

‘Zonked the hell out’: Climate change and heat stress at work

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Abstract

Climate change is most directly felt by people who cannot escape its impacts, including workers whose source of livelihood may put them directly at risk from high heat. Research on these impacts for Australian workers, especially the socio-political determinants of effective workplace heat management,

remains limited. This article presents findings from a national research project that investigated these issues in collaboration with the Australia-based United Workers Union. It reports on the experiences of members exposed to high heat, explores how they address heat stress, and how they relate this to climate change. The article expands understanding of the impacts of workplace heat, especially for indoor workers and those in lower paid jobs, through a focus on how workers articulate their experiences and understand and exercise their agency at work.

Introduction

Human-induced climate change is driving higher temperatures on average, more hot days, longer heatwaves, and more frequent and intense bushfires (IPCC, 2021: 11). It is also responsible for increasing fatalities, and accounts for a third of all heat-related deaths worldwide between 1991 and 2018 (Vicedo-Cabrera et al., 2021: 492–500). Almost half of the global population is now exposed to high heat episodes, including more than one billion workers (Ebi et al., 2021: 698–708).

Although a growing area of research internationally, studies focused on indoor workers and Australia are limited (see however Carter et al., 2020; Hansen et al., 2018; Newman and Humphrys, 2019; Oppermann et al., 2018; Singh et al., 2015; Williams et al., 2020; Xiang et al., 2016). Research examining the ‘social, economic, environmental and technical aspects’ also needs to be prioritised (Lundgren et al., 2013). There is a pressing need to develop a detailed picture of the impacts and complexities of heat-related occupational hazards in Australia, including an appreciation of how these have differential impacts across the workforce and are related to issues of inequality.

To this end, we conducted interviews and a national survey involving members of the United Workers Union (UWU), who work in a diverse range of indoor and outdoor jobs across approximately 45 industries. The project explored these workers’ experiences of high heat at work, what actions they had taken to manage it, and their views on whether climate change was impacting working conditions more generally. In this article we report on the project findings and highlight the socio-political complexities in planning for current and future impacts of global warming. We also consider the policy implications from our findings, and potential future research.

High Heat at Work

Higher global temperatures induced by climate change have been identified as a major threat to safe and decent working conditions, with workers increasingly compromised during the hottest months of the year. This is ‘particularly significant for the Australian workforce because of the prolonged warm-to-hot summers, and the increasing frequency of heatwaves’ (Williams et al., 2020: 68). Projections place most of Australia’s land mass in the moderate to high risk category for occupational heat stress, and some parts of the north-west of the country at extreme risk (Hyatt et al., 2010). Recent studies have underscored that heat stress is impacting a significant and diverse group of the working population. Interestingly, a survey of Australian labour force participants found that outdoor workers, and those in

physically demanding jobs, were no more likely to be 'often' or 'sometimes' stressed than those working in 'non-vulnerable' roles (Zander et al., 2018).

'Heat stress' refers to heat received in excess of the level that a person can tolerate, where 'the body's internal regulation mechanisms are no longer capable of maintaining body temperature at a level required for normal functioning' (ILO, 2019: 17). Several factors can moderate the risks of heat stress faced by an individual worker. These include: humidity; exertion and the nature of work being carried out; the working environment; their ability to self-pace, slow or stop work; their access to training, heat management procedures, and other protective measures.

Health and safety consequences of workplace heat are also differentiated among workers. Older workers and those with certain health conditions can struggle in hotter weather. Problems can be greater for those on less secure employment contracts, temporary workers, piece workers, on-demand workers, and migrant workers, who may have greater difficulty in taking measures to address problems (Underhill and Rimmer, 2015). While climate heat disrupts all work and presents new challenges to health and safety generally, it does this while exacerbating precariousness and extending individual risk (Newman and Humphrys, 2019).

While heat waves and extreme temperatures are particularly challenging, heat also impacts workers at moderate temperatures — especially those doing physical labour or experiencing heat associated with higher levels of humidity (ILO, 2019). A 2019 study of work-related injury and illness in Adelaide found that 'moderate temperature ranges had the greatest burden [in terms of claims] yet the greatest risk was observed at extreme temperatures' (Varghese, Barnett, Hansen, Bi, Hanson-Easey, et al., 2019). Symptoms may include rashes, dehydration, nausea, fatigue, irritability, stress, reduced concentration and slower reaction times, and more serious consequences may include miscarriage, heatstroke, heart failure, organ failure and death (Ebi et al., 2021). High heat conditions also have cognitive impacts, reducing mental capacity (Rowlinson et al., 2014). They increase the likelihood of more accidents and injuries at work (Varghese, Barnett, Hansen, Bi, Nairn, et al., 2019). A study of South Australian workers' compensation claims found that there was a significantly increased risk of heat illness above 35.5°C, and that during heatwave periods the risk of occupational heat illness was about 4-7 times higher than that of non-heatwave periods (Xiang et al., 2015; see also Park et al., 2021).

Heatwaves have a strong cumulative effect and can impact working conditions indirectly, putting pressure on an individual's health outside of work hours. High heat can impact sleep quality, the effects of which compound over several days, making it harder to work safely. Similarly, working in extreme heat can make driving to and from work more dangerous (Basagaña et al., 2015). In the hottest and most humid parts of the country some workers are unlikely to fully recover from workplace heat exposure on a daily basis, as 'the impact of the work shift extends into their personal lives, affecting them physically and mentally' (Carter et al., 2020: 7).

A recent study compared how workers manage their exposure to high heat in workplaces to the suggestions made by health and safety representatives and other relevant professionals, such as

occupational hygienists (Williams et al., 2020). The study identified common priority issues across these groups for better managing high heat. These included supporting workers to take basic protective measures, PPE policies and work planning for hot weather, and management education and support (Williams et al., 2020: 75–77). Yet, a review of policies and guidelines in Australia found that high-level frameworks across state, territory and Commonwealth jurisdictions do not cover the hazards of hot weather explicitly — rather, management of the problem is covered more generally by duty of care and workplace health and safety (WHS) provisions (McInnes et al., 2017: 338). The authors identified significant problems in available educational materials — including the range and accessibility for workers whose first language is not English, as well as the consistency of information across jurisdictions (McInnes et al., 2017: 338). Furthermore, there is ‘no requirement to provide a written hot weather plan or to ensure it is understood or available to workers [and only] two regulators recommend employers have a heat illness emergency response plan’, and only one state policy ‘advises employers to monitor weather forecasts’ (McInnes et al., 2017: 338). More research is needed to identify how hot weather is being managed in workplaces, as well as the difficulties in implementing adequate risk management strategies (McInnes et al., 2017: 338).

Methodology

UWU is one of the largest blue-collar unions in Australia, with approximately 150,000 members across 45 industries. Many UWU members work in heat-exposed environments, in both indoor and outdoor settings.

Previous workplace heat stress studies, including our own, have shown the value of gathering both general information about the prevalence of heat stress among working populations, as well as gathering industry, job and site-specific data through smaller case studies. While many exposed workers will share common heat stress symptoms, the factors contributing to their exposure can differ considerably. As such, a mixed methodology was chosen to develop a fuller picture of how this union’s members are experiencing and managing high heat.

Our study involved interviews with workers in selected industries to gain an understanding of the industry-specific issues on the ground, and to help inform a national survey of UWU’s Allied division. Industries covered by the Allied division include cleaning, agriculture, utilities, construction, food and hospitality, security and prisons, manufacturing, and transport and warehousing. The interviews and survey explored the workplace environment, the impacts of high heat, how workers and employers respond to high heat, and participants’ views on the relationship of climate change to work. In addition, the research team observed the union’s ‘Extreme Weather at Work’ OHS training and was given access to anonymised data from a UWU-initiated survey of home care workers about uniforms.

Semi-structured telephone interviews were conducted with sixteen key informants between September 2020 and March 2021. These individuals were UWU members working in different industries and locations: manufacturing (New South Wales and Victoria); water utilities (South Australia); home care (Western Australia and New South Wales); and early child education and care (ECEC) (Northern

Territory). This group was deliberately diverse; different states and industries were chosen as ‘mini-case studies’, drawing out common and differentiated issues and strategies among the union’s membership. Interviewees were aged between 23 and 63, with an average age of 49. Participants were 10 men, 5 women, and one non-binary person. Interviewees were recruited via UWU staff, who provided contact details to the research team if a member advised they would like to participate. Interviewees were given an information sheet, an opportunity to ask questions, and signed a consent form. Interviews were transcribed and coded in NVIVO qualitative text coding software to identify themes.

A national survey of members (n=798) was undertaken over 16 days in February 2021. Using the Survey Monkey platform, it was distributed to workers who subscribe to the main UWU membership email list and are assigned to the Allied division. The response rate was 4.5%. There were 35 questions, including six open-ended questions, and the survey took approximately 12-15 minutes to complete. Data was analysed in Google Sheets and R. Analysis included only those respondents who completed some or all of the demographic and job role questions, and at least one of the questions about high heat impacts. Participants could skip any question they did not want to answer, or was not relevant to them, and as such the total number of responses varies between questions.

While a wide range of members were encouraged to contribute, a self-selection bias may exist for union members who are particularly interested in or affected by workplace high heat. As the survey and instructions were written in English only and sent via email (to be completed over the internet), some members will have been excluded. This project focused on heat stress issues for union members of the UWU, and as such non-union members, and union members from other unions were not involved. Differences between these groups, in terms of heat stress experience and management strategies, were not explored in this project. Further, the UWU has been relatively active on the issue of climate change, including as a WHS issue, which may have led its members to draw stronger links between climate change and high workplace heat as compared to members of other unions or workers more generally. Efforts were made to improve survey accessibility and a plain language definition of ‘heat stress’ was provided (simplifying Kjellstrom et al, 2016: 98). The draft survey was reviewed and tested by several (non-academics) known to the authors, who gave feedback about readability, plain language, timing, survey logic, and the clarity of instructions.

About two thirds of the respondents to the survey were women (67.8%), one third were men (31.4%), and a small number were non-binary (0.8%). The age of respondents spanned from 17 to 77 years old, but almost 60% of respondents were aged between 41 and 60 years old. In terms of types of employment contracts, 73.9% of workers were in ongoing / permanent roles, 16% were fixed term, 9.6% were casual, and only one respondent (0.1%) was employed through a labour hire company. Most workers (79.4%) had been in their industry for over five years, and most (69.6%) had been in the same job role for more than five years. Close to half of the participants surveyed worked shifts or days of between 7-9 hours (48.9%), just over a third worked between 4-6 hours (34.7%), and 12.4% worked ten hours or more per shift or day.

The survey is one of the largest of its kind undertaken in Australia, although it deals with a relatively small sample of workers. This makes it difficult to reliably compare differences across industries and job roles. Moreover, although respondents were employed in a diverse range of occupations, close to half (48%) worked in educational services — primarily as teacher’s aides, Auslan interpreters, and school cleaners. This industry is strongly represented in the Allied division of UWU, and members working in that industry responded at a higher rate compared to other industry groups. Overall, more than a quarter of all workers who participated in the survey were middle-aged women (aged 45-60 years old) working in educational services in Queensland (n=235), and three quarters of those were in permanent jobs.

Experience of high heat at work

Despite the wide range of jobs and locations respondents were based in, and the high levels of access to cooling in some industries, most workers (90.7%) were affected by heat on hot days. A majority said heat affected them ‘very much’ or ‘quite a bit’ on hot days (58%), with less than 10% of workers reporting they were never or rarely affected.

Several factors can contribute to how hot an individual worker feels, including sun exposure, the level of ventilation, the availability of cooling controls such as fans and air-conditioning, and physical exertion. Most workers surveyed either only worked indoors (28%) or worked outdoors for less than a third of the time (44%). 15% of workers spent 70% or more of their time outdoors. Just over a third of workers said their workplace was well or very well ventilated, and almost half said their workplace had reasonable (‘average’) ventilation. 17.3% of those surveyed said their workplaces were poorly or very poorly ventilated. Some workers had to lift heavy loads as part of their job, which can increase the risk of heat stress, and a third of workers surveyed advised that they regularly lift loads of 10kg or more.

Unsurprisingly, most workers felt the heat most when they were outside, exposed to the weather directly. However, for others, they felt hottest at work in specific areas of the workplace, for example: in an ‘unventilated/un-airconditioned work shed’ (air reporting officer, Northern Territory); ‘in the sheds cutting up material’ (teacher’s aide, Queensland); ‘inside the plant’ (plant operator, Western Australia); and, ‘in the mill room — small, with little cooling, and directly in front of sunlight’ (development chemist, Victoria). Others noted that the hottest part of their workplace was under or near skylights.

Many workers based indoors noted that they felt hottest near heat-generating equipment and machines, including computers. Often it was a combination of factors — proximity to hot equipment/machines, inadequate climate controls or cooling mechanisms, and/or a lack of ventilation — which contributed to high ambient heat in their workplace. Most indoor workers surveyed had access to cooling controls, including fixed air-conditioning (75.4%), fixed fans (45.6%), portable fans (11.4%), and portable air conditioning / evaporative coolers (4.5%). However, some noted that existing cooling controls did not work properly, were broken, were ineffective in high temperatures, or were available only for customers. One interviewee, working as a technician in a factory in Victoria, noted ‘fans make it worse...because they take all the heat up from the machine and blow it to the site... there's nothing exhausting the hot air out’.

Cooling controls were often only available for some of the working day or week, either because controls were only available in part of the worksite or because the 'workplace' encompassed many different environments. For example, one aged care support worker in Queensland said:

...my job takes me into people's houses [and] the level of cooling controls is extremely variable. I would say portable fans are the most common [and] some clients do have air-conditioning but will not use it.

This worker was not alone in noting that some clients in aged and home care chose not to use air-conditioning, usually because of the cost of running it.

In the twelve-month period prior to the survey, 20.2% of workers were unable to work at some point due to high heat. This included having work cancelled, work stoppages, and taking sick leave. When exposed to heat at work, many workers regularly experience fatigue (77.6%), headaches (59.5%), and nausea or dizziness (36.8%), all common symptoms of heat stress. Some workers also described how they sometimes 'stopped sweating' or lost their appetites. Workers also reported slower reaction times, feeling irritable or angry, and finding it harder to concentrate. Working in high heat also had dissociative impacts for some workers, who described feeling 'out of it', 'like a zombie', on 'remote control' or being 'zonked the hell out'. One worker compared it to having 'a really severe hangover', and another said high heat problems led to 'mental health deterioration over time'. Many respondents noted ageing can make workers more susceptible to heat stress. Several workers also raised menopause: 'some women...really can't cope in the heat because of menopausal symptoms' (home care worker, Western Australia); 'I am menopausal so I have hot flushes too. The heat at the front counter affects me a lot' (administration worker, Queensland); and, '...with the hot flashes, you nearly pass out with that, with our hot uniform on top that doesn't breathe' (home care worker, New South Wales).

In a separate survey (n=487) conducted by the union about uniforms and heat, workers detailed significant issues related to the materials used, uniform design, and breathability. When asked to rate the appropriateness of their uniform on a hot day: 64.4% rated it 'terrible', 18.7% rated it poor, and only 16.9% rated it either neutral, good or 'great'. Many workers drew links between their experience of high heat and overall workloads, the timing of their work over the day, the lack of opportunity to take breaks, and the short travel times allowed between clients limiting their recovery. Around 50% of these home care workers were unaware they had the right to cease work on paid time if there was a serious and imminent risk to their safety. Of course, for workers caring for the vulnerable, ceasing work can be a very difficult choice with serious consequences for clients, meaning it is at times impractical, despite the risks of continuing to work.

Many UWW members are employed in jobs where they are directly responsible for the care and safety of others, and project participants shared their concerns about how high heat affects their patients, students and clients. In the survey, some teachers noted that high heat can lead to increased behavioural incidents, anger, stress and vomiting among students. Homecare and healthcare workers witnessed patients suffering heat stress and exhaustion. As one homecare worker based in Western Australia put it, we 'worry about our clients in the heat. ... it is actually emotionally stressful as well'.

Impacts on productivity were a problem across many industries. In the workplace, high heat conditions often produce a vicious cycle; as workers are forced to mitigate the adverse impacts of the heat, it becomes increasingly difficult for them to 'keep up', particularly if there is no commensurate reduction in their workload pressures. One worker summarised this predicament:

Essentially, it's quite terrible. You...drink way more water, so you're forced off the line, which puts pressure on you to work harder, which makes you sweat more and then tires you out. Essentially, it's just an all-round lose situation because you're hot, overheated, stressed and incredibly sweaty (manufacturing worker, New South Wales).

Due to the cumulative effects of heat, many workers suffer towards the end of their shifts, travelling to and from work, at home after they get home from work, or in the latter half of a hot or high-intensity week. Some workers described in interviews how the heat 'catches up' with them:

I have come in from some on-calls where I've done over 102 hours in a week, dry retching and throwing up, just from all the heat exhaustion and just doing 16-hour shifts, 7 days a week ... you even feel it after those hot days have gone (utility worker, South Australia).

If you go home after a long day, you just kind of want to stare at the ground for ten, fifteen minutes, until you, I don't know, become alive again (manufacturing worker, New South Wales).

... there will be days where you work all day in the hot weather, and you actually get home, have a shower, and you feel alright, and then about you know, eight o'clock, nine o'clock at night you just get a thumping headache. You know ... what you've done has finally caught up with you (utility worker, South Australia).

Workers also described serious workplace incidents. One worker recalled a particularly difficult week, working outdoors on roads around 48°C temperatures. The bitumen was sticking to his boots, and he said it 'took days to recover'. Nearly 20% of survey respondents said they were aware of serious incidents relating to heat, involving either them or their coworkers. These included workers and those in their care suffering seizures, heat exhaustion, stroke, extreme stress, and other forms of illness. A few workers reported fatalities of coworkers and patients.

Response to high heat at work

Preventing and responding to high heat was a challenge for many workers. Their ability to effectively manage the impact of heat was related to:

- their access to basic cooling measures (such as water, ice and PPE);
- their relative control over their working environment (including their ability to access cooling controls, 'pace' themselves, slow down, and/or rearrange or reschedule tasks);
- the existence of heat management policies or procedures at work;
- the level of confidence workers felt about raising issues.

Some workers said they can move to relatively cooler areas of their workplace, such as a lunchroom, lower level of a factory, or an air-conditioned space (including their car if they had time to lower the

internal temperature). For others, making these simple adjustments is not possible because climate controls are unavailable or inaccessible. All interviewees took individual measures to cool themselves in high heat conditions, including drinking more water, taking breaks, and making use of PPE (such as hats, sunscreen, and ice vests). Although some employers provided cold water, special drinks (such as electrolytes), and PPE to workers, most did not. One interviewee commented – ‘there may be some water if they know one of those stinking hot days are coming. But that just doesn't do much really’ (manufacturing worker in Victoria).

Other common measures for managing in the heat — taking breaks, slowing down or pacing, and rearranging or rescheduling work tasks — were again only available to some workers. One worker on a production line in a factory in Victoria, said: ‘I try to pace myself in a way where (the bosses) can understand that I’m working within my limits, and that I’m not overheating myself’. This worker felt able to pace himself somewhat but noted his employer had never ‘explicitly’ told him or his coworkers to slow down. He said: ‘they're just more trying to say 'don't overwork yourself', but at the same time 'don't slack off’’. Workers whose jobs are externally ‘paced’ — for example by a tight roster in the case of many homecare workers, or by the speed of machines in the case of manufacturing workers — found it more difficult or impossible to slow down or take additional breaks. Some said they were unable to leave ‘their machines’, or to take short breaks without stopping production and creating more work for themselves:

It comes down to the speed of machines. And the sort of ... planning. There's no — everything is urgent. Everything has to be done now. 'Come on. We need it done now. We need it done. It's got to be done today’ (manufacturing worker in Victoria).

A notable but small proportion of workers (2.4%) had taken formal industrial or workplace action regarding a high heat issue. Of this group, 58.8% reported the action was unsuccessful, 35.3% that it was successful, and one dispute was ongoing at the time of the survey. The low percentage of workers who took this form of action was, in some ways, a surprising finding — both because of the severity of the heat stress and illness experiences described by participants in the study, and because in recent years UWU members have been more likely to take industrial action on WHS matters than many other unions. Conversely, the limitations on industrial action in Australia — largely restricting it to periods of enterprise bargaining every three to four years and with severe penalties for unauthorised campaigning — can discourage workers from taking action outside these periods, even in cases where there are serious workplace health and safety risks and they are legally allowed to do so. One example of this is the relatively low level of action taken over the bushfire smoke emergency in 2019-2020 outside of the industrially strong industries of maritime services and construction, despite severe impacts from the smoke across many industries (including those that were part of this survey).

Cost considerations of employers were often a factor in heat management. Many workers said they often had to pay for and bring their own PPE supplies and water. Some workers talked about how unlikely it was that companies would install effective climate controls, like air conditioning, as the costs would be too high. The inability to take heat recovery breaks was often related to how ‘lean’ a workforce was, and whether there were enough staff available to relieve people: it ‘used to be much [easier to take breaks], but they've cut labour back now’ (manufacturing worker, Victoria); and, ‘[people often say] they’re fatigued, and that’s because [management] did chop the numbers and they’re running around’ (manufacturing worker, NSW). Another manufacturing worker in Victoria, agreed:

They've cut the numbers down on the floor of labour. So people are doing a lot more. So you know, they're all feeling fatigued. ... it's just the way, you know, management thinks ... save money, cut people. You know, it just doesn't work.

Almost half of the workers surveyed were unaware whether there was a policy or procedure for managing high heat in their workplace. Over half of the respondents said they had never been issued with a warning, advice or information about high heat or heat stress (53.1%), around a third said they had received this sort of advice (35.8%), and 11.1% were unsure. Only a quarter of workers were aware of a provision to stop work at a particular temperature in their workplace.

One manufacturing worker in Victoria said that although a new heat policy had been signed into their enterprise agreement the year before, it was unclear how it could be practically enforced as there was no clear system for taking additional breaks, no temperature gauge in the workplace, and nobody knew where to physically locate the heat policy. Another manufacturing worker in Victoria outlined similar problems:

... they just say 'look, just take it easy. Try and relax. It's going to be a hot day'. ... Like they've got a lot of stuff in writing saying if it's an extreme day, we'll rotate people, and everyone will get an extra five-minute break each hour. But that's rubbish. It just doesn't happen. You know, they say you can do it, but we just haven't got the manpower to be able to do that ...

One utility worker in South Australia, employed in his workplace for nearly 12 years, 'tried to get a heat policy in every year' as well as for there to be more workers to a crew. He reported that these efforts 'always [got] fobbed away by management'.

A few manufacturing and utilities workplaces had better practices, holding meetings on very hot days. Managers issued verbal warnings to 'take it easy'; 'we get some conversations around heat stress, what we should be doing, shade, sunscreen ... before summer especially, we'll have some toolbox meetings or conversations around that' (utilities worker, South Australia). However, what made a difference for many of these workers was whether the informal warnings were accompanied by procedures or policies for hot weather — such as an allowance to take additional breaks — and whether those policies were easily enforceable by workers.

Some workers also reported that the use of new forms of PPE to manage COVID-19 had exacerbated the impact of heat, causing an increase in rashes, dehydration, stress, headaches and fatigue. They also outlined other pandemic related changes that had negatively impacted the management of high heat, including: changes to rosters; limited or no access to lunch rooms and other air conditioned spaces because of social distancing; increased workloads; tasks needing be done more often and in the hottest parts of the days (such as cleaning outdoor play equipment); cessation of the use of air conditioning in some schools; decreased time for breaks; difficulty consuming water while in full PPE and busy; and, removal of access to cooling showers.

Climate change: Growing impacts at work

A key focus of the research was to examine whether workers believe climate change is having an impact on people's working conditions, and if so how. This question was asked at the end of the survey. Of those providing a clear response to this question (n=459), 56.2% said climate change was having an impact on their working conditions, 33.8% said it was not, and 10% were unsure. Younger workers (under 30) were more likely to say there was an impact, with almost 80% saying this was the case; for the 31-70 age bracket this fell to 50-60%. There was no significant difference between the views of women and men on this question, and there were too few non-binary respondents (n=2) from which to draw comparisons.

There was variation across states and territories. Workers in Queensland and Western Australia were less likely to cite climate change as compared with Victoria, the Northern Territory and South Australia. There was variation across industries as well. Workers in chemical manufacturing, professional and technical services, educational services, and agriculture were more likely to say climate change is having an impact on working conditions, workers in food services and repair and maintenance were less likely to draw this conclusion. However, given the small sample size for some industries, this needs to be explored in more detail in future research.

Approximately a third of respondents felt climate change was not having an impact on working conditions. These workers explained that they did not believe climate change was occurring or that, even if it is getting hotter, it is not being induced by human activity ('it's always been hot'; 'things go in cycles'). Two respondents pointed the finger at employers as the primary cause of workplace heat, stating they 'seem to be going backwards in the way they treat the common working man' or stated that the problem existed because management was being 'tight' in supplying the right PPE and suitable equipment.

About a tenth of workers responding were undecided. Respondents in this group often stated that they had not thought about it previously, they needed to do more research, or that they 'really [didn't] know enough to have a valid opinion'. Others agreed it was getting hotter for them at work, but they were unsure whether this was related to climate change or because they were getting older.

Workers who felt climate change is having an impact on working conditions often stated it was altering weather patterns and causing or contributing to hotter weather and more humid conditions, and/or resulting in heat waves and a variety of weather events including natural disasters. 'Weather patterns are changing, and global warming is affecting how and what we do', said a ranger from WA Parks and Wildlife. Workers described the hotter weather as 'harsher', 'more extreme', 'aggressive' and 'biting'. A number talked more frequent 'extreme weather' being caused by climate change. More generally, there was a sentiment that 'workplaces are not keeping up with changes to the environment' (education assistant, Queensland). A teacher's aide based in Queensland reported that changed weather patterns and increasingly hot summers had resulted in a school running out of tank water, conditions where it is far too hot to let students play outside, and more frequent cyclones and intense weather events where staff are required to work through heavy rain and wind events.

Climate change is a live discussion in some workplaces. A manufacturing worker from Victoria stated:

We have discussions at work about climate change. You got guys saying, you know, 'we've had bushfires as long as I've been here', but definitely not to the extent that we've been having the last, you know, decade or so. They've definitely become a lot more frequent.... Definitely gotten worse, for sure. And you see the temperatures in the sea levels, you know, the sea constantly rising where people say, 'nah climate, just a load of crap'. It's just delusional.

This worker was not the only respondent who drew a link between climate change and bushfires, in particular the 2019-2020 'black summer' events. This fire period killed 33 people directly, and a further 455 indirectly due to the smoke and ash pollution which enveloped four-fifths of Australia's population (Wahlquist, 2020). Several respondents said they were 'lucky' or relieved that the most recent 2020/2021 summer had been slightly cooler, but they knew hotter summers would return. One young manufacturing process worker in NSW was particularly despairing about the future considering climate change and stated in an interview: 'I've only been on this earth for like 23 years and...I would say that, yeah, climate change is sort of ruining this earth and we're left to die'.

Others focused on the more recent COVID crisis, drawing lessons about potential climate change impacts on workers. A homecare worker from Western Australia argued climate change requires immediate action and planning to protect workers and clients:

[The] team leader [asked] 'has anybody else got any questions?' ... I said, 'well, what happens if, for some reason, we can't get out to visit our clients, you know they're stuck at home, and we can't get out?' ... then we had the pandemic. So, it actually came true and there was no plan, because they all laughed and said 'no, that would never happen'. But climate change is something that I think they should be planning for. ... how are we going to look after people in their homes if we can't even leave our own homes because it's too hot?

A firefighter in the NT drew attention to the cost impacts of higher temperatures on the industry, calling for planning and increases to 'manning to allow for reduced exposure to heat at incidents'. Emergency services personnel have told us that their PPE is often state-of-the-art, but there is a concern over state funding for appropriate labour resourcing so workers can rest adequately to cool down while others take over. Similarly, another member working in health care said that the impacts of climate change might be mitigated by changing shift times to cooler parts of the day, but that 'no one wants to pay the penalty rates'.

Discussion and conclusion

Health, safety, wellbeing, and productivity impacts have broad social and economic consequences. High heat conditions not only test an individual's physical capacity to do certain types of work, but may challenge their willingness to do it, with broad implications for the labour market. Zander et al. (2018)'s survey of over a thousand Australian labour force participants found 10% intended to leave their job because of workplace heat stress. As these authors note, this may exacerbate already-existing issues of low workforce participation and high turnover rates in particular industries and regions of the country. Thus, workplace-based studies are crucial in understanding the contours of the problem, but also in

determining possible strategies for adaptation and remedy. This study contributes to a growing body of literature which attests that high heat is having immediate, acute impacts upon a significant and diverse section of Australia's working population. While the biophysical effects of higher temperatures on worker performance is well-established (Day et al., 2019), studies such as this help to develop a richer picture of how heat stress is impacting the performance of work and the wellbeing of workers, as well as how it is produced in and through different industrial contexts.

Heat stress is not simply a matter of the ambient temperature in a given working environment, or individual physiology, but is related to multiple other factors, as recognised by workers themselves in our research. The importance of workplace governance arrangements is confirmed by McInnes and colleagues (2017: 334):

The capacity of individual workers and the workplace to adapt to hot weather will be influenced by workplace heat stress management policies, awareness and knowledge of workers and employers of the dangers of heat, opportunities to acclimatise, access to information and training, and workplace facilities, amenities and practices.

While it is undoubtedly true that all these factors do, and will continue to, have an impact on the management of high heat in Australian workplaces, we must also be attentive to the social and political-economic factors involved. The production of heat, adaptation to growing heat, and the development of regulatory processes for managing the risks and impacts of climate change, are contested and embedded in social relations of power.

Large-scale, multi-country research projects have demonstrated how the relative historical and current strength of the labour movement within nation states determines the adequacy of WHS frameworks (Elling, 1989). This is pertinent in Australia where, although there are relatively strong labour laws in place, the size and strength of the trade union movement has declined since the 1980s (Humphrys, 2019). The agency of workers and their level of organisation shapes their experience of high heat. Workers with greater agency and power can often insist on mitigations such as better PPE, more scheduled breaks, or an increase in staffing levels so others can slow down or rest. Some unions have secured temperature cutoffs through enterprise bargaining, usually because of their relative industrial strength.

A study by Singh and colleagues (2015: 248) with key informants in WHS roles, unions, industry, and government, found participants believed responsibility for coping with heat sat with individuals rather than employers. They also concluded that 'prioritizing profits over worker health presents a powerful barrier to action' (Singh et al., 2015: 248). This presents a significant challenge for ensuring action and compliance on the part of employers. Many workers involved in this project explained they are required to work at rates of production that are incompatible with some of the most fundamental heat management strategies, such as slowing down, rehydrating, and taking breaks. If union organisation and activity is not revived, especially in workplaces characterised by insecure work, then workplace heat will continue to exacerbate an already precarious situation.

In line with expert international medical advice, ‘all countries, local communities, and institutions need to adopt effective heat health action plans tailored to local conditions’, and this includes across industries and workplaces (The Lancet, 2021: 641). Leading health experts argue that excess deaths and many health risks arising from heat stress are preventable with appropriate heat action plans (Ebi et al., 2021). As this research has demonstrated, many workplaces lack comprehensive plans, and many plans that are in place are insufficient in scope or not enforced. Employers are required to provide adequate resourcing for at-risk workers, such as high standard PPE, adequate hydration while at work, regular breaks, acclimatisation protocols, and sufficient personnel to ensure workers can be relieved for recovery time. Yet this study suggests these requirements are often not being met. It is also clear the Commonwealth and state and territory governments need to urgently review more broadly the management of current and likely future impacts of high heat and climate change for workers. This will necessitate sector-by-sector planning — involving labour, industry and government — to work through particular climate impacts across the diversity of the Australian workforce, and across the continent’s varied geography, and with regard to contingent and vulnerable workers.

There is also a pressing need for further research on the OHS impacts of workplace heat and other workplace impacts of climate change. A large-scale, national, diverse industry study would be timely. There would be significant benefit in such a study being cross-disciplinary, given the interplay of health, social, political-economic, education and communication issues. Such a study could also build on the findings in this project in relation to workers’ perceptions of climate change impacts at work.

As climate change continues to drive longer, hotter and more frequent heat waves, some trade unions are turning their attention to the issue of heat stress. This is an important step in bridging the perceived ‘gap’ between working conditions and the impacts of a warming world. While regulatory and enforcement changes are urgently needed, it is also important to acknowledge that these changes will only alleviate part of the burden that high heat is placing on millions of workers. Workplace and societal adaptation to climate change is not a politically neutral question, but one embedded in employment relations that are already exploitative. Understanding the socio-political determinants of effective responses to workplace heat is crucial.

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