INTEGRATED BENEFITS INSTITUTE

A Deeper Freeze

Extreme Temperatures and Mental Health Disability Leaves

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Executive Summary

As the polar vortex in January illustrated, events related to climate change have tremendous capacity to disrupt business operations. For some companies, productivity losses will continue if severe weather contributes to increased disability leaves from work. Disability leaves for mental health conditions may be of special concern.

- **Certain types of mental health claims may be more common at colder temperatures**. Disability claims for acute stress reactions tend to decrease as temperatures rise from extreme lows. Claims rates for depression are highest at lower temperatures, and show a slight increase as temperatures reach higher extremes. Anxiety claims show no obvious association with temperature.

- **Some other types of conditions respond to changes in the weather**. Claims rates for cerebrovascular disease tend to fall at extreme low temperatures, while respiratory infections—which are most most prevalent at lower temperatures—exhibit some decrease at higher temperatures.

- **The findings of this analysis suggest that employers should anticipate an increase in some types of mental health disability claims in the wake of extremely low temperatures**. Employers can expedite their return to productivity by incorporating coordinated absence management policies and employee assistance programs as part of their disaster recovery strategy, and by ensuring that employee benefits facilitate access to mental health benefits.

Background

January's polar vortex brought extremely cold temperatures to much of the Northeast and Midwest of the continental United States. Many businesses that closed or saw their customers, supply chain partners, and employees stay at home due to safety considerations were impacted directly. [1] However, business losses for employers may continue to the extent that weather extremes contribute to serious health episodes requiring time away from work. This may be particularly true of mental health conditions. A recent study published in the Proceedings of the National Academy of Science (PNAS) [2] found that personal and social disruptions from extreme weather, multi-year warming, and natural disasters were associated with an increased number of days of poor mental health. While the PNAS study focused on high temperature extremes, a similar pattern may exist among low temperature extremes.

To explore the link between serious mental health episodes and both low and high temperature extremes, we look at monthly short-term disability (STD) leave incidence rates and temperature data across the U.S.

Data

Our units of analysis are U.S. states within a given calendar month (i.e. "state-months"). States include the District of Columbia (DC). The data source for average monthly temperature (see below) does not include comparable information for Hawai'i, which we exclude from final models. We observe states monthly from January 2011 through December 2017. This gives us a total of 4,200 state-month observations.

MONTHLY DISABILITY CLAIMS RATES BY STATE

The analysis was conducted using disability claims data from IBI's disability benchmarking system.[3] Each year, 15 major US disability insurers and absence management firms provide IBI with more than 6 million short-term disability (STD), long-term disability (LTD), Worker's Compensation (WC), and federal Family and Medical Leave Act (FMLA) claims from more than 65,000 employers' disability and leave management policies. Claims include information on costs and durations of disability, as well as claim, claimant, and employer characteristics such as industry, plan design, state, date of birth, sex, and the primary diagnosis (International Classification of Diseases, 9th Revision [ICD-9] or 10th Revision [ICD-10]) or reason for leave.

The data for this analysis contains claims from commercially-insured STD policies held by 11 major US disability insurance carriers and third-party administrators. These policies represent the experiences of 10,300 companies, collectively employing about 17.5 million employees each year from 2011-2017. We create state claims rates (per 100,000 employees covered for disability benefits) as the ratio of new disability leaves for claimants in a given state and month to the apportioned number of covered employees in each state. [4] Diagnoses are defined using

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[1] Gray A, US Business Counts the Cost of Polar Vortex, Financial Times, January 31, 2019. < https://www.ft.com/content/2300e428-2579-11e9-b329-c7e6ceb5ffdf>

[2] Obradovich N, Migliorini R, Paulus MP, Rahwan I. Empirical evidence of mental health risks posed by climate change. Proceedings of the National Academy of Sciences. 2018 Oct 23;115(43):10953-8.

[3] Integrated Benefits Institute, 2018, *Health and Productivity Benchmarking Database* < https://ibiweb.org/tools/benchmarking>

[4] Because we do not have information on the population of covered employees who do not take disability leave, we assume that within each employer claims rates are constant across the populations of employees who reside in different states. This may be a reasonable assumption to the extent that employees at companies tend to be concentrated within single states, and that disability leave-taking reflects both the geographic distribution of illness and the organization of work across different industries.

the International Classification of Diseases, 9th revision and 10 revisions (ICD-9 and ICD-10)[5] coded within each disability claim. We focus on claims identified by the Centers for Disease Control and Prevention (CDC) as complicated by climate change[6] and described in detail in a previous analysis. [7]

For the purposes of this analysis, we focus specifically on depression (i.e. mood disorders), anxiety disorders, and acute stress reactions. We also analyze other climate impacted conditions such as ischemic heart disease, heart failure, cerebrovascular disease, respiratory infections, upper respiratory disease, pneumonia, and asthma/COPD to assess whether claims rates are generally associated with temperature extremes.

Temperature

Average monthly temperature data come from NOAA's NCEI "Climate at a Glance" pages.[8] Climate at a Glance accommodates near real-time analysis of monthly temperature and precipitation data from across the continental U.S., excluding Hawaii and DC (DC). For DC, we substituted temperatures from Maryland.

Unemployment

Because claims rates may be sensitive to the business cycle, we include a measure of unemployment. Data on monthly state unemployment rates come from the Bureau of Labor Statistics' (BLS) Local Area Unemployment Statistics (LAUS) program.[9] Models tested using both average seasonal and non-seasonal monthly unemployment rates produced virtually identical results, as did models using log-transformed and untransformed rates. The final models include non-seasonally adjusted, untransformed rates.

Method

Given the panel time-series structure of our data—that is, multiple observations of multiple states—we estimate our models with a commonly used generalized linear model approach, treating each state as having its own fixed effects (all statistical models are estimated using the xtreg, fe command in Stata version 14). In principle, state fixed effects remove any bias introduced by unobservable differences in states that are durable over time (such as geography or long-standing cultural or socioeconomic factors). Our models also include indicator variables for each observed year and calendar month. This allows us to interpret time- and state-varying factors (such as temperature, and unemployment) as independent of the time frame in which they are observed. All models

[5] World Health Organization. *International Classification of Diseases* (*ICD*), 9th revision. http://www.who.int/classifications/icd/en >

[6] USGCRP, 2016: *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Crimmins, A., et al., Eds. U.S. Global Change Research Program, Washington, DC, 312 pp. http://dx.doi.org/10.7930/J0R49NQX

[7] Gifford B, Lin R, Disability Leaves for Diseases and Health Conditions Impacted by Climate Change, 2017, Integrated Benefits Institute. <https://www.ibiweb.org/disability-leaves-for-diseases-and-health-conditions-impacted-by-climate-ch/>

[8] NOAA National Centers for Environmental Information, Climate at a Glance: Statewide Time Series, published August 2018. <https://www.ncdc.noaa.gov/cag/> Accessed August 17, 2018.

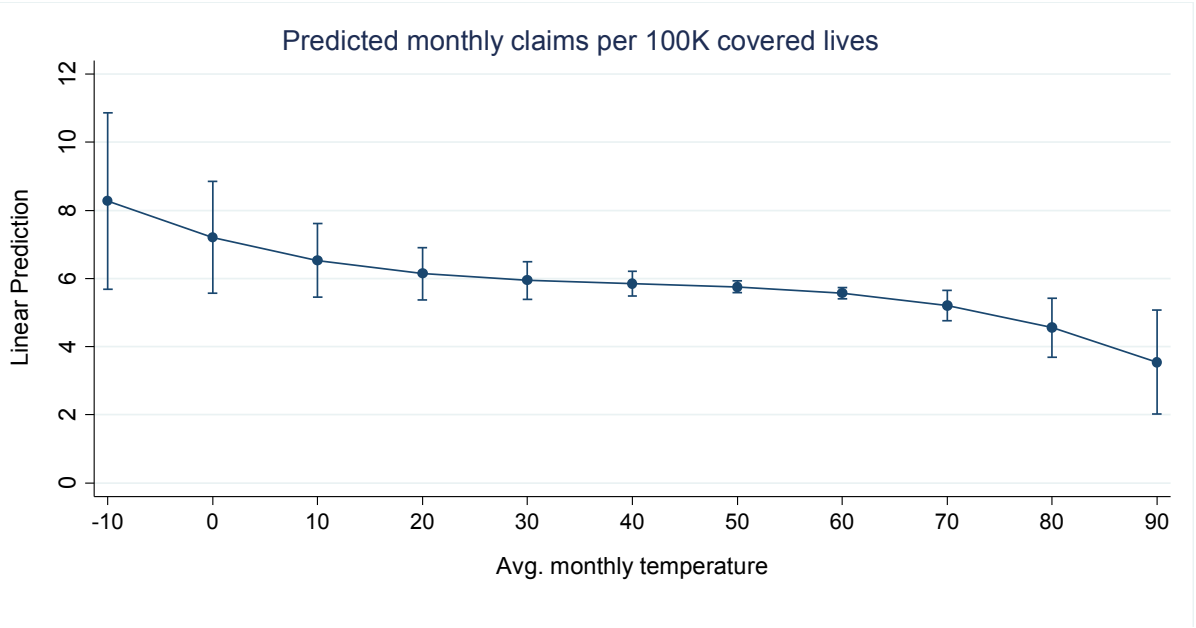
[9] US Department of Labor, Bureau of Labor Statistics. (2018). Local Area Unemployment Statistics. <https://www.bls.gov/lau/data.htm >

specify robust standard errors. Our models specify that the observed relationships between states' average monthly temperatures and disability claims for climate-impacted conditions may not be linear.[10]

Findings

Figures 1 through 3 show the estimated claims rates for different mental health diagnoses at different average monthly temperatures (Fahrenheit). The figures indicate that certain types of mental health claims may be more common at colder temperatures. Estimated claims for acute stress reactions (Figure 1) tend to decrease as temperatures increase—particularly as temperatures rise above 60° F. Estimated claims for depression (Figure 2) are highest at the lowest modeled temperature, but occur at a slightly increasing rate as temperatures rise above 40° F. However, anxiety claims (Figure 3) show no obvious association with temperatures.

Figure 1: Acute stress and adjustment reaction claims by average monthly temperature



[10] Specifically, the models include the average monthly temperature, as well as polynomial terms for the square and the cube of the temperature. The intent is to capture divergent relationships at high and low temperatures. Strong polynomial effects will be represented as curves in the chart. For example, in the depression chart below, the estimated claims rate decreases as the monthly temperature increases from an extreme of -10° F to 40° F (reflecting the contribution of the temperature squared term), and rises more gradually from 40° F to 90° F (reflecting the contribution of the temperature cubed term). Additionally, while the interpretation of the sign and statistical significance of the individual coefficients for the polynomial terms is the same as in more conventional linear models, by design the additive combination of the coefficients (that is the "full" impact of observed temperature on the estimated claims rate) can differ at different temperatures, as does our confidence in the estimates. The vertical brackets in the charts show the 95% confidence interval of the estimated claims rates at different temperatures. Estimated claims rates with confidence intervals that overlap one another at different temperatures are not considered to differ significantly from one another.

Figure 2: Depression claims by average monthly temperature

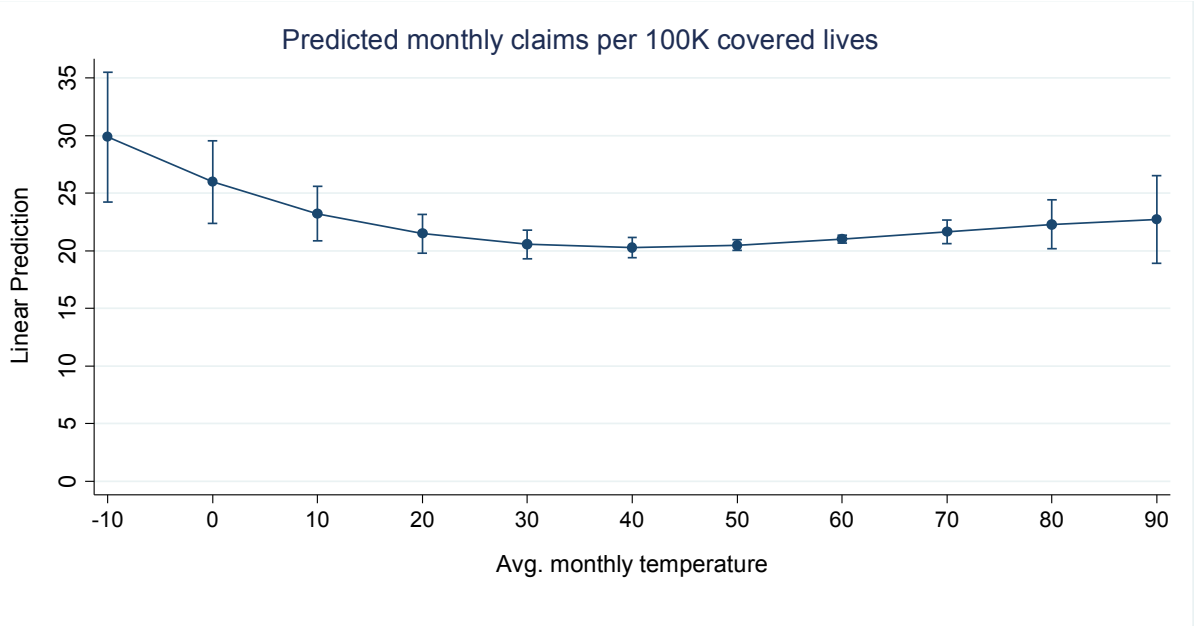
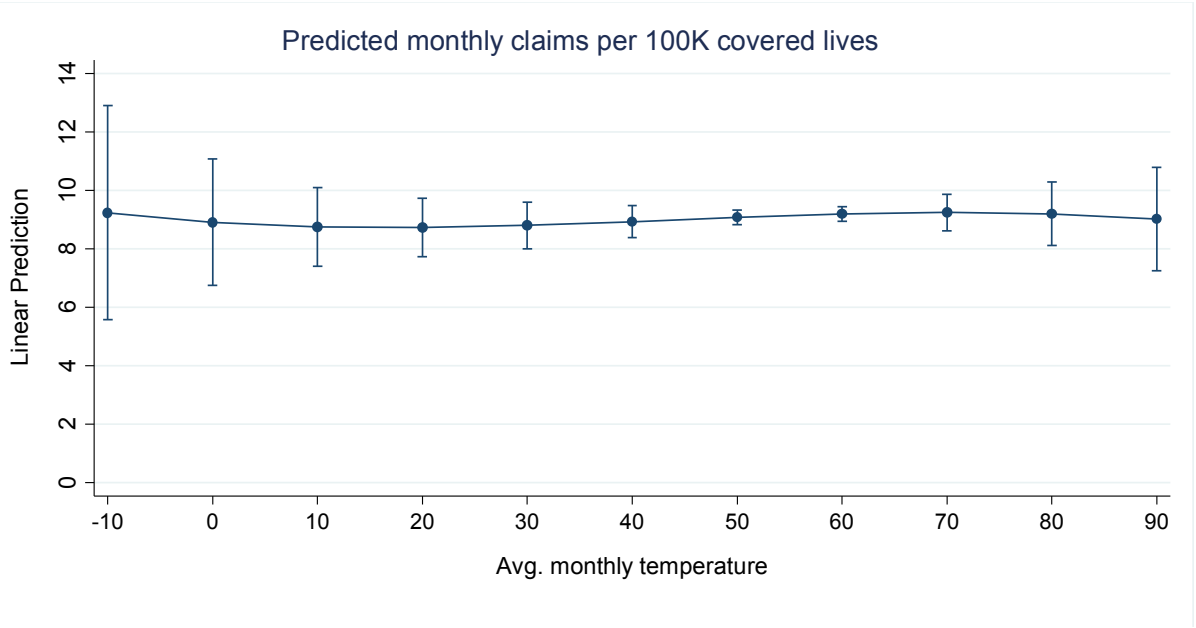


Figure 3: Anxiety claims by average monthly temperature



As a check on whether claims generally increase at low temperature extremes, we also modeled other climate-impacted conditions identified by the CDC. As shown in the figures below, claims rates for cerebrovascular disease (Figure 4) are lowest at lower temperature extremes, while respiratory infections (Figure 5) exhibit some decrease as temperatures rise. Other conditions showed no significant association with temperatures, either generally or at the extremes, and are not illustrated in this report. Table 1 in the appendix reports the regression coefficients for temperature in each model.

Figure 4: Cerebrovascular disease claims by average monthly temperature

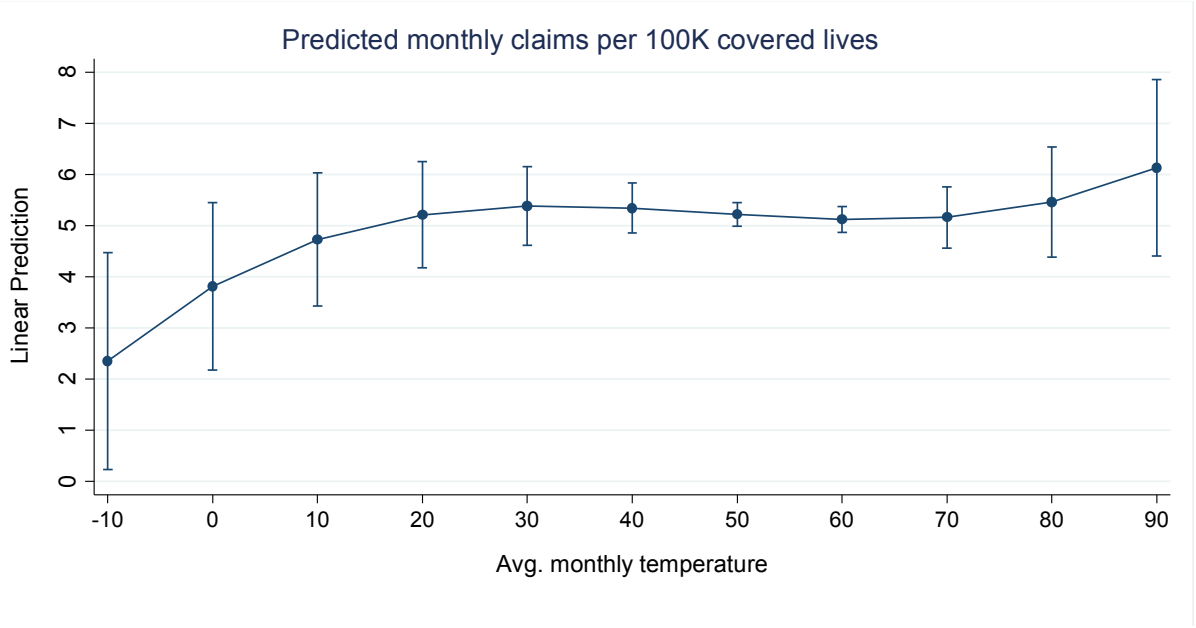
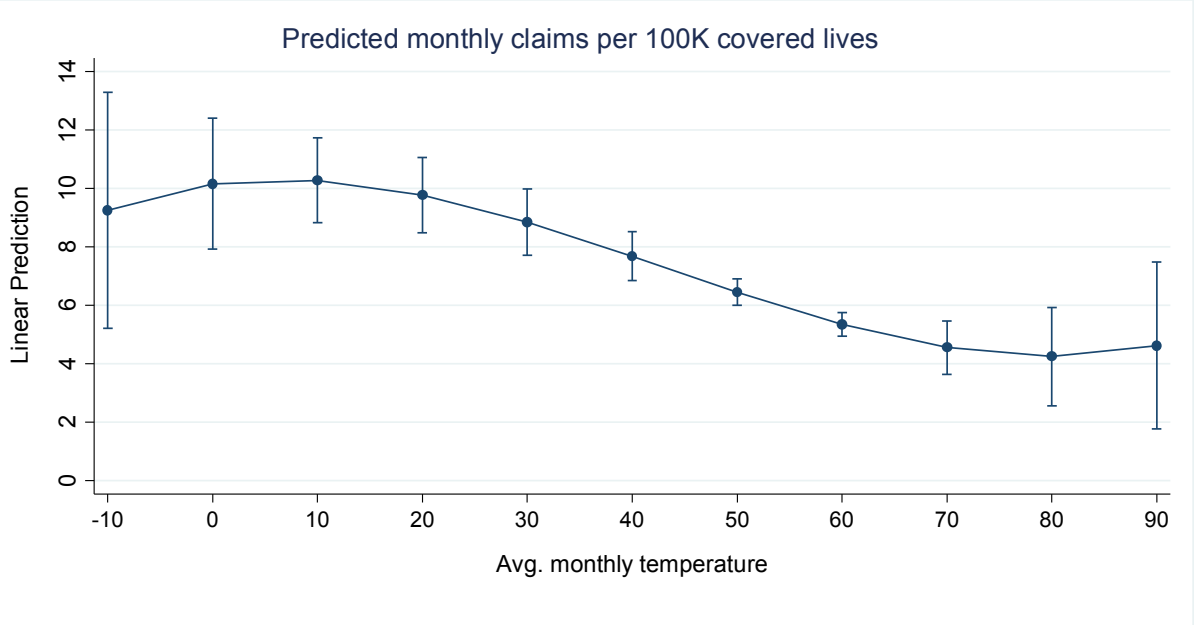


Figure 5: Respiratory infection claims by average monthly temperature



Implications for employers

The findings of this analysis suggest that employers should anticipate an increase in some types of mental health disability claims as in the wake of extremely low temperatures. Though the increased volume of mental health claims may be offset by some decrease in other diagnoses, it bears repeating that mood disorder, acute stress and adjustment reaction diagnoses are fairly common in the disability system—as many as one in 20 claims overall.[11] Mental health disability claims also account for more lost work time—and therefore cost more in wage replacements and lost productivity—than many other types of disability leaves.[12]

While low-temperature events such as the polar vortex may not constitute a disaster in the same destructive sense as tornadoes or hurricanes, the geographic and economic scale—and predictions that they will become more common as climate change progresses[13]—warrant greater attention from employers. As IBI has noted elsewhere,[14] some post-disaster productivity losses can be mitigated by including coordinated absence management policies as part of a company's disaster recovery strategy. Employee assistance programs (EAP) that incorporate benefits such as emotional counseling, financial guidance, work-life balance advice, legal support, and dedicated disaster resource channels can provide a safety net for employees suffering in the wake of major weather events.

Health care and disability carriers can also serve as key points of contact for employees' and providers' benefit and pharmacy-related questions. Absence management partners with clinical and vocational expertise may be especially valuable in assessing employees' needs and identifying solutions that can keep them engaged and at work. Temporary work from home and low-cost accommodations such as light therapy boxes are examples that may prove effective at preserving productivity.

Though recovery plans are important, employees with consistent access to comprehensive mental health resources and a supportive work environment may prove more resilient to the stresses imposed by extreme weather events. The American Psychiatric Association[15] provides guidelines to help employers ensure that their provider network is adequate to the needs of their workers, and that their benefits comply with mental health parity guidelines. Other guidance includes conducting standardized assessments of workers' mental health risks and expanding access to care through telepsychiatry or other employee assistance programs.

In addition, companies should consider their employees' mental health and well-being as part of their business continuity plan. A fast, organized response plan—communicated and rehearsed regularly—may reduce stress on customers, the business and employees in the event of a major weather event. How employers communicate with employees during and after major weather events may also mitigate factors that increase the risk for acute

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[11] Gifford and Lin, 2017 cited above in footnote 7.

[12] Integrated Benefits Institute, IBI Benchmarking Analytics Series: Short- And Long-Term Disability Outcomes For Mental and Behavioral Health Claims, 2018 < https://www.ibiweb.org/short-and-long-term-disability-outcomes-for-mental-and-behavioral-health-claims/>

[13] Associated Press, Science Says: Get Used to Polar Vortex Outbreaks, January 28, 2019. < https://www.nytimes.com/aponline/2019/01/28/science/ap-us-sci-science-says-polar-vortex.html>

[14] Gifford B, How climate change is impacting mental health— and what employers can do, August 10, 2018, Employee Benefits News < https://www.benefitnews.com/opinion/how-climate-change-is-impacting-mental-health-and-what-employers-can-do>

[15] American Psychiatric Association, Center for Workplace Mental Health, Recommendations for Improving Access to Mental Health and Substance Use Care, downloaded February 1, 2019. < http://workplacementalhealth.org/Employer-Resources/Recommendations-for-Improving-Access>

mental health episodes. Providing positive reinforcement and opportunities for employees to share stories may help them recognize that they are part of a shared experience versus feeling alone in a stressful situation. Empowering employees to make responsible, compassionate business accommodations for customers and vendors in affected areas (for example, extending deadlines for payments or contracts) may boost morale and reinforce the company's commitment to its social values.

Appendix

Table 1 reports the temperature coefficients from regression models estimating state-month disability claims rates for different climate-impacted conditions. For a general interpretation, when starting from 0 (or another minimum) as the value of X, the sign (+ or –) of the coefficient β1 indicates the direction of the curve as X increases, while the magnitude indicates its steepness. The sign of the coefficients β2 and β3 indicates whether the association changes given a value of X. For example, β1 indicates that for each 1° F increase in average monthly temperature, we expect an additional 0.117 new cerebrovascular claims per 100,000 covered lives—that is, an upwards curve. The negative sign of β2 indicates that at higher values of X, the curve will become less steep (by a factor of $-0.003 \times X^2$ until it flattens and curves downward. Finally, the positive sign of β3 indicates the curve bends upwards again at higher values of X. For this study, we discuss conditions for which at least one of the coefficients β1, β2, or β3 is statistically significant at or below the .05 level (indicated below by one asterisk).

Table 1: Select regression coefficients for fixed effects models estimating STD claims rates

	Model coefficients					
Condition Model	Avg. monthly temperature (β1)		Avg. monthly temperature^2 (β2)		Avg. monthly temperature^3 (β3)	
Depression (mood disorders)	-0.329	**	0.006	**	-2.83E-05	
	(0.094)		(0.002)		(1.44E-05)	
Anxiety disorders	-0.024		0.001		-6.60E-06	
	(0.070)		(0.002)		(1.01E-05)	
Acute stress/adjustment reaction	-0.085		0.002	*	-1.57E-05	*
	(0.044)		(0.001)		(6.82E-06)	
Ischemic heart disease	0.02		0.000		-5.43E-06	
	(0.088)		(0.002)		(1.35E-05)	
Cerebrovascular disease	0.117	***	-0.003	***	1.91E-05	***
	(0.030)		(0.001)		(4.95E-06)	
Heart failure	-0.059		0.001		-8.73E-06	
	(0.049)		(0.001)		(7.66E-06)	
Respiratory infections	0.048		-0.004		3.07E-05	*
	(0.088)		(0.002)		(1.42E-05)	
Pneumonia and influenza	0.041		-0.003		2.28E-05	
	(0.109)		(0.002)		(1.31E-05)	
Upper respiratory disease	0.003		-0.001		9.09E-06	
	(0.053)		(0.001)		(7.48E-06)	
COPD and related	0.038		-0.002		1.33E-05	
	(0.064)		(0.002)		(1.09E-05)	
Infectious and parasitic	0.007		0.000		1.88E-06	
	(0.025)		(0.001)		(4.07E-06)	

Notes: Standard errors reported in brackets. * = p <.05; ** = p <.01; *** = p <.001

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About IBI

Founded in 1995, the Integrated Benefits Institute (IBI) is a national, nonprofit research and educational organization focused on workforce health and productivity. IBI provides data, research, tools and engagement opportunities to help business leaders make sound investments in their employees' health. IBI is supported by more than 1,100 member companies representing over 20 million workers.

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