**Managing shift work and fatigue panel discussion**

**SPEAKER:** DR PETA MILLER

Welcome to Safe Work Australia's Virtual Seminar Series. I'm delighted that we have four, international experts to actually assist us with our questions today. And I might start with Claudia. Would you mind introducing yourself to Safe Work Australia's audience?

**SPEAKER:** PROFESSOR CLAUDIA ROBERTA DE CASTRO MORENO

Thank you. I'm Claudia Moreno. I am from the School of Public Health, University of São Paulo, Brazil. I am a professor there and I study circadian rhythms, sleep, and some, diseases among shift workers and the work population in general.

**SPEAKER:** PROFESSOR DREW DAWSON

I'm Drew Dawson. I'm the director of the Appleton Institute at Central Queensland University. And we've spent about the last 20 years studying the effects of shift work and fatigue, and in particular we're interested in the impact on accidents and injuries.

**SPEAKER:** PROFESSOR HANS VAN DONGEN

I'm Hans Van Dongen. I'm the director of the Sleep and Performance Research Center and a professor in the college of medicine at Washington State University in Spokane in the United States. And my research focuses on sleep deprivation and circadian misalignment, or what it is like to be a shift worker, both in the lab and in the field.

**SPEAKER:** PROFESSOR DIANE BOIVIN

I'm Diane Boivin. I'm the director of the Centre for Study and Treatment of Circadian Rhythms at Douglas Institute, McGill University, in Montreal. And I'm studying the impact of circadian misalignment or disruption of the sleep/wake cycle, on physiological rhythm and its application to shift work, and also fatigue in the field for shift workers.

**SPEAKER:** DR PETA MILLER

So you can see we've got a very impressive line-up, today to talk to. But, Drew, before we begin into the questions, we're sitting here today at the 23rd International Symposium on Shift work and Working Time, at the lovely Uluru centre that you've got us here to. Please, can you tell us what is this symposium that you have arranged?

**SPEAKER:** PROFESSOR DREW DAWSON

Well, every two years or so around about 100 to 120 people interested in the effects of shift work and treatments for shift work get together somewhere remote and exotic in the world, and the idea is to share with a group of academics, industry partners, regulators, what's the latest research in shift work, and what we can do to minimise some of the problems that are...have been identified with shift work.

**SPEAKER:** DR PETA MILLER

Fantastic. That's great. So, I might start with you, if I could, Diane. So, for our audience, what do you mean when you're talking about shift work and working time?

**SPEAKER:** PROFESSOR DIANE BOIVIN

You can answer that question on two levels. First, on the organisational level, it means group of workers who would alternate at a given position. And in France...French, we say 'travail posté' mean that you're at a position and you rotate group of workers. At the individual level it means that you will work or end up working outside of the conventional weekday daytime hours, and often it involves working during the night-time period. And there's all sorts of organisation - either it's permanent or a regular night shift or it's rotating or... You can pretty much observe a lot of organisation of work throughout various organisation or have a regular shift, being on call, and so on. So, these are atypical work schedule.

**SPEAKER:** DR PETA MILLER

Thanks, Diane. And so, Hans, have working times and shifts changed in the last 30 years? Or are they still the same?

**SPEAKER:** PROFESSOR HANS VAN DONGEN

Well, no, they've changed in a variety of ways. I think, first of all, we've gone to an increasingly 24/7-oriented economy and society, so the burden of society on people to work at all hours of the day has increased...continues to increase ever and ever. What I think is an interesting observation to make is that the way we try to manage those hours from a regulatory point of view is starting to change as well. If we go back to the beginning of the Industrial Revolution and all the way through the past century, we see there's an emphasis on regulating work time - in other words, putting maxima on how long you can work and putting minima on how long you should be off of work before you can rotate back into the workforce. What we're seeing nowadays is a tendency towards regulating not the hours per se, but, the level of fatigue that is associated with those hours and trying to put a cap on that level of fatigue so that you try to minimise the number of errors and risks that are associated with fatigue that enter the workplace. And that's a whole different kind of way of looking at the problem. It's much more dynamic, and instead of just counting hours, what you're trying to minimise is the effect of those hours as they have on performance and safety.

**SPEAKER:** DR PETA MILLER

Drew have the working hours in Australia changed, or are they...do they reflect international patterns?

**SPEAKER:** PROFESSOR DREW DAWSON

Well, a bit of both. If you go back 20 to 30 years in Australia you will have found that there was probably half a dozen rosters that were being worked around the country. Now there are literally thousands of different rosters. For many Australians the changes in the industrial landscape over the last couple of decades and in particular the shift of negotiating shifts from, government, unions and the industrial court to a situation now where it's typically negotiated between the employer and the employee at the local site means that we have a lot more people coming up with a lot of different rosters. The other interesting aspect of that is often people are designing and approving rosters with no expertise or knowledge about it. And, as a consequence, sometimes short-term productivity gains for the company or income issues for employees tend to dominate the discussion rather than the health and safety aspects of it.

**SPEAKER:** DR PETA MILLER

Claudia, you...in your introduction, you told us that one of your expertise areas was in circadian rhythms. I wonder if you can... I understand that means our internal body clocks. I wonder if you can just unpack that a little bit more for our audience, about what is our internal body clock, and why is it important?

**SPEAKER:** PROFESSOR CLAUDIA ROBERTA DE CASTRO MORENO

Well, it is important because, we are diurnal, so we are supposed to sleep during...at night and be awake during the day. And the problem is since the body was, ... since the body is with...has functions that are predetermined by...during the evolution as diurnal, this means if you inverse your work schedule you have health problems. And it's important to understand that to do a task at three in the morning is not the same as at three in the afternoon. And this has consequences on performance, on health in general, and can also lead to a number of disease. I think it's important to understand sleep, has to be according to the individual's needs, so some people really need to sleep more than others and this is not possible when you have quicker returns to work or you don't have days off enough to recover your sleep debt during the work week.

**SPEAKER:** DR PETA MILLER

I might actually open to all of you because I know you all are researching in this area, but are there big differences between individuals, you know, or... I've been hearing some comments over the last few days at this meeting, but perhaps I could ask you to tell me about the individual differences, and are they...do they really matter?

**SPEAKER:** PROFESSOR DIANE BOIVIN

Well, I think tremendously. However, it's a point where, we need more research, because we understand very little the individual determinant that will make someone more vulnerable or resistant to shift work or sleep deprivation, and...or on developing long-term medical consequences associated with shift work. And I think Hans has very nice details to share about resistance to sleep deprivation.

**SPEAKER:** PROFESSOR HANS VAN DONGEN

Yes, so, one of the things we know is that people differ in how they respond to sleep loss and to working at odd hours, in a systematic manner, in such a way that we even think it's a trait or possibly genetically determined to some extent.

**SPEAKER:** DR PETA MILLER

Is that the sort of early morning person versus...

**SPEAKER:** PROFESSOR HANS VAN DONGEN

That's an aspect of it. It's also some people are much more, resilient to just not sleeping as much as they really should, and some people are very vulnerable when they even lose about 10 minutes of their normal sleep - you immediately see the consequences. The interesting, consequence of these differences is that with more flexible or more variable work schedules, there is, in principle, a better work schedule for every specific individual, and if we could just match the individual with the work schedule, shift work might not be as big a problem as it is today. But because we put people in shifts that are not in alignment with their normal rhythms or not in alignment with the amount of sleep that they need, we then put them in a situation where shift work becomes a problem. And this pertains to night shifts, but it also pertains to early morning shifts. If you're a person, going back to this morning/this evening thing, if you're a person who is not a morning type and you're forced to work early morning hours, that is as much shift work for your specific individual as working a night shift for somebody who is not an evening type or an owl.

**SPEAKER:** DR PETA MILLER

So, Drew, what are health consequences for,...for shift work, for people with...they're not suited to it, or even if they are doing it most of the time?

**SPEAKER:** PROFESSOR DREW DAWSON

Yeah, that's a very controversial area, Peta, and I suspect this is not going to be a satisfying answer to a lot of people, which is we have some preliminary data that shift work can cause health problems. Do we know the exact mechanisms of action and what's happening at the cellular level? No, we don't. But I think you could probably think of the health effects into a couple of broad areas. We know that there are profound effects of shift work on food metabolism and how we process food, and, at certain times of the day, certain types of food that we shouldn't eat seem a lot more attractive than at others. I think we're also starting to see some good work showing that shift work, particularly where there's sleep loss, has impact on the immune system. So there's been quite good animal and human studies showing that you can be more susceptible to infection and you can take longer to recover when you've been a shift worker. But I think there's also a lot of social consequences that lead to potential health problems. So, shift workers often eat worse food, they exercise less. Traditionally they have smoked cigarettes more, have drunk alcohol more. So, in many cases we see some of the short-term coping mechanisms for shift work also leading to long-term health consequences for shift workers. But, again, this is a very new and emerging field and one that's going to require a few more years of careful research before we start raising the red flag.

**SPEAKER:** DR PETA MILLER

So - to any of you - are there gender differences? Are men and women the same? Are there age differences? I'm thinking about times when I've had adolescent children and their sleep needs. So are there...

**SPEAKER:** PROFESSOR DIANE BOIVIN

Well, there's... The sex difference is a very, very important issue, and there is recent evidence showing that the way the circadian systems, or our body clock, controls sleep differs between men and women. And we know that there are, receptors to sexual hormones within the body, on the master clock. So, receptors to testosterone, progesterone...

**SPEAKER:** DR PETA MILLER

So could you just tell people what the master clock is?

**SPEAKER:** PROFESSOR DIANE BOIVIN

Oh, the master clock is a tiny little structure in the middle of the head at the base of the hypothalamus. We call it the suprachiasmatic nucleus. You can throw that out during a party. It looks good. But it's a tiny structure and it's like the conductor, the master component of the circadian system. So, our system of body clocks, because we know there are several clocks now. But these are really sensitive to sex hormones. And the way...and they control a lot of function and rhythms throughout the body. It's so important that we have to study the sex difference. And there's some evidence that women could be physiologically more susceptible to being sleeping during the night, and so we need to pursue these question about the influence of sex, of age, individual differences and,.. But that's a great question.

**SPEAKER:** PROFESSOR CLAUDIA ROBERTA DE CASTRO MORENO

Can I add something about sex difference? Because I think it's not only sex differences, but it's also gender differences. What is the role of women at home or men at home? And this means if you have problems to be awake at night, you also have problems to sleep during the day if you have to take care of children and to do domestic tasks. So, this can also have an impact, an important impact on the adaptation of these women at work. And it's a physiological problem but it's also a social problem.

**SPEAKER:** DR PETA MILLER

And, Hans, is there age differences?

**SPEAKER:** PROFESSOR HANS VAN DONGEN

Yeah, age differences especially in shift work are very prominent, are very clearly,...and easy to find. The general tendency is that as people get older, they have more difficulty adapting to or tolerating shift work. There's a variety of reasons for that. It's the natural ageing process, but also the responsibilities that people have. When they get older, their life situation tends to change. So it's a constellation of factors that we haven't been able to tease apart very well. But we know that in general it becomes harder and harder as you get older to be a shift worker and actually function well or deal with the circumstances.

**SPEAKER:** DR PETA MILLER

So you've been talking to me about the gender differences, some of the age differences, and some, family...who's doing the caring at home. Drew, you touched on the health consequences. I'm wondering about...what about the...are there safety implications in terms of increased accident risks, or not? Is that a myth?

**SPEAKER:** PROFESSOR DREW DAWSON

Yeah, I think there's been a lot of work in the last few years, and I think we now understand that people who work shift work get less sleep, people who get less sleep are tired and people who are tired make more mistakes, and if that happens in a workplace, they can injure themselves or others. And I think there's a pretty solid basis for making that conclusion now. I think the interesting thing, however, has been the tendency in the past to think, well, the obvious solution to people being fatigued is to make them not fatigued, and that somehow we will change their rosters in a way that fatigue will go away as a problem. I think we've matured a little bit in the last decade or two and we've now come to the realisation that if you work 24/7, even if you get a decent sleep, you're always going to be tired at 4 o'clock in the morning. And I think we're moving from a culture and a safety mentality that says, "Fatigue's a problem, let's get rid of fatigue," to saying, "Fatigue's a problem. How can we get people to work safely whilst fatigued?" And I think a lot of the development in the last couple of years has been to say, "Let's identify people who are fatigued, and then let's rethink about their job and how they do things, and who knows they're fatigued, so that tired people can deliver health care and emergency services in those kind of occupations." Because, frankly, the inability to not provide the service politically has meant that people have pretended that fatigue's not a problem and done very little about it.

**SPEAKER:** DR PETA MILLER

So, we're leading into one of the questions that I think will be of great interest to the audience. So, it's what can employers be doing in order to help accommodate tired workers? If you're saying it's a reality that some workers will need to be working even though they're sleep-deprived. And I'm opening it to the whole panel here.

**SPEAKER:** PROFESSOR DREW DAWSON

Well, from our experience in Australia - and that may not be universal around the world - the biggest and the most important step is to get the organisation to acknowledge that fatigue is a problem. We often say that fatigue is a forbidden topic of conversation - Don't mention it because it'll cost us 10% in the next EBA." And our experience has been that once organisations choose to talk about it and see what they can do to manage the risks, a lot of that can be identified and you can develop quite sensible, practical ways to reduce the risk if not always changing the roster, so I think...

**SPEAKER:** DR PETA MILLER

So the first step is to start talking about it?

**SPEAKER:** PROFESSOR DREW DAWSON

Yeah, I think opening the dialogue up and saying, "Fatigue's a problem, let's talk about it. Let's share the silly things people do when they're fatigued and let's see if we can redesign the system so even if people are tired, those mistakes don't necessarily cost lives."

**SPEAKER:** DR PETA MILLER

So, Diane and Claudia and Hans, what are some of the things that employers can do to be redesigning the system to deal with this reality that some workers will be fatigued?

**SPEAKER:** PROFESSOR DIANE BOIVIN

Well like Drew mentioned, it's very important to recognise there's a problem, an issue, and to realise that there's no perfect solution. The risk zero do not exist. So first recognise it if you want to manage it properly.

And the other message is that one size doesn't fit all. It's a complex problem that needs to be approached by several different direction in order to mitigate its risk, properly. And one recommendation may work very well in some environment. For instance, "Oh, let's try to adjust the body clock of workers to revert to a night-oriented schedule with interventions such as light." It could be OK in some situation but not at all in others… But there's some general principles such as try to sleep as much as you... can. I think these are, you know... Avoid on a daily basis sleep restriction and the build-up of sleep debt as much as you can. But there needs to be some flexibility to accommodate the various situations.

**SPEAKER:** DR PETA MILLER

So, Hans, some practical suggestions for Australian and international employers about what they can be doing to make, work...design work better?

**SPEAKER:** PROFESSOR HANS VAN DONGEN

Yes, I think if you go to the working time arrangements that are currently in place, you start to look at how did they get it to be the way they are, you oftentimes find that they are a complex mixture of interactions and decisions being made by regulators, by managers, and by employees or unions, or a labour and management and regulator triad. And, so when you talk about what can employers or what can employees or what can regulators do to help with fatigue in the workplace, you almost always enter that triad, that complex interaction and have to start negotiating that problem from a more holistic point of view. And that can, under certain circumstances, be very, difficult or controversial to do, depending on the relationships that employers, employees and regulators have with each other to begin with. It turns out, however, that if you start talking about fatigue, you spend a little time with the various different parties that are involved, and you start digging...to dig into that topic a little deeper, that you find that at the end of the day, pretty much everybody wants the same thing. Everybody wants less fatigue in the workplace, more safety in the workplace, and, if possible, also more productivity. And these things are not orthogonal. So, what I found is that to make progress in this area, if you can bring the various parties to the table and get them to understand that what they really want is all the same thing and start the dialogue, from that perspective, then then it turns out that the working time arrangements and all the complexities that went into them can also be rearranged with a common goal in mind that makes it better for everybody. Maybe not perfect for anybody, because perfect is oftentimes the enemy of the good, but you can make progress, you can make, improvements.

**SPEAKER:** DR PETA MILLER

So, your point is that consult with everybody, including the workers, and, of course, in Australian legislation that's actually a requirement.

**SPEAKER:** PROFESSOR CLAUDIA ROBERTA DE CASTRO MORENO

I just want to add to workers' parts, the workers' side, their families. It's very important to involve the families because the worker himself or herself cannot do nothing alone. So, it's important to involve the families, as well the employers, the government, the regulators, and the workers. If we start from the regulation, you don't...you will probably not reach the workers. And so you need to start together with the workers and their families to support them.

**SPEAKER:** DR PETA MILLER

And what are some practical things that families can do?

**SPEAKER:** PROFESSOR DIANE BOIVIN

OK. Well, your comment, Claudia, also raised the concept of shared responsibility, so everybody has a responsibility to manage fatigue correctly, like the worker, they should use up their rest days to recover the sleep debt, the manager, they should offer condition that allow workers to recuperate between their shifts, and the family also, they have to realise. When I live with a shift worker, it has consequences." So when the person wants to rest, you need to protect that rest. And so, as part of this process, education is extremely important. And I think all levels of the organisation of the family, you know, if they can get educated on what are the challenge of working an atypical schedule, and what can each of them do, that would help tremendously.

**SPEAKER:** DR PETA MILLER

So, I've been hearing over the course of this symposium, Drew, about some of the new technologies and interventions that are out there, and I wondered if you might talk about some of those, and perhaps our other panellists as well. I've heard about things like light therapy or using melatonin. Does any of that work? Is it something that people should be thinking about?

**SPEAKER:** PROFESSOR DREW DAWSON

Well, I think to come back to Diane's point, is that there are a lot of things that you can do, but it isn't a "one size fits all". In fact, it's a "one size doesn't fit most" situation. And I think one of the key messages is that we have seen a shift in the last 10 years, and up until about 10 years ago, the primary control mechanism was the roster and discussions around the roster. I think we've seen the emergence of a whole set of new wearable computing, in-cab monitoring technologies. There's a whole set of very slick fatigue gadgets, as they are sometimes referred to as. And I think they have enormous potential to help with fatigue. But I'd also raise a cautionary note that often in some organisations they're seen as a silver bullet that's going to solve the whole problem. And to come back to Claudia's point, is it takes a family to support a shift worker. And sometimes the appeal of a piece of technology can override the more difficult but more important things that have to be done in terms of the employer's responsibilities, the family and community, the regulators. So I think we're going to see much more sophisticated systems as a result of technology, but I'm also cautious that sometimes they can be very appealing without necessarily having the evidence to support their effectiveness.

**SPEAKER:** DR PETA MILLER

Diane and Claudia and Hans, have you got any comments about the new technologies or new techniques that might be useful, or a myth that they may help?

**SPEAKER:** PROFESSOR CLAUDIA ROBERTA DE CASTRO MORENO

Well, in my case, I have been studying truck drivers for the past 10 years, and I can say, we need to work more on that. We didn't find a very nice technology to help them to really identify when they are sleepy and what they should do, and I think that this is mainly because what they should do is to sleep, and what the employer want...wants is that the truck driver reach that or deliver that...goods, on time. So this is a kind of controversial situation. And so we need to do these things together - technology and the support of the employer - I mean, in order to make the technology work.

**SPEAKER:** PROFESSOR DIANE BOIVIN

Yeah, and I share the same opinion. And if we look at,...if we look at, for instance, technology that can predict or evaluate the fitness for duty, I think they can create a false sense of security. Let's say, for instance, you have a worker arrive at the start of a night shift. The alertness can be pretty high and he can be fine at that time, but had he known about the circadian...the way the body clock controls alertness, he would know that at that time of day maybe alertness is high but it's going to dive into a low point at the end of the night. And the challenge is that these technologies should aid in controlling fatigue at work, but they cannot be the solution, because when the fatigue levels are too high, maybe it's too late also. So you need to mix education and discussion and have group of...of employees at various levels within the organisation. And especially higher-level management should embark on this fatigue management initiative.

**SPEAKER:** DR PETA MILLER

And Hans?

**SPEAKER:** PROFESSOR HANS VAN DONGEN

I think one of the tricky parts is when you put technology in the hands of people that can freely obtain and use it, that you have to be careful about the tricky parts of human behaviour. There's an anecdotal example of truck drivers who have drowsy driving warning systems in their trucks and notice that they are being alerted to be drowsy and they decide that obviously they need to have sleep and therefore they start driving faster to make it home sooner, which is the exact wrong solution to the exact right identification of a problem. And so what...as with so many aspects of human behaviour, we know the basic principles, but how it actually plays out in practice is something that continues to be a...a topic of research, and it's really complicated.

**SPEAKER:** DR PETA MILLER

So I think we're beginning to run out of time, so I'm just going to ask all of you to give one concluding practical suggestion for our viewers on what a worker or an employer can be doing to actually minimise the health and safety consequences of fatigue.

**SPEAKER:** PROFESSOR DREW DAWSON

I'm going to go for the cultural one and say it's OK to talk about it, and that if we have that dialogue we should be able to solve the problem, and it doesn't always require high-tech solutions. Just knowing that the person you're working with is tired will change the way you observe, interact and regulate their behaviour. And we see that kind of stuff happening in workplaces all the time, so I think there's some very good low-tech solutions that come when people think it's OK to talk about this topic and to share with others when they are fatigued, and particularly with their managers and people within the organisation who are responsible for managing the safety of that organisation.

**SPEAKER:** DR PETA MILLER

So speak up and tell people when you're tired.

**SPEAKER:** PROFESSOR DREW DAWSON

Yes.

**SPEAKER:** PROFESSOR CLAUDIA ROBERTA DE CASTRO MORENO

Well, I think I could say a number of things, but...I go for the dialogue as well. I think it's more important to, think about education programs that can actually be done in companies, with employers and employees, and also link this to the research world. I mean, this mean...this needs to be, close, very close. We need to work together - the university, researchers, the companies and the real world. I think this is the most important thing.

**SPEAKER:** PROFESSOR DIANE BOIVIN

Oh, OK. Yeah, I agree with, all that is said and it's important to talk about it but also to do something about it.

And, you know, we're researchers, scientists. We know the problem. We're trying to transfer the knowledge. But probably the solution will come from the workplace environment. So what do you do with this observation about fatigue? What can be done? What do you do if a worker says, "Oh, I think I'm too tired. I'm not fit for duty"? You need to start thinking ahead of time of alternative scenarios, plan B. A B plan, sorry. And... make sure that you are proactive as an organisation and have an open dialogue and... You know, make the workers feel that they can discuss that issue and that something is going to be done about it.

**SPEAKER:** PROFESSOR HANS VAN DONGEN

So, we tell people... people like myself will tell people that it would be really great if you could sleep eight hours and if you could do it in the night and you could have a regular schedule and all those things that in shift work settings are basically pretty much impossible. I think the one piece of advice that I would give is be aware of the simple but perhaps not correct solution. We have a tendency to ask, "Just tell me what to do. Just tell me how to solve this problem." And, both from the research perspective and from the organisational perspective we don't necessarily have all the answers yet, which means that we don't...we cannot necessarily give you a one-size-fits-all answer to those complicated questions. But I would also suggest that sometimes the answer has already been found. Sometimes the answer is already in the organisation, in the individuals. They've already come up with a solution to make things work.

**SPEAKER:** DR PETA MILLER

So is that things like having power naps or having better lighting?

**SPEAKER:** PROFESSOR HANS VAN DONGEN

Yeah. So... sanctioned napping in the workplaces can be a really good solution. It depends on the workplace. And in some workplaces we find it works really well. Commuting where you share rides home, to increase safety is an example of that. So, people have found solutions that can, in their particular circumstances, be just perfectly fine. And I would suggest that yes, there is always room for improvement, but don't throw overboard the things you've already figured out that actually do work.

**SPEAKER:** PROFESSOR DIANE BOIVIN

And maybe... You make me think about something which is, Hans, very important - that people often, they keep the model of a day...of a normal day-oriented schedule as a goal to achieve. Let's say, try to sleep in one single sleep episode and go as close as we can to, you know, normal behaviour. Actually, this can be quite detrimental in some work organisation, and the model that you have to sleep in one single period can actually increase fatigue. So, it's OK to have split sleep schedule. That can actually help you go through your work roster with minimal alertness impairment. And so you have to think outside of the box, basically.

**SPEAKER:** DR PETA MILLER

So it's more important to get the amount of sleep even if it's not all in one go?

**SPEAKER:** PROFESSOR DIANE BOIVIN

Exactly.

**SPEAKER:** DR PETA MILLER

Thank you very much. Is there anything, any concluding comments that you want? We've heard about a little bit of a power nap... I hear this really strong message about the need...there's no silver bullet. It's about getting enough sleep. I hear a really strong message about talking with workers in the workplace and trying to identify some practical solutions, because shift work is with us whether we like it or not. Are there any final concluding comments that you think that we should be taking home today?

**SPEAKER:** PROFESSOR DREW DAWSON

Again, going back to the notion of dialogue, it's very interesting when you go and talk to organisations and say, Tell us the dumb stuff you do when you're tired," and just having that conversation so people can then work out how to rework the workplace in ways that stops those errors happening. Health care, emergency services, defence, are all full of examples of where people, as Hans has pointed out, are already doing things to manage fatigue well, but they're not formal elements in the safety management system and, in many cases, they're procedural violations, despite the fact that they're making the place safe.

That sounds like that's a topic for another conversation, Drew, perhaps offline.

**SPEAKER:** PROFESSOR CLAUDIA ROBERTA DE CASTRO MORENO

I'd like to say there is not a single solution. Although we are discussing this in an international meeting, there is not a solution that can fit every country or all companies, different places, different categories of workers. We need to understand that it can be different depending...according to the case. And this, I think, it's my final message.

**SPEAKER:** DR PETA MILLER

What's the role of the health and safety representative, and do they need more information about the health and safety consequences of shift work and long working hours?

**SPEAKER:** PROFESSOR HANS VAN DONGEN

Yeah, I think that's an excellent question, and just like most other, aspects of running a business, it's an expertise that is required to be a part of the organisation to function fully. Just like, bookkeeping and your engineer and your building manager and all these people that have certain expertise, this is an area of expertise that needs to be brought into an organisation that is based on shift work. So if there is a person or a department where that has a natural fit, it stands to reason to make sure that these people are educated on the topic and that they can propagate that knowledge towards the workforce. Now, I would also submit that it's...that, obtaining that knowledge is not something you can just do overnight. That requires some training. And, as we've already discussed in this panel, there is some research that is starting to evolve but isn't really sorted out yet. And so I would submit that with Drew having brought together here a hundred or so experts in the world, maybe designated people in organisations can start to reach out to people like us so that we can then propagate the research and the knowledge base to the organisational officials that can subsequently translate it to the actual workplace.

**SPEAKER:** DR PETA MILLER

I've heard a question from the audience which I think is an excellent one, quite a challenging one, is what's the role of your group to actually feed in to groups like the ILO in terms of informing international conventions on working hours?

**SPEAKER:** PROFESSOR DREW DAWSON

That's a really difficult question, Peta, and it's the $64,000 question in a sense. One of the challenges is that regulatory agencies around the world often try to come up with a one-size-fits-all solution. And we have enough trouble getting a one-size-fits-all solution in one organisation and one group of workers, let alone something that's going to cover everybody all around the world. So, I think the goal of groups like us is to focus people on letting go of prescriptive approaches to legislation. I think promoting performance-based regulatory frameworks is very important. But I'll also make the comment that global and UN-based regulatory bodies are not embracing performance-based regulation or legislation just yet, and I think that's a very slow global process that's going to take decades from its birth in 1972 and the Robens reforms in the UK. I suspect if we come back in 2072 we might start to see that, but I suspect, like most things at a global level, it takes a long time. And I'd be interested in the others' views from different cultures. I think Australia and English-speaking countries in general have pushed very rapidly into the performance-based approaches, especially to fatigue. But I also know in other countries that's not popular, and I know many other countries where the idea of regulating shift work and fatigue is the least of their problems, and they're more worried about a host of other problems before we worry about a few tired shift workers.

**SPEAKER:** PROFESSOR DIANE BOIVIN

Also to add to Drew's comment, what is important is not only consider the work roster, the work shift organisation, but also the workload, because if the workload is low, and the risk associated with being fatigued at work is low, then the work hours can change, and these need to be taken into consideration. And so arriving with, international guidelines that should be followed would, I think, put an organisation at disadvantage in terms of flexibility and really recognising and mitigating their own risk. So they have to be adapted to the nature of the task, the nature of the organisation, and... there needs to be some flexibility.

**SPEAKER:** DR PETA MILLER

I'd just like to thank you all for joining us today in this panel discussion. And I look forward to meeting with you all professionally on another occasion.