First Prize Winner

Tired, Confused, and Annoyed: Excessive Heat and Workers Compensation Insurance

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> *"The sea carried up a thick, fiery breath. It seemed to me as if the sky split open from one end to the other to rain down fire. My whole being tensed and I squeezed my hand around the revolver. The trigger gave"*
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> -Meursault can't stand the heat in The Stranger by Albert Camus

Climate change is a now problem. 2023 was the hottest year in recorded history, and 2024 looks set to break that record (1). With the certainty of even hotter years on the horizon, one of the most vulnerable businesses to the financial impacts of climate change are providers of workers compensation insurance. Workers compensation providers are primarily exposed through their liabilities because they provide insurance payouts to policyholders in the event of unexpected losses, such as an unusually long heatwave that induces heat stroke in covered employees. Given the evolving nature of this risk, it is critical that providers of workers compensation insurance develop a solid understanding of how climate change may impact their business.

In climate risk analytics, the physical impacts of climate change are typically divided into chronic (long-term weather pattern changes) and acute (short, extreme weather events). Increasing temperature can be interpreted as both: as temperature averages increase (chronic), so too do extreme heat events (acute). For clarity, let us define extreme heat events as a combination of heat and humidity. Healthy humans cannot survive extended periods above a wet bulb temperature of 95˚ F/35˚ C (3,15). Wet bulb temperature is a measure of heat in direct sunlight and considers temperature, humidity, wind speed, sun angle and cloud cover. Other combined measures of heat/humidity include the heat index (for shady areas) and dew point (the temperature air must be cooled at for relative humidity to equal 100%) (14).

Discussions surrounding the effects of excessive heat on morbidity and mortality have largely focused on physical impacts—heat stress, heat stroke, and increased risk to people with comorbidities. In the case of workers compensation insurance, there is obviously potential for these impacts to result in more claims, with outdoor/semi-outdoor workers bearing the brunt of the harm.

Mental impacts have received comparatively little attention. However, it is well known that excessive heat can cause anger, irritability, mental confusion, tiredness, and difficulty concentrating (5). While these impacts are not deadly, they can compromise physical health by increasing the rate of accidents and/or violence. This phenomenon, where the mental effects of extreme heat actuate seemingly unrelated

physical harm, may significantly increase the rate of workers compensation claims during extreme heat events.

Evidence of extreme heat increasing violence and accidents is plentiful. Numerous studies have demonstrated that climate change is expected to exacerbate violent crimes (7) and suicides (10). The correlation between excessive heat and crime has been well documented, as far back as the 1970s (2,9,13). One study found that "overall crime increases by 2.2% and violent crime by 5.7% on days with maximum daily temperatures above 85 degrees Fahrenheit" (6). A 1986 study showed that road rage increased with ambient temperature, implying that the cooling effects of an air-conditioned vehicle aren't sufficient to fully dissipate heat-induced anger (8).

How exactly might the above impact workers compensation insurance? The most expensive causes of compensation are motor vehicle accidents, burns, falls/slips, getting caught, and getting struck by.. Motor vehicle accident claims costs an average of $89,152 – more than double the average cost of $41,757 (data as of 2021) (16). When excessive heat causes anger, confusion, irritability, or tiredness in workers, injury from accidents or workplace violence becomes more likely. A study from the US Department of Transportation found that the critical reason for 94% of accidents was the driver (as opposed to vehicle, environment, or unknown) (12). Excessive heat can compromise an individual's ability to drive safely by increasing irritability and decreasing focus—thus increasing the rate of motor vehicle accidents, the most expensive type of workers compensation claim.

One study from UCLA used workers compensation injury claims from 2001-2018 to document the impacts of extreme heat (11). The researchers found that hot temperatures increased not only direct injuries such as heat stress or heat stroke, but also other injury types such as falling. This is consistent with our suggestion that the mental fogginess caused by extreme heat can indirectly increase worker compensation claims by making accidents more likely. Interestingly, the authors also observed a decline in heat sensitivity over the study period, indicating the potential for adaptation.

Given that we are examining the impacts of excessive heat, it is important to consider not only the type of injury, but also which industries have the most workers compensation claims. We would expect to see the greatest increase in heat-related injuries and accidents in industries where work is fully or partly outdoors. The table below describes the top 10 private industry occupations by number of covered injuries/illnesses, along with the average salary for that occupation and whether there is a significant outdoor work component. Salary is included because there is a negative correlation between excessive heat impact and income (6). Three of the occupation categories—transportation and material moving; installation, maintenance, and repair; and construction and extraction—have an outdoor work component. Together they account for more than 800,000 compensation claims a year. Furthermore, while it does not appear in the table below, agricultural workers will face very high risk from extreme heat due to the outdoor nature of their work and their proximity to heavy machinery. While many states exempt agriculture from workers compensation insurance, 14 US states, including NY and CA, require all farms to provide workers compensation to their employees (17).

Table 1

PRIVATE INDUSTRY OCCUPATIONS WITH THE LARGEST NUMBER OF INJURIES AND ILLNESSES, 2021-2022

Rank	Occupation	Outdoor?	Avg salary (2023) (18)	Number of Injuries (4)
1	Service	N	51,690	538,380
2	Transportation and material moving	Y	46,690	503,610
3	Production	N	47,620	223,840
4	Healthcare practitioners and technical	N	102,060	223,680
5	Installation, maintenance, and repair	Y	58,500	163,140
6	Sales and related	N	53,280	146,310
7	Construction and extraction	Y	61,500	136,570
8	Office and administrative support	N	47,940	101,970
9	Management, business, and financial	N	90,580	101,460
10	Education, legal, community service, arts, and media	N	66,400	54,400

Sources: "May 2023 National Occupational Employment and Wage Estimates." Bureau of Labor Statistics. https://www.bls.gov/oes/current/oes_nat.htm and "Facts + Statistics: Workplace Safety/Workers Comp" https://www.iii.org/fact-statistic/facts-statistics-workplace-safety-workers-comp.

It is important to note that indoor workers may also be vulnerable to excessive heat-induced mental impacts if there is no or insufficient cooling in their workplace (i.e., restaurant kitchens, warehouses). In the UCLA study mentioned earlier, the authors found that extreme heat increased claims in both indoor and outdoor settings (11). Insufficient indoor cooling may be more prevalent in lower-wage industries such as service, transportation and material moving, and production—the three occupations with the greatest number of injuries and illnesses (4).

In conclusion, the rising number of excessive heat events due to climate change may increase worker injury and illness through the nexus of physical and mental effects. However, much more research is required before the mental impacts of excessive heat, and how that compromises physical safety, can be robustly incorporated into actuarial science for workers compensation insurance. Questions that should be addressed include:

Will we see an increase only in the number of claims, or also their dollar amount? Will medical or indemnity claims be impacted more? How might insurers respond—increasing premiums or deductibles, decreasing coverage, creating exclusions? How exactly is heat correlated with mental impacts—does it increase linearly or nonlinearly, is there a temperature threshold below which impacts are minimal? Are certain populations more vulnerable than others, and if so, which? How do people adapt to extreme heat? How does the US experience compare with that of workers in hotter countries—can they provide us with a model of human adaptation?

Another interesting area of research concerns how the impacts of excessive heat can be mitigated. For indoor occupations, the most obvious solution is better cooling systems. For outdoor occupations health wearables, access to shade and cold water, and cooling gear may also be effective. Changing operating

procedures such as reducing hours during the hottest time of day, restricting driving or operating of heavy machinery, and providing more frequent breaks may also reduce risks. Insurers can encourage mitigants with financial incentives such as premium discounts and by educating clients about the risks.

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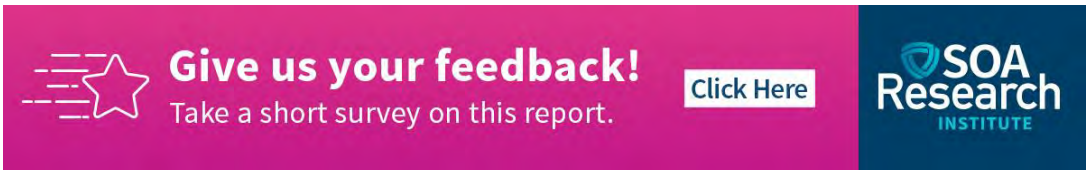

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