to49	0.52	0.50	0	1
age50plus	0.31	0.46	0	1
malerecode	0.57	0.50	0	1
maxMDC0812	6.52	2.38	1	16
ANYSTD2009	0.13	0.33	0	1
ANYSTD2010	0.13	0.34	0	1
ANYSTD2011	0.14	0.34	0	1
ANYSTD2012	0.14	0.35	0	1
DAYSABSstd2009				
DAYSABSstd2010				
DAYSABSstd2011				
DAYSABSstd2012				

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TABLE 2: YEARS 2009 AND 2010

	WITH STD IN 2009 (N=3,921)				WITH STD IN 2010 (N=4,143)			
VARIABLE	MEAN	SD	MIN	MAX	MEAN	SD	MIN	MAX
moderatePAD5yr	0.07	0.26	0	1	0.08	0.26	0	1
age18to34	0.17	0.38	0	1	0.20	0.40	0	1
age35to49	0.52	0.50	0	1	0.51	0.50	0	1
age50plus	0.31	0.46	0	1	0.29	0.45	0	1
malerecode	0.45	0.50	0	1	0.45	0.50	0	1
maxMDC0812	7.83	2.42	1	16	7.84	2.40	2	16
ANYSTD2009	1.00	0.00	1	1	0.33	0.47	0	1
ANYSTD2010	0.35	0.48	0	1	1.00	0.00	1	1
ANYSTD2011	0.35	0.48	0	1	0.36	0.48	0	1
ANYSTD2012	0.34	0.47	0	1	0.35	0.48	0	1
DAYSABSstd2009	56.82	72.23	1	919				
DAYSABSstd2010					60.01	77.40	1	989
DAYSABSstd2011								
DAYSABSstd2012								

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TABLE 2: YEARS 2011 AND 2012

	WITH STD IN 2011 (N=4,270)				WITH STD IN 2012 (N=4,423)			
VARIABLE	MEAN	SD	MIN	MAX	MEAN	SD	MIN	MAX
moderatePAD5yr	0.07	0.25	0	1	0.07	0.25	0	1
age18to34	0.18	0.39	0	1	0.18	0.38	0	1
age35to49	0.50	0.50	0	1	0.50	0.50	0	1
age50plus	0.31	0.46	0	1	0.32	0.47	0	1
malerecode	0.46	0.50	0	1	0.45	0.50	0	1
maxMDC0812	7.84	2.40	2	16	7.84	2.38	1	16
ANYSTD2009	0.32	0.47	0	1	0.30	0.46	0	1
ANYSTD2010	0.35	0.48	0	1	0.33	0.47	0	1
ANYSTD2011	1.00	0.00	1	1	0.33	0.47	0	1
ANYSTD2012	0.35	0.48	0	1	1.00	0.00	1	1
DAYSABSstd2009								
DAYSABSstd2010								
DAYSABSstd2011	64.20	80.04	1	933				
DAYSABSstd2012					61.48	70.73	1	767

Out of 30,987 individuals diagnosed with PAD during the study period, 3,921 experienced an STD incidence in 2009, 4,143 in 2010, 4,270 in 2011 and 4,423 in 2012. This represents 13% and 14% of individuals filing for an STD claim between 2009 and 2012. Those STD episodes lasted between 57 and 64 days in any given year. On average, 16% of the sample were ages 18 to 34 years, 52% ages 35 to 49 years and 31% age 50 and above. Males represent 57% of the sample.

STD Incidence Models

TABLE 3: MODELS OF SHORT-TERM DISABILITY INCIDENCE YEAR-BY-YEAR 2009 WITHOUT COMORBIDITY

MODEL OF SHORT-TERM DISABILITY INCIDENCE — WITHOUT COMORBIDITY PROBABILITY MODELED IS ANYSTD2009=1. (N=30987)						
ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES						
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept	1.000	-1.622	0.044	1337.615	<.0001	0.198
moderatePAD5yr	1.000	0.515	0.068	57.531	<.0001	1.674
age35to49	1.000	-0.049	0.048	1.034	0.309	0.952
age50plus	1.000	-0.055	0.052	1.131	0.288	0.946
malerecode	1.000	-0.576	0.035	278.236	<.0001	0.562
ODDS RATIO ESTIMATES						
Effect	Point Estimate	95% Wald Confidence Limits				
moderatePAD5yr	1.674	1.465	1.913			
age35to49	0.952	0.867	1.046			
age50plus	0.946	0.855	1.048			
malerecode	0.562	0.525	0.602			

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TABLE 3: MODELS OF SHORT-TERM DISABILITY INCIDENCE YEAR-BY-YEAR 2009 WITH COMORBIDITY

MODEL OF SHORT-TERM DISABILITY INCIDENCE — WITH COMORBIDITY PROBABILITY MODELED IS ANYSTD2009=1. (N=30987)

ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept	1.000	-3.393	0.072	2198.495	<.0001	0.034
moderatePAD5yr	1.000	0.311	0.070	19.599	<.0001	1.364
age35to49	1.000	-0.181	0.050	13.376	0.000	0.834
age50plus	1.000	-0.338	0.054	39.339	<.0001	0.713
malerecode	1.000	-0.257	0.036	49.893	<.0001	0.773
maxMDC0812	1.000	0.252	0.008	1093.908	<.0001	1.286

ODDS RATIO ESTIMATES

Effect	Point Estimate	95% Wald Confidence Limits				
moderatePAD5yr	1.364	1.189	1.565			
age35to49	0.834	0.757	0.919			
age50plus	0.713	0.641	0.792			
malerecode	0.773	0.720	0.830			
maxMDC0812	1.286	1.267	1.305			

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TABLE 3: MODELS OF SHORT-TERM DISABILITY INCIDENCE YEAR-BY-YEAR 2010 WITHOUT COMORBIDITY

MODEL OF SHORT-TERM DISABILITY INCIDENCE — WITHOUT COMORBIDITY PROBABILITY MODELED IS ANYSTD2010=1. (N=30987)

ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept	1.000	-1.390	0.041	1131.156	<.0001	0.249
moderatePAD5yr	1.000	0.552	0.066	69.551	<.0001	1.736
age35to49	1.000	-0.226	0.045	25.122	<.0001	0.798
age50plus	1.000	-0.299	0.050	36.513	<.0001	0.741
malerecode	1.000	-0.586	0.034	300.725	<.0001	0.557

ODDS RATIO ESTIMATES

Effect	Point Estimate	95% Wald Confidence Limits				
moderatePAD5yr	1.736	1.525	1.977			
age35to49	0.798	0.730	0.871			
age50plus	0.741	0.673	0.817			
malerecode	0.557	0.521	0.595			

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TABLE 3: MODELS OF SHORT-TERM DISABILITY INCIDENCE YEAR-BY-YEAR 2010 WITH COMORBIDITY

MODEL OF SHORT-TERM DISABILITY INCIDENCE — WITH COMORBIDITY
PROBABILITY MODELED IS ANYSTD2010=1. (N=30987)

ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept	1.000	-3.223	0.070	2148.229	<.0001	0.040
moderatePAD5yr	1.000	0.343	0.069	25.080	<.0001	1.409
age35to49	1.000	-0.375	0.047	64.432	<.0001	0.687
age50plus	1.000	-0.608	0.052	137.789	<.0001	0.544
malerecode	1.000	-0.251	0.036	49.490	<.0001	0.778
maxMDC0812	1.000	0.261	0.008	1214.900	<.0001	1.299

ODDS RATIO ESTIMATES

Effect	Point Estimate	95% Wald Confidence Limits				
moderatePAD5yr	1.409	1.232	1.612			
age35to49	0.687	0.627	0.753			
age50plus	0.544	0.492	0.602			
malerecode	0.778	0.725	0.834			
maxMDC0812	1.299	1.280	1.318			

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TABLE 3: MODELS OF SHORT-TERM DISABILITY INCIDENCE YEAR-BY-YEAR 2011 WITHOUT COMORBIDITY

MODEL OF SHORT-TERM DISABILITY INCIDENCE — WITHOUT COMORBIDITY PROBABILITY MODELED IS ANYSTD2011=1. (N=30987)						
ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES						
Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept	1.000	-1.452	0.042	1204.596	<.0001	0.234
moderatePAD5yr	1.000	0.447	0.067	44.534	<.0001	1.563
age35to49	1.000	-0.171	0.046	14.143	0.000	0.843
age50plus	1.000	-0.129	0.049	6.943	0.008	0.879
malerecode	1.000	-0.534	0.033	257.968	<.0001	0.586
ODDS RATIO ESTIMATES						
Effect	Point Estimate	95% Wald Confidence Limits				
moderatePAD5yr	1.563	1.371	1.783			
age35to49	0.843	0.771	0.921			
age50plus	0.879	0.798	0.967			
malerecode	0.586	0.549	0.626			

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TABLE 3: MODELS OF SHORT-TERM DISABILITY INCIDENCE YEAR-BY-YEAR 2011 WITH COMORBIDITY

MODEL OF SHORT-TERM DISABILITY INCIDENCE — WITH COMORBIDITY
PROBABILITY MODELED IS ANYSTD2011=1. (N=30987)

ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept	1.000	-3.301	0.070	2259.175	<.0001	0.037
moderatePAD5yr	1.000	0.230	0.069	11.013	0.001	1.259
age35to49	1.000	-0.319	0.047	45.839	<.0001	0.727
age50plus	1.000	-0.435	0.051	71.875	<.0001	0.647
malerecode	1.000	-0.200	0.035	32.135	<.0001	0.819
maxMDC0812	1.000	0.264	0.007	1265.106	<.0001	1.302

ODDS RATIO ESTIMATES

Effect	Point Estimate	95% Wald Confidence Limits				
moderatePAD5yr	1.259	1.099	1.442			
age35to49	0.727	0.663	0.797			
age50plus	0.647	0.585	0.716			
malerecode	0.819	0.764	0.878			
maxMDC0812	1.302	1.283	1.321			

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TABLE 3: MODELS OF SHORT-TERM DISABILITY INCIDENCE YEAR-BY-YEAR 2012 WITHOUT COMORBIDITY

MODEL OF SHORT-TERM DISABILITY INCIDENCE — WITHOUT COMORBIDITY PROBABILITY MODELED IS ANYSTD2012=1. (N=30987)

ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept	1.000	-1.450	0.042	1200.260	<.0001	0.235
moderatePAD5yr	1.000	0.453	0.066	46.900	<.0001	1.572
age35to49	1.000	-0.120	0.046	6.982	0.008	0.887
age50plus	1.000	-0.043	0.049	0.770	0.380	0.958
malerecode	1.000	-0.564	0.033	295.570	<.0001	0.569

ODDS RATIO ESTIMATES

Effect	Point Estimate	95% Wald Confidence Limits				
moderatePAD5yr	1.572	1.381	1.790			
age35to49	0.887	0.811	0.969			
age50plus	0.958	0.871	1.054			
malerecode	0.569	0.534	0.607			

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TABLE 3: MODELS OF SHORT-TERM DISABILITY INCIDENCE YEAR-BY-YEAR 2012 WITH COMORBIDITY

MODEL OF SHORT-TERM DISABILITY INCIDENCE — WITH COMORBIDITY
PROBABILITY MODELED IS ANYSTD2012=1. (N=30987)

ANALYSIS OF MAXIMUM LIKELIHOOD ESTIMATES

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq	Exp(Est)
Intercept	1.000	-3.288	0.069	2276.466	<.0001	0.037
moderatePAD5yr	1.000	0.238	0.069	12.111	0.001	1.269
age35to49	1.000	-0.264	0.047	31.352	<.0001	0.768
age50plus	1.000	-0.341	0.051	44.783	<.0001	0.711
malerecode	1.000	-0.236	0.035	46.043	<.0001	0.790
maxMDC0812	1.000	0.262	0.007	1282.064	<.0001	1.300

ODDS RATIO ESTIMATES

Effect	Point Estimate	95% Wald Confidence Limits				
moderatePAD5yr	1.269	1.110	1.451			
age35to49	0.768	0.701	0.843			
age50plus	0.711	0.644	0.786			
malerecode	0.790	0.738	0.846			
maxMDC0812	1.300	1.281	1.319			

The first set of four models exclude the comorbidity control, followed by a second set including the co-morbidity control. In the first set of models the odds of filing a disability claim for the moderate/severe PAD group compared with the mild group ranges between 1.6 and 1.7 across the four years (p<.0001). In the second set controlling for co-morbidity the odds slightly diminish to between 1.3 and 1.4 greater odds for the moderate group filing a claim compared with the mild group with the odds remaining statistically significant (p<=.001).

STD Duration Models

TABLE 4: MODELS OF SHORT-TERM DISABILITY DURATION YEAR-BY-YEAR 2009

MODEL OF SHORT-TERM DISABILITY DURATION — WITHOUT COMORBIDITY DEPENDENT VARIABLE: DAYSABSSTD2009. (N=3,921)				
Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	48.954	2.888	16.950	<.0001
moderatePAD5yr	8.572	4.423	1.940	0.053
age35to49	9.825	3.222	3.050	0.002
age50plus	0.874	3.503	0.250	0.803
malerecode	4.154	2.347	1.770	0.077

MODEL OF SHORT-TERM DISABILITY DURATION — WITH COMORBIDITY DEPENDENT VARIABLE: DAYSABSSTD2009. (N=3,921)				
Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	27.755	4.849	5.720	<.0001
moderatePAD5yr	6.385	4.426	1.440	0.149
age35to49	8.579	3.219	2.670	0.008
age50plus	-1.756	3.524	-0.500	0.618
malerecode	7.852	2.436	3.220	0.001
maxMDC0812	2.702	0.498	5.430	<.0001

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TABLE 4: MODELS OF SHORT-TERM DISABILITY DURATION YEAR-BY-YEAR 2010

MODEL OF SHORT-TERM DISABILITY DURATION — WITHOUT COMORBIDITY DEPENDENT VARIABLE: DAYSABSSTD2010. (N=4,143)				
Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	54.181	2.831	19.140	<.0001
moderatePAD5yr	10.019	4.577	2.190	0.029
age35to49	9.685	3.203	3.020	0.003
age50plus	1.744	3.539	0.490	0.622
malerecode	-0.912	2.443	-0.370	0.709

MODEL OF SHORT-TERM DISABILITY DURATION — WITH COMORBIDITY DEPENDENT VARIABLE: DAYSABSSTD2010. (N=4,143)				
Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	24.672	4.920	5.010	<.0001
moderatePAD5yr	7.741	4.559	1.700	0.090
age35to49	7.784	3.193	2.440	0.015
age50plus	-2.001	3.554	-0.560	0.573
malerecode	3.797	2.512	1.510	0.131
maxMDC0812	3.782	0.517	7.310	<.0001

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TABLE 4: MODELS OF SHORT-TERM DISABILITY DURATION YEAR-BY-YEAR 2011

MODEL OF SHORT-TERM DISABILITY DURATION — WITHOUT COMORBIDITY DEPENDENT VARIABLE: DAYSABSSTD2011. (N=4,270)				
Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	61.331	2.985	20.550	<.0001
moderatePAD5yr	9.201	4.812	1.910	0.056
age35to49	1.467	3.348	0.440	0.661
age50plus	-6.181	3.626	-1.700	0.088
malerecode	7.479	2.481	3.010	0.003

MODEL OF SHORT-TERM DISABILITY DURATION — WITH COMORBIDITY DEPENDENT VARIABLE: DAYSABSSTD2011. (N=4,270)				
Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	21.775	5.044	4.320	<.0001
moderatePAD5yr	5.181	4.778	1.080	0.278
age35to49	-1.172	3.323	-0.350	0.724
age50plus	-10.167	3.611	-2.820	0.005
malerecode	13.558	2.534	5.350	<.0001
maxMDC0812	5.053	0.522	9.670	<.0001

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TABLE 4: MODELS OF SHORT-TERM DISABILITY DURATION YEAR-BY-YEAR 2012

MODEL OF SHORT-TERM DISABILITY DURATION — WITHOUT COMORBIDITY DEPENDENT VARIABLE: DAYSABSSTD2012. (N=3,921)				
Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	57.287	2.641	21.690	<.0001
moderatePAD5yr	7.472	4.184	1.790	0.074
age35to49	2.354	2.960	0.800	0.427
age50plus	3.378	3.183	1.060	0.289
malerecode	3.096	2.160	1.430	0.152
MODEL OF SHORT-TERM DISABILITY DURATION — WITH COMORBIDITY DEPENDENT VARIABLE: DAYSABSSTD2012. (N=3,921)				
Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	19.540	4.437	4.400	<.0001
moderatePAD5yr	3.759	4.148	0.910	0.365
age35to49	0.444	2.930	0.150	0.879
age50plus	-0.573	3.167	-0.180	0.856
malerecode	8.567	2.197	3.900	<.0001
maxMDC0812	4.815	0.458	10.520	<.0001

For the models without comorbidity, individuals with moderate/severe PAD experience approximately 7.5 to 10 additional days of disability in any given year compared with those with mild PAD (p<=.03 to marginal significance p<=.07). However, once comorbidity is added, the effect of moderate/severe PAD diminishes and is no longer statistically significant. As comorbidity increases by 1 unit (i.e., each additional major diagnostic group represented by medical utilization) individuals experience 3 and 5 additional days of disability (p<.0001).

Cumulative Bias Tests

As a test of potential sample bias over time, three samples were tested representing cumulative disability days for four years (2009 to 2012), three years (2010 to 2012) and two years (2011 to 2012) as represented in Table 5.

TABLE 5: MODELS OF CUMULATIVE SHORT-TERM DISABILITY DURATION FOUR YEARS (2009 TO 2012)

MODELS OF CUMULATIVE SHORT-TERM DISABILITY DURATION
DEPENDENT VARIABLE: DAYSABSSTD2012. (N=3,921)

	N	Mean	Std Dev	Minimum	Maximum
Overall	3921.000	134.448	165.375	1.000	1518.000
Mild PAD	3632.000	132.857	165.377	1.000	1518.000
Moderate/severe PAD	289.000	154.452	164.322	4.000	863.000

WITHOUT COMORBIDITY

Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	135.1821	6.6074	20.4600	<.0001
moderatePAD5yr	22.9648	10.1211	2.2700	0.0233
age35to49	9.3317	7.3729	1.2700	0.2057
age50plus	-19.6079	8.0159	-2.4500	0.0145
malerecode	-2.7053	5.3705	-0.5000	0.6145

WITH COMORBIDITY

Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	-2.2869	10.7979	-0.2100	0.8323
moderatePAD5yr	8.7835	9.8546	0.8900	0.3728
age35to49	1.2518	7.1672	0.1700	0.8614
age50plus	-36.6680	7.8469	-4.6700	<.0001
malerecode	21.2739	5.4236	3.9200	<.0001
maxMDC0812	17.5232	1.1080	15.8200	<.0001

TABLE 5: MODELS OF CUMULATIVE SHORT-TERM DISABILITY DURATION THREE YEARS (2010 TO 2012)

MODELS OF CUMULATIVE SHORT-TERM DISABILITY DURATION
DEPENDENT VARIABLE: DAYSABSSTD2012. (N=4,143)

	N	Mean	Std Dev	Minimum	Maximum
Overall	4143.000	114.754	139.233	1.000	1704.000
Mild PAD	3832.000	113.408	137.885	1.000	1704.000
Moderate/severe PAD	311.000	131.336	154.158	4.000	1070.000

WITHOUT COMORBIDITY

Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	116.3322	5.0913	22.8500	<.0001
moderatePAD5yr	19.7215	8.2307	2.4000	0.0166
age35to49	4.6944	5.7595	0.8200	0.4151
age50plus	-14.7043	6.3637	-2.3100	0.0209
malerecode	-2.7437	4.3940	-0.6200	0.5324

WITH COMORBIDITY

Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	4.0444	8.6474	0.4700	0.6400
moderatePAD5yr	11.0524	8.0120	1.3800	0.1678
age35to49	-2.5386	5.6120	-0.4500	0.6510
age50plus	-28.9568	6.2454	-4.6400	<.0001
malerecode	15.1764	4.4148	3.4400	0.0006
maxMDC0812	14.3919	0.9093	15.8300	<.0001

TABLE 5: MODELS OF CUMULATIVE SHORT-TERM DISABILITY DURATION TWO YEARS (2011 TO 2012)

MODELS OF CUMULATIVE SHORT-TERM DISABILITY DURATION
DEPENDENT VARIABLE: DAYSABSSTD2012. (N=4,270)

	N	Mean	Std Dev	Minimum	Maximum
Overall	4270.000	90.187	108.154	1.000	1431.000
Mild PAD	3972.000	89.220	107.799	1.000	1431.000
Moderate/severe PAD	298.000	103.077	112.180	1.000	552.000

WITHOUT COMORBIDITY

Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	90.3370	4.0339	22.3900	<.0001
moderatePAD5yr	12.9099	6.5030	1.9900	0.0472
age35to49	0.1500	4.5244	0.0300	0.9736
age50plus	-12.0144	4.9007	-2.4500	0.0143
malerecode	5.7527	3.3530	1.7200	0.0863

WITH COMORBIDITY

Parameter	Estimate	Standard Error	t Value	Pr > [t]
Intercept	15.9239	6.7467	2.3600	0.0183
moderatePAD5yr	5.3463	6.3913	0.8400	0.4029
age35to49	-4.8151	4.4448	-1.0800	0.2787
age50plus	-19.5125	4.8298	-4.0400	<.0001
malerecode	17.1893	3.3888	5.0700	<.0001
maxMDC0812	9.5055	0.6987	13.6000	<.0001

The overall duration model findings hold with the moderate group having 13, 20 and 23 more days of disability for each of the respective samples (2, 3 and 4 years) compared with the mild PAD group ($p<=.05$). As with the year-by-year samples, once comorbidity is controlled, the effect of the moderate/severe group is no longer significant. For each additional comorbidity, duration increases as follows: 9.5 days for the 2-year sample, 14 days for the 3-year sample and 18 days for the 4-year sample ($p<.0001$).

Limitations

STD INCIDENTS ARE FOR "ANY CAUSE", not restricted to PAD, although all individuals in this study have been diagnosed with PAD. Although we control for the count of comorbidities we are not controlling for types of comorbidities which may be associated with the incidence and duration of STD.

Discussion

EVEN ACCOUNTING FOR COMORBIDITY, HAVING MODERATE TO SEVERE PAD compared with mild PAD significantly affects the incidence of short-term work disability. If PAD cases can be managed in a way that prevents mild cases from becoming moderate/severe then employees and employers may benefit from less work disruption due to fewer cases of short-term work disability. Once an STD case begins, those with moderate to severe cases of PAD fare worse than mild cases in terms of duration in lost work days but once comorbidity is factored in the effect of the moderate/severe group disappears. Comorbidity is a critical factor to consider in both the incidence and duration of short-term work disability.[21] Further research should investigate the relationship between comorbid condition type and work disability as well as the potential need to target specific age groups given the statistically different outcomes for the 35 to 49 age group in STD duration compared with the youngest group. Since the above age 50 group often displayed no difference compared with the youngest group it suggests the middle group (aged 35 to 49) may need focused study and attention when it comes to medical treatment for PAD and potential economic effects beyond treatment costs. Other research has shown significant relationships between socioeconomic status and PAD.[22] Guideline development efforts and related research have suggested that more attention should also be focused on preventive therapies and guideline adherence across populations.[23,24,25,26,27] By adopting a patient-centered approach to prevention, treatment access and improved outcomes we should expect greater focus on functional and quality of life outcomes that matter to individuals. For those in the workforce, being able to attend work, perform well on the job and stay at work or return to work in a timely and healthy fashion should a period of work disability occur is critical for the continued physical and socioeconomic health of the individual.[28]

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