ACTIVE & SAFE

Evidence Summary: Surfing

Kayla Kashluba BKin, MSc (C)

Version 1
February 2018

BC INJURY research and prevention unit

The British Columbia Injury Research and Prevention Unit (BCIRPU) was established by the Ministry of Health and the Minister's Injury Prevention Advisory Committee in August 1997. BCIRPU is housed within the Evidence to Innovation research theme at BC Children's Hospital (BCCH) and supported by the Provincial Health Services Authority (PHSA) and the University of British Columbia (UBC). BCIRPU's vision is *to be a leader in the production and transfer of injury prevention knowledge and the integration of evidence-based injury prevention practices into the daily lives of those at risk, those who care for them, and those with a mandate for public health and safety in British Columbia.*

Author: Kayla Kashluba

Editors: Sarah A Richmond, Amanda Black

For any questions regarding this report, contact:

BC Injury Research and Prevention Unit
F508 – 4480 Oak Street
Vancouver, BC V6H 3V4
Email: bcinjury1@cw.bc.ca
Phone: (604) 875-3776
Fax: (604) 875-3569
Website: www.injuryresearch.bc.ca

Suggested Citation:

Kashluba K, Black A, Richmond SA, Babul S, Pike I. *Evidence Summary: Surfing.* Active & Safe Central. BC Injury Research and Prevention Unit: Vancouver, BC; 2018. Available at http://activesafe.ca/.

UBC BC Children's Hospital Research Institute

Evidence synthesis tool

SPORT:	Surfing	**Target Group:**	Both recreational and competitive male and female surfers
Injury Mechanisms:	**Common Injuries:** spinal cord injury, lacerations, cervical spine fracture, surfer's myelopathy (SM), permanent paraplegia, abrasions, puncture wound, surfer's ulcers, soft tissue injuries, skin infections and rashes, bites and stings, ocular trauma, sprains/strains, skull and body fractures, tympanic membrane perforations, rotator cuff strains **Common Mechanisms:** Collision between the surfer and the board (sharp fins and tail of the board), the combination of multiple environmental variables (force and mechanism produced by the breaking wave), rider thrown from their board head first toward the seafloor, time spent paddling out (SM), contact with rocks and coral reefs, It was revealed that ~ half of the mechanisms of injuries occur while the surfer is paddling, duck diving, or actual wave riding (noncontact); the remaining injuries were due to contact injuries (direct trauma) (Furness et al., 2015).		

Incidence/Prevalence	**Risk/Protective Factors**	**Interventions**	**Implementation/Evaluation**	**Resources**
Overall Injury Rates In 2004, Thompson et al., examined a series of non-traumatic spinal cord injuries associated with surfing lessons. Nine patients (8 male, 1 female) were detected with surfer's myelopathy (SM). Surfers with SM were on average, 25 years of age. In 2006, Taylor et al. reported 3.5 injuries per 1000 surfing days. In 2015, Furness et al., studied acute injuries in recreational and competitive surfers in a 12-month period in Australia. A total of 1348 participants (91.3% males; 43.1% competitive surfers) were included in the analysis and a total of 512 acute injuries were reported. Authors calculated an incidence proportion of 0.38 (CI 0.35-0.41) acute injures per year. The incidence rate was 1.79 (CI 1.67-1.92) major injuries per 1000 hours	The following summarizes the review of literature on the influence of environmental and sport specific factors on injuries in wave-riding sports. These studies did not specifically examine risk factors for injury; however, authors suggest the following as potential risk factors for injury (Thomspon et al., 2004; Falconi et al., 2016; Taylor et al., 2006): 1. Lack of knowledge of the diverse wave-riding activities. 2. The type of wave, the wave height, and the break of the wave (which is dependent on factors such as tides, wind speed, and wind direction). 3. The incline of the seafloor. 4. Seafloor composition (coral/rocks). 5. Prolonged hyperextension of the cervical spine- prone position for long periods of time especially in the	There is currently no evidence-based injury prevention strategies in the peer-reviewed literature that have been shown to reduce the burden of injury in surfing; however, there are opportunities for prevention based on the type and mechanism of injury occurring in surfers. Studies reviewed for this report suggest: 1. Knowledge of the influences of environmental factors. (Falconi et al., 2016) 2. Surf lessons from an experienced surf school or advice from a reputable surf shop. (Falconi et al., 2016) 3. Proper equipment, such as a surfboard that is the right length and buoyancy for the surfer's size. (Falconi et al., 2016;	No studies were found that have evaluated the implementation or evaluation of intervention strategies in this sport.	

of surfing**.** In 2015, Furness et al., reported the injury incidence proportion for surfers completing aerial maneuvers was 0.48 (CI 0.39-0.58) major injuries per year, this being the highest incidence proportion irrespective of competitive status. **Common Injury Types** In 2003, Sunshine studied the injuries that occur in surfing. It was noted that lacerations are the most common type of surfing injury overall. Other common injuries reported were soft tissues injuries which constitute 35-45% of injuries in which the most common mechanism is being struck by the board. Additionally, skin infections and rashes due to irritation and friction, sunburns from sun exposure, and marine animal bites and stings can happen when surfing. Ocular injuries are most commonly caused by direct trauma from the nose of the surfboard after a wipeout, and surfer's ear (external auditory canal exostosis) was shown to affect 80% of avid surfers who have surfed more than 10 years and is seen in more cold water temperature (<60F degrees). In 2006, Taylor et al., noted the most common type of injury for surfers to be lacerations (41%),	novice rider. 6. The athlete's experience level (inexperience). 7. Weak paraspinal musculature. 8. The sharp shape of the nose of the surfboard. 9. The rail and fin of the board. 10. The leash of is vital the board may increase the risk of board-induced injury and leash recoil. 11. The surfing style- may explain the high number of ankle injuries seen over the past decade. 12. New board design allows the surfer to more easily maneuver on the wave and perform torsional movements; this may place increased stresses on ligaments and contractile tissues and possibly explain the rise in muscular and joint injuries. 13. Increased participation levels, competitive history, and ability to perform aerial maneuvers. 14. Competitive status, hours surfed (>6.5 hours/week), and the ability to perform aerial maneuvers.	Sunshine, 2003) 4. Decrease the amount of time spent in the hyperextended position. (Falconi et al., 2016) 5. Sport-specific strength training and conditioning. (Thompson et al., 2004; Furness et al., 2015) and flexibility training. (Taylor et al., 2006) 6. Strength and conditioning to limit muscle imbalance and shoulder impingement. (Furness et al., 2015) 7. The use of sunscreen. (Sunshine, 2003) 8. Rubber surfboard nose covers to avoid contact with the sharp nose of the board. (Sunshine, 2003; Taylor et al., 2006) 9. Urethane-bordered fins to soften the fin's edge to protect the body from lacerations. (Sunshine, 2003) 10. Safety helmets made of shatterproof plastic and lined with foam. (Sunshine, 2003; Taylor et al., 2006) 11. Wearing a rash guard made of 80% nylon and 20% spandex to protect the neck and chest from friction can help limit the occurrence of folliculitis and dermatitis. (Sunshine, 2003)		

followed by dislocations and sprains/strains. Other injuries included skull and body fractures, and tympanic membrane perforations. In 2015, Furness et al., studied acute injuries in recreational and competitive surfers in a 12-month period in Australia. Injuries were predominantly muscular, joint, and skin injuries (30.3%, 27.7%, and 18.9% respectively). Skin injuries were primarily from direct trauma, while joint and muscular injuries were mainly a result of maneuvers performed and repetitive actions. In 2016, Falconi et al., studied the influence of environmental and sport specific factors on spinal cord injuries in wave-riding sports. It was interesting to note that motion analysis shows than ~50% of the total time surfing is taken up by paddling out to wave break points and 40% is spent waiting for an optimal wave, while actual riding only accounts for 4-5% of the sport's total time. The injury types seen in surfers were cervical spine fractures, head and facial trauma, and surfer's myelopathy. Surfer's myelopathy (SM) is described as a rare non-traumatic spinal cord injury that was been seen in the novice rider, which is thought to be due to an ischemic event caused by the excessive time spent in the		12. Education on water safety and ensuring that surfers know how to swim. (Sunshine, 2003) 13. Education on (venomous) marine animals especially in tropical and subtropical climates. (Sunshine, 2003; Taylor et al., 2006) 14. The use of a board leash to reduce the number of loose boards hitting other surfers and can help provide a floatation device in the event of safety a serious injury – board leashes; however, could increase the risk of ankle-related injuries. (Taylor et al., 2006)		

hyperextended prone position while surfing. Falconi reports that lacerations are the most common injury (35%-46%), with spinal cord injuries and cervical fractures occurring when the athletes collide with the seafloor. **Common Injury Regions** In 2003, Sunshine reported common injury regions for surfers to be the upper and lower extremities, followed by the head (skull) and face (chin). Thompson et al. (2004) reported the spinal cord to be a common injury region for surfers, particularly novice surfers. In 2006, Taylor et al. studied the medical illnesses and injuries encountered during surfing. He noted that 41% of all injuries were to the head (skull) or the lower extremity. In 2015, Furness et al., studied acute injuries in recreational and competitive surfers in Australia; the shoulder, ankle, and head/face regions had the highest frequencies of acute injury (16.4%, 14.6% and 13.3% respectively).				

Works Cited: Falconi, A.D.O, et al. (2016) Spinal cord injuries in wave-riding sports: the influences of environmental and sport-specific factors. *Sports Medicine Reports, 15* (2), 116-120. Furness et al. (2015) Acute injuries in recreational and competitive surfers. *The American Journal of Sports Medicine, 43* (5), 1246-1254. Sunshine, S. (2003). Surfing injuries. *Current Sports Medicine Reports*, 136-141. Taylor, K. S., Zoltan, T. B., & Achar, S. A. (2006). Medical illnesses and injuries encountered during surfing. *Current Sports Medicine Reports*, *5*(5), 262–267. Thompson et al., (2004). Surfers myelopathy. *Spine, 29* (16) 353-356.	**Works Cited:** Falconi, A.D.O, et al. (2016) Spinal cord injuries in wave-riding sports: the influences of environmental and sport-specific factors. *Sports Medicine Reports, 15* (2), 116-120 Furness et al. (2015) Acute injuries in recreational and competitive surfers. *The American Journal of Sports Medicine, 43* (5), 1246-1254 Taylor, K. S., Zoltan, T. B., & Achar, S. A. (2006). Medical illnesses and injuries encountered during surfing. *Current Sports Medicine Reports*, *5*(5), 262–267. Sunshine, S. (2003). Surfing injuries. Current Sports Medicine Reports, 136-141. Thompson et al., (2004). Surfers myelopathy. *Spine, 29* (16) 353-356. .	**Works Cited :** Falconi, A.D.O, et al. (2016) Spinal cord injuries in wave-riding sports: the influences of environmental and sport-specific factors. *Sports Medicine Reports, 15* (2), 116-120 Furness et al. (2015) Acute injuries in recreational and competitive surfers. *The American Journal of Sports Medicine, 43* (5), 1246-1254 Taylor, K. S., Zoltan, T. B., & Achar, S. A. (2006). Medical illnesses and injuries encountered during surfing. *Current Sports Medicine Reports*, *5*(5), 262–267. Sunshine, S. (2003). Surfing injuries. Current Sports Medicine Reports, 136-141. Thompson et al., (2004). Surfers myelopathy. *Spine, 29* (16) 353-356.		

Review of Sport Injury Burden, Risk Factors and Prevention

Surfing

Surfing is a popular water sport. (Falconi et al., 2016) The International Surfing Association estimates that approximately 23 million people participated in surfing worldwide in 2014. (Falconi et al., 2016) Given this increase in participation, there has been an increase in the number of surfing injuries. (Sunshine et al., 2003) Despite the increase in popularity of the sport, there is a lack of information on the incidence of injury and the risk factors and interventions to reduce the impact of injury in surfing.

Incidence and Prevalence

To date, there is a paucity of literature examining the incidence rates in surfing. In 2004, Thompson et al., examined a series of non-traumatic spinal cord injuries associated with surfing lessons. Nine patients (8 male, 1 female) were detected with surfer's myelopathy (SM), (average age of 25). In 2006, Taylor et al., reported an injury rate of 3.5 injuries per 1000 surfing days. Furness et al. (2015), studied acute injuries in recreational and competitive surfers in a 12-month period in Australia. A total of 1348 participants (91.3% males; 43.1% competitive surfers) were included in the analysis (Furness et al., 2015). A total of 512 acute injuries were reported, with an incidence proportion of 0.38 (CI 0.35-0.41) acute injuries per year (Furness et al., 2015). The incidence rate was calculated as 1.79 (CI 1.67-1.92) major injuries per 1000 hours of surfing (Furness et al., 2015). In 2015, Furness et al., reported the incidence proportion for surfers completing aerial maneuvers was 0.48 (CI 0.39-0.58) major injuries per year; the highest incidence proportion irrespective of competitive status.

Lacerations are the most common injuries reported in surfers (Sunshine, 2003; Taylor et al., 2006; Furness et al., 2015). Other common injuries reported were soft tissues injuries which represented 35-45% of all injuries. The most common mechanism reported in surfing injuries is being struck by the board. Additionally, skin infections and rashes due to irritation and friction, sunburns from sun exposure, and marine animal bites and stings constitute 3% of acute surfing injuries. It was also noted that ocular injuries are most commonly caused by direct trauma from the nose of the surfboard after a wipeout, and surfer's ear (external auditory canal exostosis) was shown to affect 80% of avid surfers who have surfed more than 10 years and is seen in more cold water temperature (<60F degrees). In 2006, Taylor et al., noted that sprains/strains, skull and body fractures, and tympanic membrane perforations are common types of injuries experienced by surfers.

In 2006, Taylor et al. reported that 41% of all injuries were head (skull) injuries and injuries to the lower extremity. In 2015, Furness et al. (2015) studied acute injuries in recreational and competitive surfers in Australia, and the shoulder, ankle, and head/face regions had the highest frequencies of acute injury, representing 16.4%, 14.6% and 13.3% respectively.

Risk and Protective Factors

The following summarizes the review of literature on the influence of environmental and sport specific factors on injuries in wave-riding sports. These studies did not specifically examine risk factors for injury; however, authors suggest the following as potential risk factors for injury (Thomspon et al., 2004; Falconi et al., 2016; Taylor et al., 2006):

1. Lack of knowledge of the diverse wave-riding activities.
2. The type of wave, the wave height, and the break of the wave (which is dependent on factors such as tides, wind speed, and wind direction).
3. The incline of the seafloor.
4. Seafloor composition (coral/rocks).
5. Prolonged hyperextension of the cervical spine- prone position for long periods of time especially in the novice rider.
6. The athlete's experience level (inexperience).
7. Weak paraspinal musculature.
1. The sharp shape of the nose of the surfboard.
2. The rail and fin of the board.
3. The leash of is vital the board may increase the risk of board-induced injury and leash recoil.
4. The surfing style- may explain the high number of ankle injuries seen over the past decade.
5. New board design allows the surfer to more easily maneuver on the wave and perform torsional movements; this may place increased stresses on ligaments and contractile tissues and possibly explain the rise in muscular and joint injuries.
6. Increased participation levels, competitive history, and ability to perform aerial maneuvers.
7. Competitive status, hours surfed (>6.5 hours/week), and the ability to perform aerial maneuvers.

Opportunities for Prevention: Effective Interventions, Cost-Effectiveness, Implementation and Evaluation

There is currently no evidence-based injury prevention strategies in the peer-reviewed literature that have been shown to reduce the burden of injury in surfing; however, there are opportunities for prevention based on the type and mechanism of injury occurring in surfers. Studies reviewed for this report suggest:

1. Knowledge of the influences of environmental factors. (Falconi et al., 2016)
2. Surf lessons from an experienced surf school or advice from a reputable surf shop. (Falconi et al., 2016)
3. Proper equipment, such as a surfboard that is the right length and buoyancy for the surfer's size. (Falconi et al., 2016; Sunshine, 2003)
4. Decrease the amount of time spent in the hyperextended position. (Falconi et al., 2016)
5. Sport-specific strength training and conditioning. (Thompson et al., 2004; Furness et al., 2015) and flexibility training. (Taylor et al., 2006)
6. Strength and conditioning to limit muscle imbalance and shoulder impingement. (Furness et al., 2015)
7. The use of sunscreen. (Sunshine, 2003)

8. Rubber surfboard nose covers to avoid contact with the sharp nose of the board. (Sunshine, 2003; Taylor et al., 2006)
9. Urethane-bordered fins to soften the fin's edge to protect the body from lacerations. (Sunshine, 2003)
10. Safety helmets made of shatterproof plastic and lined with foam. (Sunshine, 2003; Taylor et al., 2006)
11. Wearing a rash guard made of 80% nylon and 20% spandex to protect the neck and chest from friction can help limit the occurrence of folliculitis and dermatitis. (Sunshine, 2003)
12. Education on water safety and ensuring that surfers know how to swim. (Sunshine, 2003)
13. Education on (venomous) marine animals especially in tropical and subtropical climates. (Sunshine, 2003; Taylor et al., 2006)
14. The use of a board leash to reduce the number of loose boards hitting other surfers and can help provide a floatation device in the event of a serious injury – board leashes; however, could increase the risk of ankle-related injuries. (Taylor et al., 2006)

References

Falconi, A., Flick, D., Ferguson, J., Glorioso, J.E. (2016) Spinal cord injuries in wave-riding sports: the influences of environmental and sport-specific factors. *Sports Medicine Reports, 15* (2), 116-120. Retrieved from http://journals.lww.com/acsm-csmr/Abstract/2016/03000/Spinal_Cord_Injuries_in_Wave_Riding_Sports___The.17.aspx

Furness, J., Hing, W., Walsh, J., Abbott, A., Sheppard, J.M., Climstein, M. (2015) Acute injuries in recreational and competitive surfers. *American Journal of Sports Medicine, 43* (5), 1246-1254. doi: 10.1177/0363546514567062

Sunshine, S. (2003). Surfing injuries. *Current Sports Medicine Reports*, 136-141. Retrieved from https://link.springer.com/article/10.1007/s11932-003-0046-x

Taylor, K. S., Zoltan, T. B., & Achar, S. A. (2006). Medical illnesses and injuries encountered during surfing. *Current Sports Medicine Reports*, *5*(5), 262–267. Retrieved from https://doi.org/10.1097/01.CSMR.0000306426.16414.52

Thompson, T.P., Pearce, J., Chang, G., Mdamba, J. (2004). Surfer's myelopathy. *Spine, 29* (16) 353-356. Retrieved from http://journals.lww.com/spinejournal/Abstract/2004/08150/Surfer_s_Myelopathy.25.aspx