Extreme Heat and Workers’ Health in South Australia: Association, perceptions, and adaptations in the workplace

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PUBLICATIONS DURING CANDIDATURE

Peer-reviewed Journals

Published


Manuscript in draft


5. Xiang J, Bi P, Pisaniello D, Hansen A. Workers’ perceptions on workplace heat exposure in South Australia.


Conference presentations


2. Xiang J, Bi P, Pisaniello D, Hansen A. Association between high temperature and work-related injuries in Adelaide, South Australia, 2001–2010 (*Poster presentation*). The
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AWARDS RECEIVED DURING PhD CANDIDATURE

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- Postgraduate Travelling Fellowship, funded by the Freemasons Foundation. Faculty of Health Sciences Research Committee, the University of Adelaide, 2013.


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<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>ACGIH</td>
<td>American Conference of Governmental Industrial Hygienists</td>
</tr>
<tr>
<td>AIOH</td>
<td>Australian Institute of Occupational Hygienists</td>
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<tr>
<td>ASCO</td>
<td>Australian Standard Classification of Occupation</td>
</tr>
<tr>
<td>AT</td>
<td>Apparent Temperature</td>
</tr>
<tr>
<td>BOM</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td>CEN</td>
<td>European Committee for Standardization</td>
</tr>
<tr>
<td>CFMEU</td>
<td>Construction, Forestry, Mining and Energy Union</td>
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<tr>
<td>CI</td>
<td>Confidence Interval</td>
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<tr>
<td>FIFO</td>
<td>Fly-in/fly-out</td>
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<tr>
<td>GEE</td>
<td>Generalized Estimating Equation</td>
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<td>H/W</td>
<td>Heatwave</td>
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<tr>
<td>ICD</td>
<td>International Classification of Diseases</td>
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<tr>
<td>IRR</td>
<td>Incidence Rate Ratio</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>NIOSH</td>
<td>National Institute for Occupational Safety and Health</td>
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<tr>
<td>OH&amp;S</td>
<td>Occupational Health &amp; Safety</td>
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<tr>
<td>OLS</td>
<td>Ordinary Least Square</td>
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<td>OR</td>
<td>Odd Ratio</td>
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<td>PPE</td>
<td>Personal Protective Equipment</td>
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<td>SA</td>
<td>South Australia</td>
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<td>SAWIC</td>
<td>South Australia WorkCover Industrial Classification</td>
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<td>SafeWork South Australia</td>
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<tr>
<td>TAFE</td>
<td>Technical and Further Education</td>
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<tr>
<td>TLV</td>
<td>Threshold Limit Value</td>
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<td>$T_{\text{max}}$</td>
<td>Maximum Temperature</td>
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<td>TOOCS</td>
<td>Type of Occurrence Classification System</td>
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<td>United Kingdom</td>
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<td>USA</td>
<td>United States of America</td>
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<tr>
<td>USG</td>
<td>Urine Specific Gravity</td>
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<tr>
<td>UTCI</td>
<td>Universal Thermal Climate Index</td>
</tr>
<tr>
<td>WBGT</td>
<td>Wet Bulb Globe Temperature</td>
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<tr>
<td>WHS</td>
<td>Workers’ health and safety</td>
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Background

Occupational heat exposure may lead to adverse health effects and contribute to work-related injury, illness or even death. With the predicted increase in the frequency and intensity of extremely hot weather in South Australia, workplace heat exposure is presenting a growing challenge to workers’ health and safety. This thesis aims to examine the effects of workplace heat exposure on workers’ health and safety in Adelaide, South Australia, to investigate perceptions of risks associated with workplace heat exposure, and to provide scientific evidence for the development of heat necessary heat prevention and adaptation strategies particularly in a warming climate.

Methods

This study can be broadly divided into two parts. The first part is the analyses of workers’ compensation claim data and weather data, obtained from the SafeWork South Australia and the Bureau of Meteorology, respectively for 2001-2010. Time-series analysis approach was used to quantify the effects of heat exposure on workers’ health and safety. Heat-related claims were identified according to the Type of Occurrence Classification System coding information and text-based diagnosis-related descriptions. Case-crossover analytic approach was undertaken to estimate the risk of occupational heat illnesses during heatwaves. The second part of this study comprises two cross-sectional questionnaire surveys to investigate how workers and occupational hygienists perceive the risk of workplace heat exposure and health impact.
Results

Analyses of workers’ compensation claim data

Generally, there was a reversed U-shaped relationship between daily maximum temperature ($T_{\text{max}}$) and daily injury claims in Adelaide. With increasing $T_{\text{max}}$ below certain threshold temperatures ranging from 31.8°C to 38.9°C, significant temperature-injury claims associations were found in the following sub-groups: young workers aged $\leq 24$ years; those working in some outdoor industries such as ‘agriculture, forestry and fishing’, ‘construction’, and ‘electricity, gas and water’; or employed as labourers, production and transport workers, and tradespersons in small and medium sized businesses. When the temperature was extremely hot, almost all industries had a decrease in injury claims, except the ‘electricity, gas and water’ industry.

During heatwave ($\geq 3$ consecutive days with $T_{\text{max}} \geq 35^\circ \text{C}$) periods, outdoor male labourers and tradespersons aged $\geq 55$ years in ‘agriculture, forestry and fishing’ and ‘electricity, gas and water’ industries were found to be at higher risk of work-related injuries. Occupational burns, lacerations, amputations, and heat illnesses were found to be significantly associated with extreme heat, together with injuries resulting from moving objects, chemical exposures, and environmental factors.

There were 306 heat-related injury claims reported during the 9-financial year period in South Australia, with an incidence rate of 4.5 per 100,000 workers. Relatively high heat illness incidence rates were observed in ‘mining’ and ‘electricity, gas and water’ industries, and those employed as labourers and tradespersons across the state during the study period. When $T_{\text{max}}$ was above 35.5°C, a 1 °C increase of $T_{\text{max}}$ was associated with a 12.7% increase in occupational heat illness claims. During heatwave periods the risk of occupational heat illness was about 4-7 times higher than that of non-heatwave periods.
Workers and occupational hygienists’ perceptions on heat exposure

Surveyed workers were moderately concerned about heat exposure. Young workers (≤24 years) were less concerned than older workers. Workers undertaking very physically demanding work, wearing personal protective equipment, or having had a previous heat illness/injury were found to be more concerned about heat exposure.

The majority (90%) of occupational hygienists and specialists surveyed showed great concerns over heat stress, but they did not show strong willingness to amend heat prevention recommendations to management or companies. From the occupational hygienists’ point of view, Australian workplaces may not be well-prepared for the likelihood of increasing heat stress due to climate change.

Conclusions

Findings from this study will provide essential epidemiological evidence for policy makers and relevant stakeholders to develop regulations and guidelines locally and/or internationally to reduce the impacts of extreme heat on workers’ health and safety, particularly in the susceptible subgroups identified. Industrial specific workplace hot weather alerts and response mechanisms need to be developed via multi-sectoral cooperation between stakeholders to improve vulnerable groups’ risk perceptions and knowledge about harm minimisation strategies during extremely hot weather. In a warming climate, there is a need to develop specific and clear enforceable heat regulations to ensure the implementation and compliance of heat policies.
DECLARATION

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