

Electrical Burns and Your Mental Health

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Published in: *Electrical Source Industrial Power Systems Magazine*. May/June, 2012. Vol 8(3):30-33

Nearly 20,000 workers were burned on the job in Washington State between January 2001 and April 2008 and recorded through the Washington's workers' compensation system managed by the Department of Labor and Industries.¹ These burn injuries come from workers in a wide variety of industries, including

Workers experiencing electrical burns are 7 times more likely to suffer mental health problems compared to other burn victims.

construction, utilities, agriculture, manufacturing, transportation and more. Of the 20,000 burn injuries, 329 (2%) were severe enough to require hospitalization. Of the 329 hospitalized burns, 62 (19%) had a mental health diagnosis related to the burn injury.

It is widely known that burn injuries can lead to physical scarring, pain, and disability. It is also understood that severe burns, which require a period of physical recovery, can result in lower or lost wages. You already know that burns are a bad thing, but one of the most interesting recent findings from Washington State's occupational burns research is that some kinds of burns have worse outcomes than others. Workers burned by electricity were 7 times more likely to have mental health problems compared to workers burned from fire, chemicals, or radiation. Electricians, electrical power-line workers, and others who work near power sources on a frequent basis know that they can be burned at work, but may not realize that a burn risks their mental health as well. In our investigation, almost 6 out of 10 workers who experienced an electrical burn also reported mental health symptoms.

Why are electrical burns hard on your mental health?

Workers suffering burns have reported several kinds of mental and emotional symptoms including anxiety, depression, Acute Stress Disorder (ASD) and Post Traumatic Stress Disorder (PTSD). There are several possible causes for these mental health symptoms after a burn injury, from the traumatic experience itself to the lasting physical effects of scars and pain. Stimulation by electrical current can result in serious heart problems (like irregular heartbeats), as well as damaging changes in the brain and nervous system. Changes to the brain and nervous system can affect a person's mood, memory, and

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ability to pay attention and focus.^{2,3,4} Electrical injury can also work as a unique conditioning event to the brain, similar to electroshock therapy, making an injured worker very reluctant to encounter the same hazards, which might lead to another electric shock injury.⁵ These changes in the brain can occur even from low-voltage (<1000V) electrical contact.² More than other occupations who suffer electrical injuries,

electricians and electrical power-line workers must confront the source of their burn injury throughout their daily course of work. Anxiety and flashbacks may occur, with possible fear about completing a job or being able to continue within the electrical profession.

How do electrical burns compare to other types of occupational burns?

Thermal burns are most commonly caused by fire and were the most common type (80%) of burn requiring hospitalization. Fourteen percent of workers with thermal burns experienced mental health problems with their burn. In contrast, electrical burns are a less frequent type of hospitalized burn (9% of all hospitalized work-related burns), yet 57% of electrically-burned workers experienced mental health problems. Regardless of burn type, the majority of workers with a mental health diagnosis had burns involving multiple body parts – these burns can be larger or more severe, and can be more traumatic. Workers with burns to the head and face had a significant proportion (28%) of resulting mental health problems. Workers who suffered from mental health diagnoses spanned all age ranges and came from both small and large employers.

Burns are described by the medical community as covering less than (or more than) 10% of the “Total Body Surface Area” or TBSA. This refers to the amount of body burned, but does not address how deep the burns are. Because burns that cover more of the body are inherently more expensive, injured workers were grouped for analysis by burns covering less than 10% or more than 10% TBSA. As expected, the majority (67%) of workers with mental health diagnosis had burns covering more than 10% of their TBSA. Workers suffering mental health problems had 4 to 8 times higher median medical costs. For workers burned over more than 10% TBSA and having mental health problems, the median medical costs were over \$98,000. This is much greater than the median cost of \$13,000 for workers who did not experience mental health symptoms (and medians are the middle range of costs – not even the highest!). The number of days that an injured worker is not able to work does affect the cost of the injury. Days lost from work are referred to as ‘time loss’ and are counted starting with the fourth day of missed work

(the first 3 days are not counted). Workers with mental health problems had 5 to 10 times more median days of lost work time compared to workers without mental health problems. For workers burned over more than 10% TBSA and suffering mental health problems, the median time loss was 300 days, much greater than the median time loss of 32 days for workers who did not experience mental health symptoms.

Interestingly, medical costs and time loss were much higher for workers with mental health problems *at both levels of TBSA*. This means that workers who suffer burns on even a small part of the body are at risk for mental health problems and may experience significant time lost from work.

Who is at risk, and what are common causes of electrical burns?

Out of the 329 hospitalized burns, 28 (9%) were from an electrical source. Table 2 shows information for the 28 electrical burn injuries using the medical records filed with Washington State's workers' compensation system. Electrical burns occurred for 14 different occupations (as defined by the 2000 Standard Occupational Classification (SOC) System⁶). As expected, the majority of electrical burns occurred within the occupations of electrician and electrical power-line installers and repairers. Electrical burns also occurred in several construction trades, such as painters, as well as a few cases in farm workers, laborers, and production workers (Table 2).

Description of the burn incident in the medical records indicated that the source of electricity was most commonly overhead power lines for 79% of the burn injuries. All incidents involving overhead power lines were considered to be high-voltage, as well as those where medical professionals had classified the burn as being from high-voltage contact. The remaining 21% of electrical burns occurred from a source other than high-voltage power lines, such as electrical panels, meters, and electrical equipment such as pumps. Interestingly, less than half of electricians were burned by high voltage, while *all* electrical power-line workers, painters, and most other occupations were caused by high voltage power. Examples in which workers were burned by high voltage include:

- 4 workers in 4 separate incidents were operating a cherry picker, man lift, or bucket lift that contacted an overhead power line
- 2 workers (1 concrete dumper operator and 1 electrician) in separate incidents where the worker touched a vehicle electrified by an overhead power line
- 2 painters in separate incidents were burned when they were carrying ladders that struck an overhead power line
- 1 pipelayer was burned when their crane struck an overhead power line

- 1 cement mason raising a pole that contacted an overhead line
- 1 roofer raising a pipe over a roof, the pipe struck an overhead line
- 1 roofer carrying a gutter up a ladder was burned when the gutter contacted power lines.

Finally, four of these 28 electrically burned workers suffered amputations as a result of contact with a high voltage power line. Additionally, there was one incident that resulted in at least 1 hospitalized burn (included in this analysis) and one fatality (not included in this analysis) in which a worker (occupation unidentified) was fatally burned by high voltage.

Table 2. Occupations of workers with electrical burns	Number of workers	Number caused by high voltage
Electricians	7	3
Electrical Power-Line Installers and Repairers	6	6
Painters, Construction and Maintenance	3	3
Electrical and Electronic Engineering Technicians	2	1
Cement Masons and Concrete Finishers	1	1
Construction and Building Inspectors	1	1
Farm workers and Laborers	1	1
First-line Supervisors/Managers of Construction Trades and Extraction Workers	1	1
Laborers and Freight, and Stock Handlers	1	1
Paving, Surfacing, and Tamping Equipment Operators	1	1
Pipelayers	1	1
All Other Production Workers	1	1
Roofers	1	1
Heating and Air-Conditioning and Refrigeration Mechanics & Installers	1	0
Total	28	22

In conclusion, workers with electrical burns are 7 times more likely to experience mental health problems such as depression, anxiety, Acute Stress Disorder, and Post Traumatic Stress Disorder compared to those burned by fire, chemicals or radiation. Electricians, electrical power-line installers, and others who work on or near high-voltage lines, are at great risk for mental health problems following a burn injury. Injured workers who suffer mentally as well as physically invariably have higher medical costs and more days of lost work.

If you have suffered a burn injury, even in the distant past, and feel you have lasting mental effects, you can contact your local burn treatment center for help. Burn treatment centers understand the psychological effects of burn injuries. You can also discuss your concerns with your personal health care provider.



To reduce your risk of electrical injury, know and follow your company's policies concerning job safety. Hazard analysis is an effective and systematic approach to identify, evaluate, and control hazards at a work site. Hazard analysis can increase employee safety awareness on a job site, and can be performed by workers, foremen, and company owners alike. One simple approach to hazard analysis is to have one or more workers conduct a site walk-through before the morning safety meeting to identify site-specific hazards. Discussing what was observed during the walkthrough will bring variety and realism to the safety meeting.

There are a number of controls that can be commonly used to prevent electrical injury when working near overhead lines – lockout/tagout procedures and working de-energized, marking overhead lines, and following safe distance requirements. Check out Fatal Facts Report # 47-10-2005 <http://www.Lni.wa.gov/safety/research/face/files/powerlineelectrocutions.pdf> for more detailed information on safety when working near overhead lines. More injury prevention ideas for electricians can be found in “Common Ground: Electricians Connect on Safety & Health” at www.Lni.wa.gov/safety/research/HealthyWorkplaces/Electrical.

¹ Anderson NJ, Bonauto DK, Adams D. Psychiatric diagnoses after hospitalization with work-related burn injuries in Washington State. *Journal of Burn Care and Research*. 2011; 32:369-378.

² Singerman J, Gomez M, Fish J. Long term sequelae of low-voltage electrical injury. *Journal of Burn Care and Research*. 2008;29:773-777.

³ Ramati A, Pliskin NH, Keedy S, Erwin RJ, Fink JW, Bodnar EN, Lee RC, Cooper MA, Kelley K, Sweeney JA. Alteration in functional brain systems after electrical injury. *Journal of Neurotrauma*. 2009; 26:1815-1822.

⁴ Pliskin NH, Ammar AN, Fink JW, Hill SK, Malina AC, Ramati A, Kelley KM, Lee RC. Neuropsychological changes following electrical injury. *Journal of the International Neuropsychological Society*. 2006; 12:17-23.

⁵ Mancusi-Ungaro HR, Tarbox AR, Wainwright DJ. Posttraumatic Stress Disorder in Electric Burn Patients. *Journal of Burn Care and Research*. 1986;7(6)521-525.

⁶ U.S. Bureau of Labor Statistics, 2000 Standard Occupational Classification (SOC) system. http://www.bls.gov/soc/2000/soc_majo.htm