

# Should daylight saving be abolished?

## What they said...

*'I can tell you unambiguously now, there are social and environmental costs associated with daylight savings time because of the pollution emissions and carbon dioxide emissions contributing to climate change'*

**Matthew Kotchen, a University of California-Santa Barbara economics professor**

*'The chamber is fully supportive of adopting daylight saving here on the Gold Coast, not least because of our geographical positioning, because of the impact it has on our close neighbours and staff just over the border'*

**The Gold Coast Chamber of Commerce expressing its support for Queensland adopting daylight saving time**

## The issue at a glance

On November 6, 2018, as part of the United States Midterm Election, nearly 60 per cent of Californian voters supported Proposition 7, a measure that gives the state legislature the ability to establish Daylight Saving Time (DST) all year-round.

<https://www.vox.com/midterm-elections/2018/11/7/18071628/california-proposition-7-results-ballot-daylight-saving-time-all-year-round> This would mean no more turning clocks an hour forward or back — clocks would remain an hour forward, even in the wintertime, giving more darkness in the morning and less at night.

For the permanent establishment of daylight saving to come into effect the change will have to be supported by a two-thirds majority vote in the Californian state legislature.

Two months earlier, on August 31, 2018, the president of the European Commission, Jean-Claude Juncker, announced that millions of Europeans surveyed on having DST operate all year had voted in support of the proposal. 84 per cent of 4.6 million respondents called for ending the spring and autumn clock change. The Commission's proposal requires support from the 28 national governments and Members of the European Parliament to become law.

<https://www.bbc.com/news/world-europe-45366390>

Despite these evidences of the popularity of DST, the arrangement remains controversial in all those jurisdictions where it is in place. In Australia, Western Australia, the Northern Territory and Queensland do not adopt DST each year, putting them out of step with other Australian states and territories.

There has been consistent agitation from Queensland's business community to have the state adopt daylight saving time when the southern states do so. However, there is opposition from northern Queenslanders, with some threatening to secede from the south should it be introduced. Former Premier, Anna Bligh, rejected a serious push to have DST introduced in the state late last decade, because of the extreme opposition of some of the residents of the state's rural hinterland. <https://www.news.com.au/lifestyle/real-life/news-life/is-it-time-for-australia-to-rethink-daylight-saving/news-story/ceecb1742e0fdb92472c9edd07fa52d>

## Background

The information below is abbreviated from the Wikipedia entry titled 'Daylight Saving Time' and from the Wikipedia entry titled 'Daylight saving time in Australia'

The full entries can be accessed at [https://en.wikipedia.org/wiki/Daylight\\_saving\\_time](https://en.wikipedia.org/wiki/Daylight_saving_time) and [https://en.wikipedia.org/wiki/Daylight\\_saving\\_time\\_in\\_Australia](https://en.wikipedia.org/wiki/Daylight_saving_time_in_Australia)

Daylight saving time (DST) is the practice of advancing clocks during summer months so that evening daylight lasts longer, while sacrificing normal sunrise times. Typically, regions that use daylight saving time adjust clocks forward one hour close to the start of spring and adjust them backward in the autumn to standard time. In effect, DST causes a lost hour of sleep in the spring and an extra hour of sleep in autumn.

#### First proposals of daylight saving

The New Zealand entomologist, George Hudson, first proposed modern DST. Hudson's shift-work job gave him leisure time to collect insects and led him to value after-hours daylight. In 1895 he presented a paper to the Wellington Philosophical Society proposing a two-hour daylight-saving shift, and after considerable interest was expressed in Christchurch, he followed up with an 1898 paper. Many publications credit DST proposal to the prominent English builder and outdoorsman William Willett, who independently conceived DST in 1905 during a pre-breakfast ride, when he observed with dismay how many Londoners slept through a large part of a summer day. An avid golfer, Willett also disliked cutting short his round at dusk. His solution was to advance the clock during the summer months, a proposal he published two years later. The Liberal Party member of parliament (MP) Robert Pearce took up Willett's proposal, introducing the first Daylight Saving Bill to the House of Commons on February 12, 1908. A select committee was set up to examine the issue, but Pearce's bill did not become law, and several other bills failed in the following years. Willett lobbied for the proposal in the United Kingdom until his death in 1915.

#### The adoption of daylight saving time around the world

Port Arthur, Ontario, Canada, was the first city in the world to enact DST on July 1, 1908. This was followed by Orillia, Ontario, introduced by William Sword Frost while mayor from 1911 to 1912.

The first states to adopt DST nationally were those of the German Empire and its World War I ally Austria-Hungary commencing April 30, 1916 as a way to conserve coal during wartime. Britain, most of its allies, and many European neutrals soon followed. Russia and a few other countries waited until the next year, and the United States adopted daylight saving in 1918.

Broadly speaking, most jurisdictions abandoned daylight saving time in the years after the war ended in 1918. However, many different places adopted it for periods of time during the following decades and it became common during World War II. It became widely adopted, particularly in North America and Europe, starting in the 1970s as a result of the 1970s energy crisis. Since then, the world has seen many enactments, adjustments, and repeals.

#### Daylight savings time in Australia

The choice of whether to use daylight saving time (DST) in Australia is a matter for the individual states and territories. However, during World War I and World War II all states and territories had daylight saving. In 1968 Tasmania became the first state since the war to practise daylight saving. In 1971, New South Wales, Victoria, Queensland, South Australia, and the Australian Capital Territory followed Tasmania by observing daylight saving. Western Australia and the Northern Territory did not. Queensland abandoned daylight saving time in 1972. Queensland and Western Australia have observed daylight saving over the past 40 years from time to time on trial bases.

New South Wales, the Australian Capital Territory, Victoria, Tasmania and South Australia observe DST every year. This has resulted in three time zones becoming five during the daylight-saving period. South Australia time becomes UTC+10:30, called Central Daylight Time (CDT), possibly with "Australia" prefixed (ACDT). The time in the southeastern states

becomes UTC+11, using 'Eastern' in the time zone name, Eastern Daylight Time (EDT), respectively Australia Eastern Daylight Time (AEDT).

Officially, the change to and from DST takes place at 2:00 am local standard time (which is 3:00 am DST) on the appropriate Sunday. Of the states that observe DST, most began on the last Sunday in October, and ended on the last Sunday in March, until 2008. Tasmania, owing to its further southern latitude began DST earlier, on the first Sunday in October, and ended on the first Sunday of April. On 12 April 2007, New South Wales, Victoria, Tasmania and the Australian Capital Territory agreed to common starting and finishing dates for DST. From the 2008/09 period, the start of DST in these states and in South Australia commences on the first Sunday in October and ends on the first Sunday in April. Western Australia became the only state to observe daylight saving from the last Sunday in October to the last Sunday in March. Since 2009 Western Australia no longer observes daylight saving.

Queensland (AEST UTC+10), Northern Territory (ACST UTC+9:30) and Western Australia (AWST UTC+8) do not observe DST.

## **Internet information**

On November 9, 2018, The Guardian published a report titled 'Permanent daylight saving? California springs ahead with bold initiative' which details California electors' support for a proposal which would see daylight saving time introduced on a full-time basis in their state. The full text can be accessed at <https://www.theguardian.com/us-news/2018/nov/09/california-permanent-daylight-saving-time-vote-prop-7>

On November 5, 2018, The Conversation published an opinion piece by Lisa Kramer, Professor of Finance, University of Toronto, titled 'Here's what happens the day after the clocks change'

The article considers some of the negative aspects of the time change and suggests that these could be avoided were DST to be adopted all year round as is being proposed by the European Union.

The full text can be accessed at <https://theconversation.com/heres-what-happens-the-day-after-the-clocks-change-106243>

On November 3, 2018, Business Insider published an article by Hilary Brueck titled 'Daylight Saving Time is literally killing us' which details a wide range of adverse side effects attributed to the adoption of daylight saving time.

The full text can be accessed at <https://www.businessinsider.com/daylight-saving-time-is-deadly-2018-3/?r=AU&IR=T>

On October 5, 2018, SBS published a report titled 'Daylight saving on the agenda as most states ready to wind clock forward' which considers the push by key industry bodies to have daylight saving time adopted across Australia.

The full text can be accessed at <https://www.sbs.com.au/news/daylight-saving-on-the-agenda-as-most-states-ready-to-wind-clock-forward>

On September 18, 2018, ABC's Radio National published an analysis by David Sparkes titled 'Nearly 50 years on, we're still arguing about whether daylight saving time is a boon or a blight'

The piece considers a range of arguments for and against the manner in which daylight saving time has been adopted in Australia.

The full text can be accessed at <https://www.abc.net.au/news/2018-09-18/daylight-saving---still-arguing-about-it-50-years-on/10265160>

On September 1, 2018, CNN published a report titled 'EU plans to abolish daylight saving time and make summer last forever' which details the European Union's plans to introduce daylight saving time on a year-long basis.

The full text can be accessed at <https://edition.cnn.com/2018/08/31/europe/eu-abolish-daylight-saving-time-intl/index.html>

On August 31, 2018, The Independent published a report titled 'EU set to stop countries turning clocks back and forwards for daylight saving' which details the European Commission's intention to adopt DST all year round and the widespread support for the proposal.

The full text can be accessed at <https://www.independent.co.uk/news/world/europe/eu-daylight-saving-time-stop-member-countries-clocks-back-forward-summer-a8516426.html>

On March 29, 2018, The Conversation published an opinion piece by Andrew C. Worthington, Professor of Finance, Department of Accounting, Finance and Economics, Griffith University, titled 'Daylight saving can boost the economy but Australia needs to make it uniform' arguing for the advantages of adopting daylight saving time so long as the change is implemented across the country.

The full text can be accessed at <https://theconversation.com/daylight-saving-can-boost-the-economy-but-australia-needs-to-make-it-uniform-93727>

On March 12, 2018, Popular Mechanics published a comment by Dan Nosowitz titled 'Why Daylight Saving Time Is Actually Great'

The article challenges many of the objections to daylight savings as exaggerated and narrowly based.

The full text can be accessed at

<https://www.popularmechanics.com/science/environment/a18011/in-defense-of-daylight-saving-time/>

On March 8, 2018, CNN published a report titled 'Why daylight saving time can be bad for your health' which examines a range of adverse health effects associated with daylight savings time.

The full text can be accessed at <https://edition.cnn.com/2016/03/11/health/daylight-saving-time-health-effects/index.html>

On February 14, 2018, Broadsheet Brisbane published an opinion piece by Sonja Mapleston titled 'Why Can't We Have Daylight Saving in Brisbane, and What Are the Costs?' which considered the advantages of Queensland adopting daylight savings time and some of the arguments put against the proposal.

The full text can be accessed at <https://www.broadsheet.com.au/brisbane/city-file/article/why-cant-we-have-daylight-saving-brisbane-and-what-are-costs>

On October 31, 2017, Live Science published an article by contributor Samantha Mathewson titled 'Daylight Saving Crime: When Clocks Fall Back, Assaults Spike' The article examines evidence suggesting that putting the clock forward an hour reduces the incidence of a number of types of crime.

The full text can be accessed at <https://www.livescience.com/60806-daylight-saving-time-linked-to-assault.html>

On October 13, 2017, Business Insider published a wide-ranging comment by Dave Mosher titled 'Daylight-saving time is a curse against humanity, and we should end it forever' which considers a variety of adverse consequences attributed to the introduction of daylight saving time.

The full text can be accessed at <https://www.businessinsider.com.au/daylight-saving-time-dst-alternatives-arguments-against-2017-10?r=US&IR=T>.

On October 1, 2017, The Queensland Times published a background piece giving a brief history of the adoption of daylight saving time in Australia.

The text can be accessed at <https://www.qt.com.au/news/daylight-saving-why-do-we-and-dont-we-do-it/3229801/>

On March 12, 2016, Business Insider published an article by Jennifer Welsh and Sarah Kramer titled 'Daylight-saving time is bad for your health and the economy' which considers the negative impacts on individual health and on the economy of daylight saving time.

The full text can be accessed at <https://www.businessinsider.com/daylight-savings-time-bad-health-effects-sleep-2016-3/?r=AU&IR=T>

In September, 2014, Brake, the British road safety lobby group updated its website presenting information demonstrating the favourable impact on accident rates attributable to the introduction of daylight saving time.

This information can be accessed at <http://www.brake.org.uk/facts-resources/15-facts/473-time-to-put-the-clocks-forward>

On November 1, 2014, Business Insider published an article by Jennifer Welsh and Chelsea Harvey titled 'Daylight Saving Time Is Bad For Your Health' which examines some of the adverse health effects attributed to the switch to daylight savings time.

The full text can be accessed at <https://www.businessinsider.com.au/health-effects-of-daylight-saving-time-2014-10?r=US&IR=T>

On March 9, 2008, The Star published an article by Catherine Porter titled 'Why daylight saving time is bad for the environment' which details some of the negative environmental impacts associated with daylight savings time.

The full text can be accessed at

[https://www.thestar.com/news/insight/2008/03/09/why\\_daylight\\_saving\\_time\\_is\\_bad\\_for\\_the\\_environment.html](https://www.thestar.com/news/insight/2008/03/09/why_daylight_saving_time_is_bad_for_the_environment.html)

## **Arguments for abolishing daylight saving**

### **1. Daylight saving is injurious to human health**

Daylight saving has been judged as harmful to human health because it disrupts circadian rhythms with a range of adverse consequences.

Dr Michael J. Brues, writing for WebMD, has stated, 'Moving our clocks in either direction changes the principal time cue -- light -- for setting and resetting our 24-hour natural cycle, or circadian rhythm. In doing so, our internal clock becomes out of sync or mismatched with our current day-night cycle.' <https://www.webmd.com/sleep-disorders/features/coping-with-time-changes>

A study, published in 2007 in the journal BMC Biology, combined surveys from 55,000 people in central Europe with data on 50 individuals' sleeping and wakefulness patterns for eight weeks around the shifts to and from daylight saving time. The researchers found people

never fully adjust their circadian rhythms to the hour shift associated with daylight saving time. <https://www.livescience.com/18967-daylight-saving-time-sleep.html>

In an interview on the ABC's Radio National on September 18, 2018, Professor Thomas Kantermann, an expert on chronobiology (the study of biorhythms) at the University of Applied Sciences for Economics and Management in Germany, has stated, 'We are like other animals... we have this biology ticking in us that tries to synchronise us with the environment, and adding this artificial clock change, this pretending we are moving into a different time zone — it just irritates...

If you have morning light, you synchronise with the day, and it helps you to fall asleep at an adequate time in the evening. If you have no daylight in the morning and only daylight or brighter light in the latter part of the day or the evenings, it makes you sleep later; it shifts your clock into the night.' <https://www.abc.net.au/news/2018-09-18/daylight-saving---still-arguing-about-it-50-years-on/10265160>

In an article published in The Conversation on October 5, 2018, Oliver Rawashdeh, Lecturer in Biomedical Sciences at the University of Queensland, stated, 'Changing the clock alters the body's rhythmic production of melatonin, the hormone produced when it gets dark, and cortisol, the stress hormone. These regulate when we feel like going to sleep, when we're hungry, and our ability to fight off bugs. This misalignment is a form of jetlag, and can upset the body's rhythms. It can affect our ability to think clearly and can increase the risk of heart attacks, depression, and even miscarriage.' <https://theconversation.com/how-the-switchover-to-daylight-saving-time-affects-our-health-93646>

Dr Rawashdeh has further noted, 'Several studies have shown your risk of having a heart attack (myocardial infarction) and stroke increases in the two weeks after the changeover, compared with the two weeks before. The risk is highest in the first three weekdays following the switchover...

[While] a 2017 study of IVF patients found a greater chance of pregnancy loss after embryo transfer in spring, when daylight saving time began: 24.3%, as opposed to 15.5% before daylight saving time.' <https://theconversation.com/how-the-switchover-to-daylight-saving-time-affects-our-health-93646>

A CNN report published on March 8, 2018, further noted, 'A 2016 study found that the overall rate for stroke was 8% higher in the two days after daylight saving time. Cancer victims were 25% more likely to have a stroke during that time, and people older than 65 were 20% more likely to have a stroke.' <https://edition.cnn.com/2016/03/11/health/daylight-saving-time-health-effects/index.html>

## 2. Daylight saving is psychologically harmful

DST has been associated with an increased incidence of depression.

Psychologists have noted that the master biological clock, situated in the anterior hypothalamus, plays a vital role in orchestrating the circadian rhythms of multiple biological processes. Increasing evidence points to a role of the biological clock in the development of depression. In seasonal depression and in bipolar disorders it seems likely that the circadian system plays a significant part in the genesis of the disorder.

<https://www.ncbi.nlm.nih.gov/pubmed/21476953>

Bertel Hansen of the political science department at the University of Copenhagen examined nationwide data between 1995 and 2012 from the Danish Psychiatric Central Research Register, which included 185,419 depression diagnoses. One of his group's findings was that it takes about 20 weeks after the time change to DST for the number of depression diagnoses to level off. <https://theweek.com/articles/659390/science-why-daylight-saving-time-bad>

It has also been suggested that DST is related to an increase in male suicides in Australia. A study published in 2008 in the journal *Sleep and Biological Rhythms* found an uptick in

suicides in Australian men during the first weeks after daylight saving time.

<https://www.businessinsider.com.au/health-effects-of-daylight-saving-time-2014-10?r=US&IR=T>

Australian suicide data from 1971 to 2001 were assessed to determine the impact on the number of suicides of a one hour time shift due to daylight saving. The results confirm that male suicide rates rise in the weeks following the commencement of daylight saving, compared to the weeks following the return to eastern standard time and for the rest of the year. After adjusting for the season, prior to 1986 suicide rates in the weeks following the end of daylight saving remained significantly increased compared to the rest of autumn. This 2008 study suggests that small changes in chronobiological rhythms are potentially destabilizing in vulnerable individuals.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1479-8425.2007.00331.x>

DST has also been connected to anxiety and lapses in emotional control. In 2015, research from Tel Aviv University found sleep disruption can stir anxiety and increase the likelihood of emotional outbursts. <https://www.goodtherapy.org/blog/daylight-saving-times-effect-on-mental-and-physical-health-0317162>

It has also been suggested that the adoption of DST adversely affects students' test performances. A study published in the Journal of Neuroscience, Psychology, and Economics suggested there was a surprisingly strong negative relationship between imposition of the time policy in a geographic area and SAT scores of local high school students.

<http://psycnet.apa.org/record/2010-22968-001>

It has been suggested that adopting DST on an ongoing basis, so as to avoid the heightened negative affects which seem to occur immediately following the annual adoption of DST may not be the solution. In an article published in Psychology Today on October 5, 2017, Dr Judith Wurtman suggested, 'The increased hour of darkness in the morning resulting from not switching to Standard Time may potentiate symptoms of a winter depression or seasonal affective disorder.' <https://www.psychologytoday.com/au/blog/the-antidepressant-diet/201710/would-permanent-daylight-saving-time-prevent-depression>

### 3. Daylight saving is environmentally harmful

Opponents of daylight saving argue that it increases energy consumption and the production of greenhouse gases and thus is environmentally damaging.

Studies conducted in the United States have demonstrated that power usage has increased as a result of daylight saving. It is claimed that energy demands for both cooling and heating have grown as a result of daylight saving. A study conducted in Indiana post 2006 concluded, 'The largest effects occurred in the summer – when shifting clocks forward aligns our lives with the hottest part of the day, so that people tend to use more air conditioning – and late fall, when we wake up in a cold dark house and use more heating, with no reduction in lighting needs.' <https://theconversation.com/is-daylight-saving-time-worth-the-trouble-research-says-no-86739> Residential electricity consumption was estimated to have increased by between one and four per cent.

Commenting on the effects observed in Indiana, Catherine Porter, writing for The Star in March, 2008, noted, 'Instead of saving electricity and money by adding an extra hour of sunlight to evenings most of the year, it cost Indiana homes an extra \$8.6 million in electricity bills – mostly from chugging air conditioners – each year. And since 95 per cent of that extra energy was generated by coal-fired power plants, that meant much more atmosphere-warming carbon dioxide was spewed into the air.'

[https://www.thestar.com/news/insight/2008/03/09/why\\_daylight\\_saving\\_time\\_is\\_bad\\_for\\_the\\_environment.html](https://www.thestar.com/news/insight/2008/03/09/why_daylight_saving_time_is_bad_for_the_environment.html)

Also referring to the effects observed in the Indiana study, Matthew Kotchen, a University of California-Santa Barbara economics professor, has stated, 'In Indiana, I can tell you unambiguously now, there are social and environmental costs associated with daylight savings time because of the pollution emissions and carbon dioxide emissions contributing to climate change.'

[https://www.thestar.com/news/insight/2008/03/09/why\\_daylight\\_saving\\_time\\_is\\_bad\\_for\\_the\\_environment.html](https://www.thestar.com/news/insight/2008/03/09/why_daylight_saving_time_is_bad_for_the_environment.html)

In another study, scientists used the extension of daylight saving time in some states in Australia during the 2000 Olympics to examine the real-world effects of the policy.

'Our results show that the extension failed to conserve electricity,' the researchers wrote in their 2007 report. <http://ftp.iza.org/dp2704.pdf> In fact, energy usage went up with additional daylight savings, especially in the mornings. <https://www.livescience.com/56725-does-daylight-saving-time-save-energy.html>

Critics of the supposed energy-saving benefits of daylight saving argue that early predictions of such gains were originally based on the savings to be made from reduced use of lighting. Contemporary studies have indicated that modern lighting is now much more energy-efficient than was the case when daylight saving policies were originally adopted. Thus the actual energy savings from reduced use of artificial light are now quite low. What has increased is the reliance on air-conditioning which together with the greater use of heating due to early morning starts has resulted in an increase rather than a reduction in energy consumption.

<https://www.livescience.com/56725-does-daylight-saving-time-save-energy.html>

This position was summed up by John Stromberg, in an article published in Vox on November 1, 2015. Stromberg stated, 'Despite the fact that daylight saving time was introduced to save fuel, there isn't strong evidence that the current system actually reduces energy use — or that making it year-round would do so, either. Studies that evaluate the energy impact of DST are mixed. It seems to reduce lighting use (and thus electricity consumption) slightly but may increase heating and AC use, as well as gas consumption. It's probably fair to say that energy-wise, it's a wash.'

<https://www.vox.com/2015/11/1/9640018/daylight-saving-time-year-round>

Additionally, DST increases petrol consumption. It has been suggested this is because evening activities – and the vehicle use they require – increase with the extra hour of daylight. <https://www.businessinsider.com.au/daylight-saving-time-dst-alternatives-arguments-against-2017-10?r=US&IR=T>.

#### 4. Daylight saving promotes accidents

Numerous studies have linked both the beginning and the end of daylight saving with an increase in automobile and some workplace-related accidents.

According to a Texas A & M University study, the week after daylight saving ends there is a 7% increase in traffic accidents, with a 14% increase in morning accidents. Dr. Alfred Lewy, director of the Sleep and Mood Disorders Laboratory at Oregon Health & Science University, has stated, 'Just like when you have jet lag, your performance falls. Your cognitive abilities decrease... Even though you're not [necessarily] sleep deprived, your [circadian] rhythms aren't adjusted, and that produces deficits in performance.'

<https://restonic.com/blog/daylight-saving-time-causes-accidents-fatigue-disrupted-sleep-347853>

The connection between fatigue and the proclivity to suffer an accident is well established. A 2004 study of 400 United States Army motor-vehicle collisions found a correlation 'between insufficient sleep and driver-at-fault accident.' A 2008 National Transportation and Safety Board report 'noted that train crew fatigue resulted in the failure of the engineer and conductor to appropriately respond to wayside signals governing the movement of their train,

resulting in three deaths and \$5.85 million in damages.'

<https://www.theatlantic.com/business/archive/2014/03/be-careful-workplace-injuries-spike-following-the-switch-to-daylight-saving-time/284327/>

Relatedly, it has been claimed that workplace accidents increase following the change to DST. Researchers from the Michigan State University have analysed 23 years of data from the Mine Safety and Health Administration to determine potential links between DST and accident rates. On average, 3.6 more injuries occurred on the Mondays following the switch to daylight saving time compared to other days, and 2,649 more days of work were lost as a result of those injuries. <https://www.ehstoday.com/safety/news/daylight-saving-time-increased-workplace-injuries-2130>

Researchers have argued that loss of sleep, in addition to the disruption to circadian rhythms, is a significant factor in causing DST-related accidents. The sleep deprivation mechanism is triggered by the transition into DST, when clocks jump forward an hour on the transition date. This creates a 23-hour transition day, rather than the standard 24-hour days people are accustomed to. While this “missing” hour could be cut from work or leisure time, researchers Barnes and Wagner (2009) find that Americans make up the majority of the missing time by sleeping less. Using the American Time Use Survey, the researchers found Americans sleep an average of 40 minutes less on the night of the spring transition. Research conducted in 1997 found that depending on the individual, this transition can impact sleep patterns for anywhere from two days to two weeks with an average of about one week.

<https://pubs.aeaweb.org/doi/pdfplus/10.1257/app.20140100> It has been estimated that car crashes in the United States caused by sleepy daylight-saving drivers cost 30 additional lives over the nine-year period from 2002-2011. <https://www.businessinsider.com/daylight-saving-time-is-deadly-2018-3/?r=AU&IR=T>

##### 5. Daylight saving leads to a decrease in productivity

It has been claimed that lost sleep and the disruption of circadian rhythms results in reduced productivity.

David Wagner and Christopher Barnes, professors of management at the University of Oregon and University of Washington argue that daylight saving results in lost productivity. Their studies found office-based 'workers tend to "cyberloaf"', using computers for non-work purposes, on Mondays after a shift to Daylight Saving. One study, sponsored by a foam and cushion manufacturer, estimated a national productivity loss of nearly \$434 million — about \$1.65 per person. <http://fortune.com/2016/03/12/daylight-saving-time-effects/>

An index from Chmura Economics & Analytics, released in 2013, suggests that the cost could be up to \$434 million in the United States alone. That is an estimated total of all of the health effects and lost productivity attributed to daylight saving.

<https://www.businessinsider.com/economic-and-health-effects-of-daylight-saving-time-2014-3/?r=AU&IR=T>

Till Roenneberg, a chronobiologist at Ludwig-Maximilians University in Munich, Germany, has conducted research which indicates that the human body's circadian clock, kept in tune by light and darkness, never adjusts to the changing chronology of DST.

In an interview conducted with National Geographic in 2010, Roenneberg stated, 'Light doesn't do the same things to the body in the morning and the evening. More light in the morning would advance the body clock, and that would be good. But more light in the evening would even further delay the body clock...

The consequence of that is that the majority of the population has drastically decreased productivity, decreased quality of life, increasing susceptibility to illness, and is just plain tired.' [13/11/131101-when-does-daylight-savings-time-end-november-3-science/](https://www.businessinsider.com/when-does-daylight-savings-time-end-november-3-science/)

The impact of reduced sleep and circadian disruption on human function has been studied extensively. Electro-encephalograph data show decrements in central nervous system arousal as a function of increased sleepiness. Brain imaging studies of sleep-deprived participants have found that the greatest decrease in cerebral metabolic rate is in the prefrontal cortex. The prefrontal cortex is an especially important part of the brain for such functions as temporal memory and divergent thinking tasks as well as control of emotional responses and attention. Consistent with this contention, empirical research indicates that sleep is an important determinant of alertness and attention deployment and control.

<https://www.apa.org/pubs/journals/releases/apl9451317.pdf> All these sleep-related impairments reduce productivity by reducing human efficiency in the workplace.

The impact of sleep deprivation on human decision making suggests that there is a relative loss in the capacity to weigh a range of conflicting factors when forming a decision. A recent study found that judges hand out harsher sentences — 5% longer in duration — the Monday following the time change, as compared with other days of the year. This means that sleep impairment could be influencing important decisions that should be impartial.

<https://www.marketwatch.com/story/the-costs-of-the-annual-switch-to-daylight-saving-time-are-becoming-increasing-evident-2018-03-07>

## **Arguments against abolishing daylight saving**

1. Daylight saving increases the opportunity for recreation and exercise

One of the major arguments put forward in support of daylight saving is that, by adding an additional hour of available daylight at the end of the school and working day, daylight saving increases the population's opportunity to enjoy outdoor activities and especially to exercise. A number of studies have supported this potential benefit.

A 2014 study examining exercise patterns among Australian, British and European children during daylight saving months found that evening daylight seems to prompt an increase in children's activity. Although the average increase in activity was small in absolute terms, these increases applied across all children in the populations surveyed. Moreover, these small effect sizes compared favourably with the typical effect of other interventions intended to increase children's exercise levels. The study stated, 'We therefore conclude that...the introduction of additional daylight saving measures could yield worthwhile public health benefits.' <https://ijbnpa.biomedcentral.com/articles/10.1186/1479-5868-11-84>

A 2014 United States study similarly concluded that daylight saving appears to promote exercise within the community and thus has the potential to benefit public health. The study stated 'Americans spend six minutes in front of the TV for every minute that they spend outdoors. This figure is alarming, especially in light of the health care costs imposed by obesity, diabetes, and heart disease. We find that DST has the potential to increase outdoor activity by 30 minutes and burns an additional 10 per cent of calories. This may have important policy implications.' <https://econ.washington.edu/sites/econ/files/old-site-uploads/2014/06/Economica-R-and-R-2014-Wolff-Makino.pdf>

The study further stated, 'During the DST extension period, the average American has the potential to reduce their Body Mass Index (BMI) by 0.91per cent... This translates into healthcare savings of \$8.33 billion annually.' <https://econ.washington.edu/sites/econ/files/old-site-uploads/2014/06/Economica-R-and-R-2014-Wolff-Makino.pdf>

Western Australia does not currently have daylight saving; however, it trialled daylight saving between 2006 and 2009. A study of the impact of this policy change on the activity level of Western Australians found a discernible increase in the activity levels of men and some other subgroups in the state.

The findings of this study suggest that the introduction of daylight saving in Western Australia resulted in almost half the population changing their physical activity patterns.

These changes were evident both in terms of when people were physically active (in the morning before work, during the day, in the afternoon after work, later in the evening) and the number of sessions of physical activity. The study found that for males, respondents 30-44 years of age, and those living in the metropolitan Perth area, daylight saving provided a greater opportunity to take advantage of additional after work

hours of daylight for physical activity. The same positive effect was not observed with a majority of female respondents suggesting that morning exercise may suit them better.

<https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1753-6405.2010.00479.x>

The study concluded, 'The introduction of a public policy that imposes a relatively modest compulsory change, such as daylight saving, can...have a powerful impact on patterns of physical activity.' <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1753-6405.2010.00479.x>

## 2. Daylight saving advantages a range of industries and businesses

Supporters of daylight saving generally argue that it has substantial benefits for many industries and businesses. By extending the available daylight at the end of the working day, DST enables many people to recreate after work in a way that advantages restaurants, entertainment venues, sporting-related businesses and many others.

When federal law extended daylight saving by a month in the United States it met with widespread approval from American business spokespeople. The United States Chamber of Commerce praised the extension of daylight saving under the 2005 law, which increased the amount of shopping and commerce after work in evenings. In the golf industry, the group has noted exceptional increase in revenue of '\$200 million in additional sales of golf clubs and greens fees'. The extension of daylight saving has also had a notable impact on Halloween and candy sales. Wyoming Senator Michael Enzi and Michigan Representative Fred Upton advocated the extension from October into November especially to allow children to go trick-or-treating in more daylight. <https://www.revolvvy.com/page/Daylight-saving-time-in-the-United-States>

Michael Downing, a lecturer at Tufts University and author of the book 'Spring Forward: The Annual Madness of Daylight Saving Time' argues that the primary motivation for daylight saving time is the benefits that it offers the business community. Downing states, 'Since 1915, the principal supporter of daylight saving in the United States has been the Chamber of Commerce on behalf of small business and retailers...The Chamber understood that if you give workers more sunlight at the end of the day they'll stop and shop on their way home. It's not just golf—the barbecue industry loves daylight savings, so do the home good stores because people tend to go out of their houses, see that their roofs need replacing and buy more shingles. It's a really important part of niche marketing for the retail industry.'

<https://www.wnyc.org/story/who-really-benefits-daylight-savings/>

A 2002 survey of 708 businesspersons in Queensland on the question of whether the state should adopt daylight saving indicated positive expectations regarding employment, increased sales and growth in cultural and recreational services industries.

<https://www.sciencedirect.com/science/article/pii/S0313592604500164>

One of the key industries claimed to benefit from daylight saving is tourism. Extended available daylight provides further opportunities for tourists to sightsee and consume the products of the country or region they are visiting. Keith Tully commented in Real Business Rescue in March, 2015, that 'According to British government statistics and data provided by the Tourism Alliance, putting the clocks forward is estimated to boost UK tourism revenues to the tune of £3.5 billion and generate around 80,000 jobs. This is the upshot of lighter and longer evenings which...see businesses open for longer and tourists – and locals – more inclined to spend money on outdoor recreation and leisure.'

<https://www.realbusinessrescue.co.uk/news/what-does-putting-the-clocks-forward-mean-for-the-uk-economy>

3. The negative effects of daylight saving are short-lived and their effects are exaggerated. Supporters of daylight saving argue that many of the negative claims made about it either refer to effects of very short duration, or are highly exaggerated.

Critics of DST tend to focus on the disorientation and sleeplessness that can result immediately after the moving of clocks forward or back when daylight saving begins and ends in a particular jurisdiction. The short-term health risks and the brief period of increased accident rates are used as a basis for condemning the entire operation of DST. Its defenders argue that these are only short-term problems that are outweighed by the benefits that daylight saving offers over the months each year during which it is in place.

In an article published in Popular Mechanics on March 12, 2018, Dan Nosowitz argued that common criticisms of daylight saving were based on 'humans being impatient and all too willing to miscalculate the harm of short-term problems over subtle long-term benefits'. Nosowitz explains, 'Remember! DST is not the two days per year...we move our clocks around. DST is eight months long [in the United States and six months in the Australian states that adopt it]; those two days are the beginning and the end of DST. To focus on just those two days is ridiculous.'

<https://www.popularmechanics.com/science/environment/a18011/in-defense-of-daylight-saving-time/>

David Prerau, the author of *Seize the Daylight: The Curious and Contentious Story of Daylight Saving Time*, has argued, 'There's a big difference between the effects of the one-hour change from standard time to daylight saving time—those effects take place over a day, maybe up to three days—versus daylight saving time itself, which lasts eight months.'

<https://www.popularmechanics.com/science/environment/a18011/in-defense-of-daylight-saving-time/>

Nosowitz argues that even these short-term disadvantages tend to be exaggerated and taken out of context. He states, 'Critics of DST often focus their criticisms around those two days per year, citing confusion, schedule disruption, and even health problems. A 2012 study indicated that in the few days around the springtime clock change (the beginning of DST, in other words), incidents of heart attack rose by 10 percent. Never mind that heart attacks were found to decrease around the time of the autumn clock change ... also by 10 percent. Never mind that heart attacks are much more likely to come in the winter and early spring than any other time of year, period. Statistics like that are pretty easy to twist to your liking.'

<https://www.popularmechanics.com/science/environment/a18011/in-defense-of-daylight-saving-time/>

Supporters of DST further note that if the disadvantages associated with the two days of daylight saving transition each year are considered too great, a better solution would be to impose DST all year round and so remove those days of adjustment altogether.

Adjusting the clocks by an hour every spring and autumn could be put to an end by the European Commission after a survey found most European Union (EU) citizens were against it. Commission President Jean-Claude Juncker said the continent-wide survey to which 4.6 million people responded, revealed 84 per cent of Europeans want to stop moving the clocks back and forward by an hour under daylight saving time and would prefer DST all year round. <https://www.independent.co.uk/news/world/europe/eu-daylight-saving-time-stop-member-countries-clocks-back-forward-summer-a8516426.html>

4. Daylight saving reduces crime

Supporters of daylight saving argue that it discourages crime in both the short- and medium-term. They point to studies that indicate an immediate drop in assaults following the introduction of daylight saving and a longer term decline in crime as the extra hour of available daylight reduces opportunities for crime.

A United States study published in October, 2017, in *The Journal of Experimental Psychology* noted that in the short term, losing an hour of sleep can reduce certain crimes. After the start of daylight saving time in the spring (when clocks are turned on an hour), the study found assault rates dropped by about 3 percent. <https://www.livescience.com/60806-daylight-saving-time-linked-to-assault.html>

In contrast, when daylight saving ended and people gained one hour of sleep, the average assault rate increased; it was 3 percent higher on the Monday immediately following the end of daylight saving time, compared with the Monday a week later, the researchers found.

<https://www.livescience.com/60806-daylight-saving-time-linked-to-assault.html>

Study co-author Adrian Raine, a professor of criminology, psychiatry and psychology at the University of Pennsylvania, stated, 'Sleep problems have previously been associated with increased antisocial and criminal behaviour, so we were surprised to find that increased sleep was associated with increased offending.' <https://www.livescience.com/60806-daylight-saving-time-linked-to-assault.html>

The researchers have suggested that the drop in assaults at the beginning of daylight saving time may be because people are just too groggy to act on their aggression after losing that hour of sleep in the spring. Lead study author, Rebecca Umbach, a doctoral student in criminology at the University of Pennsylvania, stated, 'You think, "If I don't get a lot of sleep, I'm going to be cranky and angry" ...Your intention is to act more aggressively, but your behaviour does not reflect that, because you're tired. You're too lethargic and sleepy to act.'

<https://www.livescience.com/60806-daylight-saving-time-linked-to-assault.html>

In a study published in December 2015 in *The Review of Economics and Statistics* it was argued that daylight saving helps to reduce the incidence of certain sorts of crime for the entire period that the additional hour of available daylight is in place.

The study found shifting available daylight from the morning to the early evening has a substantial effect on public safety. When DST begins in the spring, robbery rates for the entire day fall an average of 7 percent, with a much larger 27 percent drop during the evening hour that gained some extra sunlight. <https://www.brookings.edu/blog/brookings-now/2015/10/29/fighting-crime-with-daylight-saving-time/>

This decrease remained consistent even after accounting for differences in day of the week, weather differences, and crime levels. They also found a 43 percent reduction in murder and a 56 percent drop in rape during the extra hour of evening daylight.

<https://enddaylightsavingtime.org/daylight-saving-time-reduces-crime-rates/>

The researchers speculate that sunset is the time many people leave work, and walking to their cars or homes in the dark makes them easier targets for street criminals. They suggest that the greater available daylight at this key period in people's days has a significant deterrent effect, causing potential criminals to believe their risk of detection and apprehension would be greater. <https://www.brookings.edu/blog/brookings-now/2015/10/29/fighting-crime-with-daylight-saving-time/>

Examining a period beginning in 2007 when Congress extended daylight saving across the United States by four months, the study found extending DST saved \$59 million per year in avoided social costs by reducing the number of evening robberies.

<https://www.brookings.edu/blog/brookings-now/2015/10/29/fighting-crime-with-daylight-saving-time/>

Further, the extra hour of darkness in the morning did not impact morning robbery rates, nor did it lend any credence to those who asserted that children walking to school or waiting for

the school bus would be more susceptible to being abducted. In other words, offenders did not merely reallocate their crimes to a different part of the day as evidenced by overall reductions in daily crime totals during DST. <https://enddaylightsavingtime.org/daylight-saving-time-reduces-crime-rates/>

#### 5. Daylight saving reduces road accidents

Supporters of daylight saving argue that DST reduces the overall incidence of road accidents. This is despite studies which have indicated that in the day immediately following the adoption of daylight saving in a particular year, there is a short-term increase in traffic accidents.

Referring to the United States, the law firm, Ingerman & Horwitz, stated, 'What many do not know is that Daylight Saving Time...reduces traffic accidents and deaths. The 1970 Department of Traffic study...showed DST reduced traffic accidents, saving 50 lives and about 2,000 injuries in March and April of the years studied.'

<https://www.vehicleservicepros.com/shop-operations/safety-health/blog/10892109/daylight-saving-time-equals-less-car-accidents>

A United States study published in 1995 in the American Journal of Public Health examined the effect of daylight saving on road accidents in the period from 1987 through to 1991. The study concluded 'During daylight saving time, which shifts an hour of daylight to the busier evening traffic hours, there were fewer fatal crashes. An estimated 901 fewer fatal crashes (727 involving pedestrians, 174 involving vehicle occupants) might have occurred if daylight saving time had been retained year-round from 1987 through 1991.'

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1615292/>

Another United States study conducted in 2004 and published in Accident Analysis & Prevention produced very similar findings. Analysis of county level data from the Fatality Analysis Reporting System for 2-week periods in 1998 and 1999 were used. Results showed that full-year daylight saving time would reduce pedestrian fatalities by 171 per year, or by 13 per cent of all pedestrian fatalities in the 5:00–10.00 a.m. and in the 4:00–9:00 p.m. time periods. Motor vehicle occupant fatalities would be reduced by 195 per year, or 3 per cent, during the same time periods.

<https://www.sciencedirect.com/science/article/abs/pii/S0001457503000150>

In 2007, a study titled 'Short and Long Run Effects of Daylight Saving Time on Fatal Automobile Crashes' and published in The B.E. Journal of Economic Analysis and Policy outlined numerous advantages of daylight saving in the reduction of traffic accidents. The United States study stated, 'DST has no significant detrimental effect on automobile crashes in the short run; [and] DST significantly reduces automobile crashes in the long run with an 8-11% fall in crashes involving pedestrians, and a 6-10% fall in crashes for vehicular occupants in the weeks after the spring shift to DST.'

<https://www.vehicleservicepros.com/shop-operations/safety-health/blog/10892109/daylight-saving-time-equals-less-car-accidents>

British research has also indicated that daylight saving time results in an overall reduction in traffic-related accidents and fatalities. Studies indicate that road casualty rates increase with the arrival of darker evenings and poor weather. For example, in 2013 there were more than twice as many pedestrian deaths in December as in June (the onset of summer in the northern hemisphere). It has been observed that each year from when the clocks go back in October, the peak in evening road casualties shifts so it falls in the hour after sunset. Research has also found that serious and fatal pedestrian collisions increase 10 per cent in the four weeks after daylight saving ends. <http://www.brake.org.uk/facts-resources/15-facts/473-time-to-put-the-clocks-forward>

The British road safety lobby group Brake has called for year-round implementation of daylight saving time. Brake has claimed, 'It is estimated this would prevent 80 deaths and more than 200 serious injuries on UK roads every year.' <http://www.brake.org.uk/facts-resources/15-facts/473-time-to-put-the-clocks-forward>

## **Further implications**

The following is a slightly abbreviated version of a comment written by Andrew C. Worthington, Professor of Finance, Department of Accounting, Finance and Economics, Griffith University. It was first published in The Conversation on March 29, 2018, and can be accessed in full at <https://theconversation.com/daylight-saving-can-boost-the-economy-but-australia-needs-to-make-it-uniform-93727>

When we compare daylight saving across countries, states and territories its economic impact is mostly positive. But this breaks down in the “transition” in and out of it, such as the days before and after, and when people cross borders between states that have daylight saving and those that don't.

The easiest way to resolve this would be for daylight saving to be applied uniformly across Australia as it is in nearly every other country that has it.

The problem in Australia is unique. While a similar size, the European Union has just three time zones year round, with the shift to and from daylight saving time synchronised throughout since 1996. Likewise the mainland United States has four time zones, with uniform daylight saving everywhere but Arizona.

When daylight saving ends in Australia, the country will revert from five different time zones to three. The time difference between the east and west coast will also change from three to two hours.

The transitions to and from daylight saving time (setting clocks forward or back, or moving between states with and without daylight saving) has economic costs. Many of these are associated with increased health care, but also include lost earnings and higher insurance costs.

One problem is that there is a 'daylight saving effect' linked to changes in circadian rhythms and a (negative) effect on sleep patterns. As with jet lag, the movement to daylight saving time compresses the day, while the movement away stretches it.

Research has linked changes to and from daylight saving time with sudden changes in biological rhythms. Swedish data show a significant increase in heart attacks for the first few days after the introduction of daylight saving time and again, but for a shorter period, following its end.

A United States study found that pedestrians were nearly seven times more likely to be injured following transitions to and from daylight saving. A Canadian study suggested a significant increase (up to 8 per cent) in accident risk on the Mondays following the spring and autumn daylight saving time changes.

There is also evidence that the 'artificial' daylight saving transition when crossing the Queensland–New South Wales border imposes significant costs on businesses. The study found that Gold Coast businesses lose sales and have higher administration costs because of it.

Businesses throughout Queensland believe that its failure to adopt daylight saving time has a negative influence on the functioning and performance of the state economy.

Ultimately, Australia needs to simplify what is one of the world's most fragmented national set of time zones.

The administration costs of scheduling business across time zones, and through the transition, are a burden on business. This has an economic cost in terms of lost profits (and therefore taxation), as well as employment.

In the United States, some are advocating fewer time zones, or even year-round daylight saving time, to avoid the costly transition twice a year.

Here in Australia, introducing daylight saving in Queensland would avoid significant business co-ordination problems with the other eastern states, especially for the highly populated southeast. There would be similar benefits for Western Australian and the Northern Territory.

While getting rid of daylight saving altogether would also remove these transition costs, its economic benefits suggest it would be much better for daylight saving to be adopted throughout Australia.