

Expert Views

Staying in the Bike Lane

Understanding cycling in life underwriting

Extreme Sports
An Underwriting series

SCOR
The Art & Science of Risk

July 2022



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Executive summary

An estimated two billion cyclists pedal around the world, a figure that includes recreational, amateur, and professional cyclers, as well as commuters and delivery riders – in short, anyone who rides a bicycle. That's approximately 35% of the world's population.

Because of the huge variety involved in terms of intensity, riding conditions, and frequency, the risks of cycling vary drastically from one cyclist to another. A mother riding with her young children in an urban park once a month is not going to face the same risks as a professional cyclist competing in the Tour de France, nor will her risks be the same as a delivery driver who cycles 10 hours every day in a traffic-dense city. This can make it difficult for underwriters to judge the risk when presented with the need to consider cycling as a part of the risk assessment process, or during claims analysis.

In this report, we will focus our attention on those risks associated with athletic cycling, both amateur and professional, in order to provide underwriters with a deeper understanding of how cycling risks should be considered during the insurance application process. Additional considerations for commuters, delivery riders, or other types of cyclists can be found in the appendix to this report.

Author's introduction

I was five years old when my parents gave me my first bike and I discovered the thrill of riding. It was the start of a lifelong passion. In my mind, I was right there in the throng of racers as they struggled up the impossible slopes, flew through the winding countryside, and battled for their chance to lead the pack in Le Tour de France, Il Giro de Italia, or La Vuelta a España.

Years later, after a summer of working in the fields in my mother's village in Spain, I traded all my savings for my first road bike, a Peugeot Avoriaz that I still have today. With it, and on the roads of Toledo, I tried to emulate the exploits of Perico Delgado and Miguel Indurain, my biggest heroes in the world of cycling.

The years went by and my passion for cycling has not waned. I may not be vying for a spot on the podium in Le Tour de France this summer, but I am convinced of the positive impact that cycling has on both my physical and mental wellbeing. As an underwriter, however, I'm always mindful of potential risks and I hope that this report will not only help underwriters to understand the risks and benefits but also lead to better prevention of these risks among cyclists.

Alberto Zazo
Medical, Financial & Claims Underwriter, SCOR Iberia





Introduction to Cycling

The recent Covid-19 pandemic has led to a sharp increase in cycling for leisure, exercise, and transportation. Adding environmental concerns to the mix, we can anticipate that the popularity of cycling will continue to grow in the coming years.

While the net impacts of cycling have been proven to be positive overall, there are nonetheless inherent risks. Underwriters must understand how these risks differ based on the type and frequency of cycling, the cyclist's experience, and the implementation of appropriate safety precautions.

Imagine you receive the following application for a life insurance policy:

A 48-year-old male used to be an avid cyclist. He was involved in a car accident five years ago, in which he suffered a concussion, a whiplash injury that occasionally still causes neck pain, and a broken ankle that required surgery and three screws to repair. Since the accident, he has only cycled occasionally, for recreation and not as a form of fitness. Recently, the applicant accepted a promotion at work that requires longer hours at the office. As a result, he has gained weight and he is now training to participate in local cycling races in hopes of improving his physical fitness. He is 178 cm (5'10) tall and, at the time of the application, weighs 80 kilos (176 lbs.). He is otherwise healthy, with no underlying medical conditions, but he does have a family history of cardiovascular disease; his father suffered a heart attack at age 50 and his grandfather at age 59.

After offering insights into the risks and benefits of cycling, we will return to this case study to offer a clear example for how to approach this case and others.

History of cycling

Cycling is a relatively new sport compared to the traditional Olympic sports such as wrestling and swimming. The first modern form of bicycle – conspicuously lacking pedals and requiring the “rider” to push themselves along with their feet – was invented in 1817. Since then, the bicycle has gone through several evolutionary stages, eventually giving way to the modern and often extremely specialized forms we know today.

In 1868, the first competitive cycling races were held at the Parc de Saint-Cloud in Paris and at Hendon, England. Track racing also became popular, but it was so dangerous and injury-prone that controversial events such as Six Day Racing were outlawed in England and the US. Long-distance road racing from city to city such as Paris-Brest became very popular, attracting many racers and spectators. By 1893, the first world championship race was held. In 1896, cycling was added to the Olympic Games. The Tour de France, arguably the most well-known cycling road race, began in 1903.

Combined with the fitness boom and the rising awareness of eco-friendly transportation, road cycling became an extremely popular sport in the second half of the 20th century. Cycling as a sport is popular in Europe, especially in countries like Belgium, Denmark, the Netherlands, Sweden, France, and Spain. And the Covid-19 pandemic has only fueled its popularity.

There are no exact statistics on how many bikes exist in the world, but a study by the World Economic Forum suggests that two billion bikes or more are being used globally, and the number could rise to five billion by 2050¹. China has the largest amount of bikes in the world (45%), followed by the US, Japan, Germany, and Brazil². But this ranking is based on the number of bicycles rather than on bicycle population density. In terms of the cyclist population density, one of the most bicycle-friendly countries is Denmark, where nine



out of ten people own a bike, while four out of ten own a car.

Protective gear

Protective gear worn by cyclists differs by the risk tolerance of a person, the type of cycling, local regulation, and other factors. Road cyclists are advised to wear helmets and have been required to do so in competitions since 2003³. Off-road cyclists such as mountain and BMX bikers wear more protection, including helmets, goggles, pads, and gloves.

The wearing of bicycle helmets outside competitions is not mandatory except in Argentina, Australia, and New Zealand. In some other countries and jurisdictions partial helmet rules apply, such as for child cyclists in France,

Japan, Canada (varies by province), and the US (varies by state)⁴. Other countries, including where cycling is very popular such as Denmark and Netherlands, do not have helmet laws.

Whether or not someone wears appropriate protective gear regularly is not something that underwriters currently take into consideration. However, it is in the cyclist's best interest to do their due diligence in researching appropriate protective gear, investing in quality gear, and wearing it correctly and systematically. As we will discuss in more detail later, traumatic brain injuries are one of the leading causes of cyclist death and lasting injury. Cycling helmets have been found to reduce serious head injury by up to 60%, traumatic brain injury by 53%, and the total number of cyclists killed or seriously injured by 34%⁵.





Types of cyclists

There are numerous ways and purposes for which people use bicycles. Some use them purely for sports and recreational purposes, some ride bicycles out of necessity, and others cycle for a combination of reasons. The chart below maps out the various types of cyclists, major associated risks, and underwriting considerations. In this report, we will focus our analysis on athletic and sports cyclists as described below, both professional and amateurs. For further information on recreational and commercial cyclists, please refer to the appendix.

the cycling population. Road bikes, the bicycles road cyclists ride, are one of the oldest and most popular types of bicycles. They are characterized by a lightweight frame and thin tires, designed to be used on paved roads. There are several types of road bike, each of them built for specific purposes: endurance, race, aero, triathlon, fitness, flat bar, gravel and cyclocross.

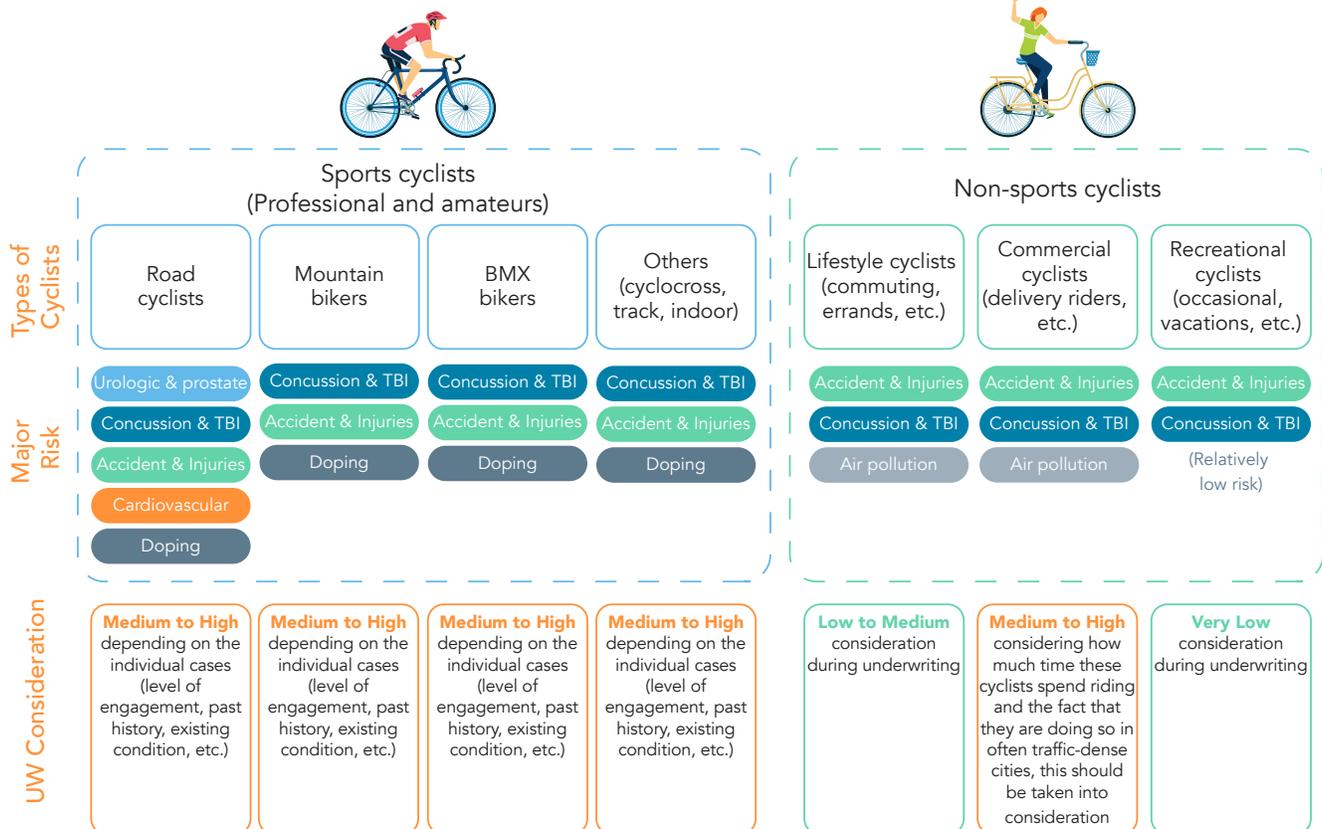
Professional road cycling is an extremely demanding endurance sport. Typical professional cyclists cycle approximately 30,000 to 35,000 km (18,641 miles to 21,748 miles) each year in training and competitions. Those who participate in high-profile international competitions such as the Tour de France cycle all day for 21 days, approximately 100 hours of competition⁶.

Road cyclists

Road cyclists, who ride on paved roads as a sport and/or for fitness, account for the majority of

Figure 1: Types of cyclists, risk and UW consideration

Types of Cyclists, Risk, and UW Consideration





The Union Cycliste Internationale (UCI), the international governing body for cyclists, hosts more than 600 road cycling competitions per year, ranging from amateur races to the internationally known elite races such as the Tour de France, Giro d'Italia, and Vuelta a España. Beyond Europe, professionals can participate in the UCI Asia Tour, the Tour Down Under, UCI Africa Tour, and others. For amateurs, there are thousands of bike races held around the world and throughout the year, ranging from local races to a global events such as the UCI World Cycling Tour. One type of cycle racing popular with competitive amateurs is Criteriums, intense closed-circuit lap racing for approximately one to two hours, where there are different levels of difficulty depending on ability.

Mountain bikers

Mountain biking started in California in the 1970s and by 2013, 8.5 million Americans were

participating in the sport. There are more than 600 Mountain bike (MTB) races registered at UCI worldwide. These races take place on rough, narrow, and unpaved winding mountain roads, and racers must be vigilant for steep climbs, unexpected obstacles such as rocks, dirt, puddles, and other unpredictable conditions.

BMX bikers

Another California invention from the 1970s, the bicycle motocross bike, more commonly called BMX, is an off-road bike used for both racing and stunt riding. BMX bikes have smaller wheels and frames, with a simple and streamlined design that allows for intense and unique riding conditions such as in skate parks and tracks. BMX races come in various formats and places, including asphalt or dirt tracks, halfpipes, and skate parks, and often incorporate obstacles or jumps.

Health and safety risks associated with cycling

Regardless of the mode, cycling is a great form of exercise that can have a huge positive impact on an individual's health. Regular cycling reduces the incidence of stroke, coronary heart disease, hypertension, dyslipidemia, obesity, and diabetes mellitus. These benefits should be weighed against the inevitable risks – some perceived, some proven – which we will discuss in the following section.

Heart health and cardiovascular risk

It is estimated that constant, low to medium intensity pedalling for one hour can burn up to 300 calories, making cycling an ideal sport for those looking to lose weight, prevent cardiovascular disease (CVD), stroke, or Type 2 diabetes, or lower their LDL cholesterol⁷. Individuals should consult with their doctor before starting any intensive sport regime following a heart attack, but cycling can typically be recommended after the initial recovery period.

Nonetheless, it is widely accepted that cardiac alterations in high-level sportspersons predispose them to a particularly high risk of suffering sudden death, which is why an early diagnosis of any cardiomyopathy is essential to avoid this dramatic outcome.

Regular physical activity can be associated with increased left ventricular mass, such as dilated cardiomyopathy (DCM), which stretches, thins, and weakens the muscle tissue that makes up the heart's pumping chambers. The degradation of these muscles can eventually impede the heart's ability to pump. However, there is currently no evidence to suggest that this is more prevalent in cycling than in other sports, and these types of impacts on the heart are typically not a reason for concern. If the heart size has not returned to normal three months after stopping the activity, however, further tests may be needed to detect the underlying cause of the cardiomyopathy.



For amateurs and professional cyclists with CVD, there is, therefore, a non-negligible risk when it comes to intensive training. According to the European Association of Preventive Cardiology, intensive exercise training that exceeds seven sessions or 18 hours of strenuous exercise per week increases the mortality risk in patients with coronary artery disease. The report goes on to say that the observed incidence rate is lower, however, suggesting that “benefits of regular physical activity and sport participation outweigh by far the increased risk for coronary events triggered by acute, intensive physical activity.”⁸

So, does cycling improve or worsen the risks associated with cardiovascular disease? The question is not as straightforward as it might seem at first glance, and the response is peppered with nuances that are heavily dependent on the individual’s level and intensity of activity, current health, age, family health history, exercise routine, and many other factors. Age, for example, plays an important factor in risk evaluation. For young competitive cyclists, we initially see that the high levels of physical activity can be expected to bring a reduction of risks. However, as that same athlete ages, the risks associated with the same level of physical activity will begin to increase, particularly after age 50, following a U- or J-curve.

Cycling in general improves general fitness and reduces the likelihood of cardiovascular disease. It can also help in reducing risk factors that would otherwise contribute to the recurrence of a heart attack. If a cyclist does develop cardiovascular disease, however, they can be at greater risk of sudden cardiac arrest due to the intense demand they are placing on the heart.

In assessing cyclists’ health risk, understanding their activity levels (from leisure/amateur level to professional levels) is important, as the two groups should be considered separately. It is recommended that both amateur and professional cyclists have their heart health assessed regularly by a healthcare professional.

Urologic health: prostate and testicular conditions

Cycling has traditionally been associated with complications such as infertility, elevated prostate-specific antigen (PSA) levels, erectile dysfunction (ED), lower urinary tract symptoms, and increased predisposition to prostate cancer. The scientific community is still divided on if or to what extent a causal relationship exists between cycling and these complications. Their understanding of the impact of cycling on a person’s urological and sexual function is, therefore, still evolving and under study.

One study published in the *Journal of Men’s Health* found that there was no association between the amount of time spent cycling and ED or infertility. The authors go on to explain that this effectively disputes the existence of a simple causal relationship. In other words, cycling was not found to lead to either ED or infertility⁹.

The same study also examined the risk of prostate cancer among men 50 and older, and found that the risk increased incrementally with the distance cycled each week. Meanwhile, a scientific literature review published in 2014 found that there does not appear to be any evidence linking cycling with prostate enlargement or prostate cancer, but concedes that there is weak evidence that trauma from bicycle riding can irritate the prostate and might lead to inflammation of the prostate¹⁰. Yet another study, published in 2018 by the US National Library of Medicine (NLM), noted that men who exercised the most – equivalent to 25 minutes of high-intensity cycling a day – were 30% less likely to develop advanced prostate cancer and up to 25% less likely to die from such cancer¹¹.

Another study involving a sample of 3,932 male cyclists, swimmers, and runners showed that both low and high intensity cyclists scored higher on the Sexual Health Inventory for Men (SHIM) compared to swimmers or runners, although clinically this difference was considered insignificant. However, no statistically significant differences were



observed between cyclists and non-cyclists on other validated measures, such as the International Prostate Symptom Score (IPSS) or the NIH Chronic Prostatitis Symptom Index (NIH CPSI)¹².

While the link between cycling and these and other male health concerns remains a topic of debate, for underwriting purposes we can consider that there is no demonstrated increase in risk.

Testicular cancer was also associated with cycling after it was diagnosed in famous professional cyclists like Lance Armstrong and Ivan Basso. The association has existed since the 1980s, before those two cases became known, but it does not imply a causal relationship¹³.

Accidents

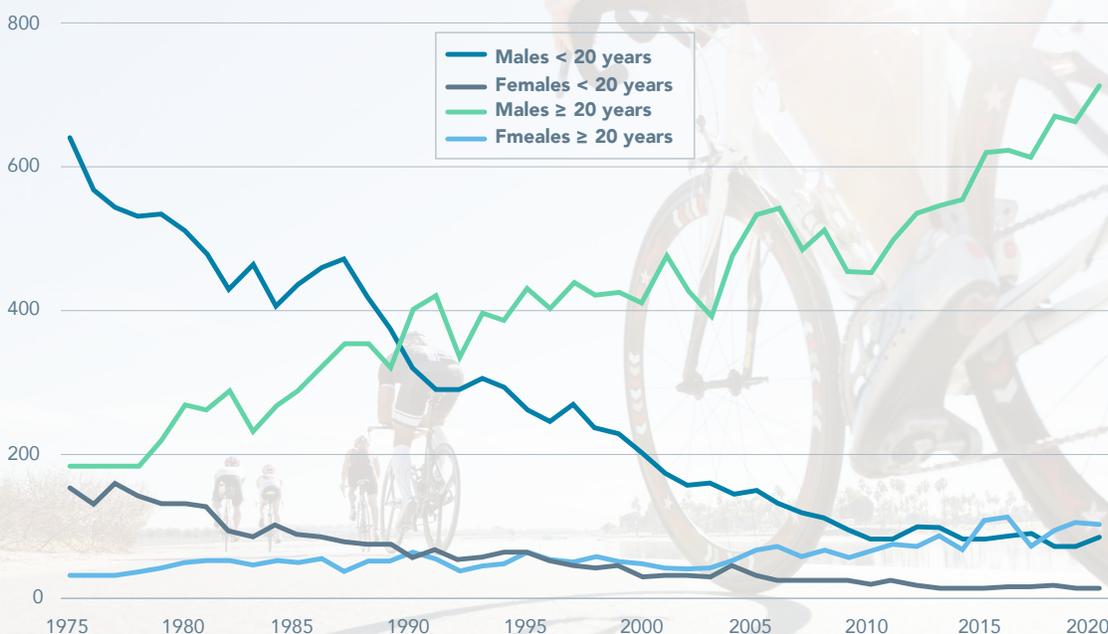
Falls, collisions, and other accidents are common in cycling. While recreational cyclers are more likely to experience an accident when cycling in areas without proper infrastructure, such as bike lanes, any cyclist – professional or amateur, road cyclist,

mountain biker, or BMX rider – is vulnerable. Accidents are considered the top cycling-related health risk.

According to the Insurance Institute for Highway Safety (IIHS), each year approximately two percent of all road traffic fatalities in the US are cyclists. While there has been a steady decrease in fatalities among children riding bikes since 1975, the number of deaths among cyclists aged 20 and older has quadrupled in this same period. The IIHS reported that 932 cyclists were killed in crashes with motor vehicles in 2020, representing a nine percent increase from 2019¹⁴.

Both the “bike friendliness” of the cycling environment and the cyclist’s use of proper equipment are key factors in the likelihood of accidents and collisions. Lack of bike lanes, prevalence of potholes and road debris and heavy traffic are major concerns for cyclists, as there is increased opportunity for accidents or collisions to occur. Conversely, high-traffic areas

Figure 2: Bicyclist deaths by age and sex, 1975-2020
 SOURCE: Insurance Institute for Highway Safety, Fatality Facts 2022: Bicyclists¹⁵





with few cyclists also see a high rate of incidents, likely because motorists are not accustomed to watching for cyclists on the road¹⁶.

Many of the accidents that occur involve a cyclist who does not wear a helmet, or does not comply with the appropriate safety regulations when wearing one. Of the more than 900 cyclists killed in crashes with motor vehicles in the US in 2020, the IIHS reported that 57% were not wearing helmets and helmet use was unknown for an additional 25%¹⁷. Should a collision occur, failure to wear a helmet can often result in a TBI (traumatic brain injury) of varying degrees, which can lead to irreversible disability, dependence, or death. We will discuss TBIs in more detail in the following section.

Experiencing a previous crash is also a predictor of future collisions, suggesting that the rider's behavior on the road can also impact the likelihood of an incident (non-compliance with traffic laws, signaling turns inappropriately, riding erratically, etc.). The same study also found that habitual use of conspicuity aids lowered the risk of incidents¹⁸.

The level of accident risk while cycling greatly differs by purpose (racing, occupational, lifestyle, recreational, etc.), location, and many other factors. In general, injury and mortality rates among recreational cyclists are much lower than those of professional or amateur racers. One study found that the risk of on-road crashes increased by six percent and the risk of collisions increased by eight percent for every additional cycling hour each week¹⁹. Meanwhile, mountain bikers' injuries tend to occur after faulty jumps or falls from cliffs, roadsides, or steep downhill riding. They have a higher occurrence of spinal injuries that often require surgical intervention compared to road cyclists²⁰.

Aside from accidents, overuse injuries can be a concern for cyclists due to the repetitive motions involved in the sport. While these injuries are often not serious enough to force the rider to stop cycling, they can cause significant discomfort and are extremely common among active cyclists:

some studies suggest that between 50% and 60% of cycling injuries are overuse injuries, and up to 85% of all recreational cyclists report an overuse injury^{21,22}.

Concussions and other traumatic brain injuries

A concussion is the most common type of mild traumatic brain injury (TBI) and one of the major mortality and morbidity risks associated with cycling. Generally speaking, a TBI is caused by an outside force, usually a violent blow to the head or an object penetrating the skull which may cause bruising, bleeding, swelling or torn nerve fibers. In cycling, this most often occurs during a fall or collision.

Concussions are usually not life-threatening and can completely heal over time with proper care. Moderate or severe TBIs, on the other hand, could result in coma or amnesia, which have negative long-term effects on morbidity and mortality of the survivors, including seizures, disability, addiction, mental illness, alcohol abuse, etc. Studies also show an increased risk of developing dementia and Alzheimer's disease in older adults with a history of moderate and severe TBIs²³. Premature mortality is a potential risk for moderate and severe TBI survivors as the risk of mortality from external causes (suicide, assault, etc.) and substance abuse increases.

The Center for Disease Control reported that cycling accounts for 19.5% of all sports-related TBIs in the US, the highest among all sports and nearly twice as many as American football²⁴. Epidemiological studies estimate that sports-related concussion (SRC) accounts for 1.3% to 9.1% of all road cycling injuries – and this rate is increasing²⁵. The actual total number of cycling-related concussions, however, is estimated to be much higher, as many concussion cases may not be officially reported. The risk of concussion is not limited to professional cyclists but should be considered for recreational cyclists of all ages.



Wearing helmets will help, but it does not always prevent cyclists from getting TBIs. According to the *American Journal of Surgery* in 2016, 25% of the cyclists who were diagnosed with TBIs were helmeted²⁶. Technological advances in recent years continue to improve the functionality and performance of helmets, and educational efforts encourage cyclists of all ages to wear their helmets every time they ride.

For professional road cyclists the cycling race format itself presents challenges in assessing riders for TBIs directly following a crash. "When a rider... crashes, his first impulse is always to get back on the bike as quickly as possible," an article in *Bicycling* explained following an incident during the 2017 Tour of California that sparked discussion about the sport's failure to minimize injury. "There are no timeouts in pro cycling; every moment you're stationary means a harder, longer chase to get back into the group. So riders almost always are riding again in seconds; there's almost zero opportunity for officials to take a rider aside for a moment and check his condition post-crash."²⁷

TBIs remain one of the biggest concerns for amateur and professional cyclists alike and this risk should not be discounted during the underwriting process.

Increased exposure to air pollution

A 2011 study in UK found that bicycle riders inhale more than twice the amount of black carbon particles as pedestrians in urban areas. Considering that it is widely accepted that hazardous air pollutants can cause cancer, birth defects, brain damage, impaired lung function, cardiovascular system damage and other health problems, at what point do the risks of air pollution outweigh the health and fitness benefits gained from cycling²⁸? Should people quit cycling to reduce their exposure to air pollution?

Researchers in the UK and *Financial Times* established graphs showing how long people can cycle before the risk of pollution outweighs

the benefits of cycling. In London, for example, a cyclist could ride for nine hours and 50 minutes before the exposure to air pollution posed a more significant risk than cycling benefited the rider. Meanwhile, in more polluted cities like Delhi and Beijing, it would take only a few hours for the risks to outweigh the benefits²⁹.

While air pollution could pose a risk for amateur and professional sport cyclists, particularly road cyclists who are investing a large amount of time in training for a race, this is typically not a significant concern as many training and race routes will take them outside the city. Air pollution risks are of little concern for mountain bikers and BMX riders. However, air pollution becomes a more significant consideration for those riding in urban areas for extended periods of time, such as delivery riders or frequent commuters.

Performance-enhancing drug use

Doping, the use of chemical substances and drugs to improve a cyclist's physical performance, is a concern that should also be taken into account when underwriting professional cyclists. Although the use of performance-enhancing drugs is explicitly prohibited, the fact remains that some cyclists continue to use substances such as growth hormone, erythropoietin, stanozolol, testosterone, norandrosterone, nandrolone, anabolic steroids, and clenbuterol. These substances can have side effects ranging from dependence to the development of tumors, diabetes, organ damage, psychological disorders, and more.^{30,31}

Cycling remains the sport most associated with the issue of doping, perhaps because it was in a cycling competition that the first case of the death of an athlete attributed to doping occurred (following the death of a Danish cyclist during the 1960 Olympic Games in Rome, an autopsy determined that the main cause of death was the abuse of amphetamines and vasodilators). However, it was between 1992 and 2006 that doping became endemic in cycling, the greatest example of which was the 1998 Tour de France, when an entire team was expelled for using synthetic erythropoietin.



Covid-19 as a risk factor

Although the magnitude is not yet clear nor clinically proven, Covid-19 has had an unprecedented negative long-term impact on people's health and lives, long after the initial viral infection. The so-called "long-Covid" patients show symptoms such as fatigue, shortness of breath, loss of taste and/or smell, difficulty concentrating (sometimes referred to as "brain fog"), headaches, trouble sleeping, and anxiety. Lingering effects may also include organ dysfunction, residual inflammation, neuropsychiatric symptoms, thrombosis with microangiopathy, and the reactivation of another virus, according to Dr. Regina Rosace, Medical Director at SCOR Life & Health, in her article "Is Long-Covid Here to Stay?".

Cyclists are not exempt from this worrying trend. Those who have had Covid-19 and still want to

cycle the way they used to may find difficulties picking up where they left off before getting sick. They may be even facing serious health risks they are not aware of, particularly myocarditis.

Myocarditis is inflammation of the heart and is a leading cause of sudden cardiac death among athletes, which could occur without previous symptoms. While one study showed that 60% of people who recovered from Covid-19 had signs of ongoing heart inflammation, another suggests that the prevalence of Covid-19-related myocarditis among athletes is very low (1% to 4%)^{32,33}. It is nonetheless important to recognize and quickly treat, and many medical professionals are already adapting their screening methods for athletes, implementing cardiac enzyme blood tests, 10-day rest periods, ECG tests, and echocardiogram analysis for athletes returning after a Covid-19 diagnosis³⁴.

Implications and recommendations for underwriting

We, as underwriters, know that no two risks are identical. It would, therefore, be impossible to have one overarching underwriting recommendation for cyclists. We must consider each applicant on a case-by-case basis, first identifying the type of cycling and whether it is at a professional, amateur, or recreational level. A quick risk guide related to each cyclist category is shown in Figure 2. It is also important to know the type of discipline practiced, the experience and training of the applicant, their physical fitness, as well as their history of injuries and whether they take part in competitions and/or are a member of a federation. Ideally, we would also ask about the safety equipment used (helmet, knee or elbow pads, etc.); however, this is currently not a standard part of underwriting cycling risks.

The possible use of doping substances and stimulants to improve physical performance also deserves special consideration if there is evidence of use, particularly when it comes to professional athletes.

For TBIs caused by cycling accidents, underwriting considerations can vary, depending on the

frequency and severity of the injuries. If an applicant has had a single concussion and has fully recovered, a favorable decision may be appropriate. If they have experienced multiple concussions, mortality considerations need to be considered as they may result in complications such as seizures or Chronic Traumatic Encephalopathy (CTE), even many years after the initial injury. For major head injuries such as moderate to severe TBI, it may be prudent to wait for a period to allow for an adequate assessment of possible complications. Post-traumatic epilepsy may have a mild to moderate mortality impact if controlled but an excess effect on mortality if seizures are frequent. Prolonged loss of consciousness, coma, or amnesia lasting greater than two weeks would require a thorough review to assess for any residual effects.

Underwriting recommendations in practice: a case study

Now that we have a better understanding of the risks associated with cycling and have reviewed typical considerations underwriters should be aware of, we can return to the case study we presented at the beginning of this article.

"In South Asia, since the onset of the pandemic, interest in cycling has grown significantly and in particular there are many more participating in road cycling. There is arguably a larger degree of risk in our region with extremely busy city traffic, more challenging road conditions, poorer driver awareness or care, and generally road safety regulations are less protective for cyclists. We continue to research this subject and ensure the best evidence-based terms are available for our clients."

Nick Williamson
Chief Underwriting Officer
Head of Innovation, South Asia

"In South Africa we don't have as many people participating in cycling as countries like the Netherlands for instance. Our roads are deemed too dangerous, and most cycling takes place in designated "safe areas".

We do not load an extra for cycling in most circumstances as there is a significant level of unnatural death benefit built into the SA premium base."

Michael Vincent
Senior Underwriter, South Africa

"Road bike riding is becoming a more common hobby of choice, especially among those with high-income occupations. We are observing, however, that they tend to be prone to accidents – whether by falling off in wet weather, hitting parked cars or poles or other stationary objects, colliding with motor vehicles, other cyclists and pedestrians, etc. In Australia, we have seen surging income protection claims from bicycle-related injuries. Underwriting some of the potentially high-risk road-bike cyclists the same as trail bike riders may be worth considering."

Andrew Prichard
Head of Claims, Asia

We have a 48-year-old male candidate, who has been cycling sporadically for five years and who reported a recent weight gain due to changes in his habits, with a reduction in his physical activity for work reasons.

Although the applicant stated that he had gained weight, his current BMI was acceptable (25.2) so this aspect can be disregarded for assessment purposes, as can his history of an ankle fracture, resolved with surgery. Despite having osteosynthesis material (three screws in his ankle), the applicant's mobility is not limited, nor does it represent any complication in his daily life or in the practice of cycling.

More relevant for underwriting purposes may be his history of a traffic accident a few years prior, which caused a concussion episode, as well as a cervical injury that still causes him pain and discomfort from time to time.

When considering if there is any residual impact from a concussion, we can keep in mind that younger people usually recover more quickly and people over 40 may take a little longer to return to normal. In the case of our applicant, who was 43 years old at the time of the accident, apart from the cervical symptoms, there are no other symptoms associated with this episode (headaches, dizziness, insomnia, etc.).

In any case, his cervical symptomatology does not have any impact on mortality; only in terms of disability coverage could it have any repercussions. As the information provided by the applicant is subjective (he claims to have neck pain or discomfort "from time to time" without specifying severity or frequency), we would like to have a clearer understanding of his current medical state. As such, we would follow up with the applicant to acquire more detailed medical information that would allow us to determine whether the application of any exclusion for injury or affection at the vertebral level could be the appropriate decision.

Our applicant also declared his intention to compete in local races, so we would try to broaden this information by requesting the type of race in which he intends to participate, the frequency of participation, and the average distance, as well as the location and the safety equipment used (helmet, etc.).

Finally, the applicant noted a family history of cardiovascular disease. While the applicant's family history impacts his own risk of developing cardiovascular disease, we must refer to the current legislation in our market to determine whether we have the right to use this information for our evaluation, as most markets do not allow family medical history to be considered in underwriting decisions.



Conclusion

Cycling, as we have seen, can have a huge impact on an individual's wellbeing. With a global obesity epidemic leading to a high prevalence of cardiovascular disease, stroke, and type 2 diabetes, cycling offers one potential solution to curbing the prevalence of these health concerns. From a general perspective, the health benefits largely outweigh the risks that come with the sport. However, as underwriters, it is our job to understand that each cyclist will face a different set of circumstances, some riskier than others.

If the recent trend of increased cycling uptake continues, one of the largest road cycling risks could realistically be greatly reduced. It's feasible that greater demand could lead to a reallocation of urban planning resources to create bike lanes and improve infrastructure, in order to ensure the safety of road cyclists. This seems especially likely

when considering the positive environmental impact of making our urban areas more bike-friendly.

Still, riders have a role to play in protecting themselves. Proper safety equipment like a well-fitting helmet can reduce injuries in the case of a collision or fall, and riders should take care to be aware of their surroundings – whether they're cycling through a busy intersection or on a mountain trail. These safety precautions are typically not considered during the underwriting process, but with the potential to mitigate the risk of injury in the case of a fall or collision, perhaps this is an additional aspect that should be incorporated into the underwriting decision.

For further information or underwriting guidance, reach out to your local SCOR underwriting contact.

We invite you to follow this ongoing series as we tour the world of extreme sports, tapping into SCOR's network of expert insurance professionals – and amateur athletes – whose passion and knowledge allow SCOR to break through common misconceptions and offer a better understanding of the true risks surrounding extreme sports for amateurs, professionals, and – occasionally – even spectators. We will also explore the most recent trends and the implications of new medical developments, predict how a changing climate and other evolving factors might impact these sports, and highlight the hidden links between Life and Health and Property and Casualty coverage in the world of extreme sports.



Appendix

Non-sport cyclists

Although the following types of cyclists do not ride bicycles exclusively for sport purposes and therefore do not fall within the scope of this series, we would nonetheless like to offer a short overview as 1) they could be using bicycles as often as sport cyclists, 2) many of them cite sport and fitness as the motivating factor for cycling, and 3) they are exposed to the same or in some cases even higher levels of health and safety risks and benefits.

Lifestyle cyclists: Many people worldwide use bicycles for their daily necessities – commuting, going to school, running errands, etc. Many of them do so not because they do not have other options, but because they choose to do so for various benefits of cycling including economic, athletic, fitness, and/or environmental reasons.

The population of lifestyle bikers varies by country. In the Netherlands, for example, the percentage of people using bicycles for urban trips is 30%. In Denmark, the number goes up to 52%³⁵. Meanwhile in the US, only 1% of the population rides bicycles regularly, although the bicycle population growth in the largest US cities is rapidly increasing³⁶. The bikes used by this group vary, including road bikes, utility bikes, e-bikes, etc., depending on each cyclist's purpose, taste, and budget.

Commercial bikers: Bicycles have been used as an integral part of some occupations since their inception. Among the precursors to today's Uber Eats and Deliveroo bikers were 19th century milkmen and postal service workers. In New York City alone, there are approximately 65,000 estimated delivery bikers³⁷. Since the pandemic, both demand and the number of jobs available have increased dramatically worldwide.

These cyclists face special risks compared to other types of cyclists. Their jobs often involve extreme conditions such as riding late at night,

in bad weather, on wet or icy roads, on highways with no bike lanes, under high pressure to make a timely delivery, etc. The types of bicycles these bikers use vary, ranging from simple road bikes to electric bikes.

A study on Boston bicycle messengers found that most of the observed working couriers observed had suffered at least one injury while cycling for work, including bone fractures, sprains, and other non-fatal injuries. Only 34% of those in the study wore a helmet on a regular basis³⁸. A 2021 Australian study found that commercial delivery cyclists are increasingly vulnerable to road accidents, and concerns regarding their safety need to be addressed and surveyed³⁹. Around the world, fatal accidents of food delivery workers are increasing as the demand for delivery services has risen rapidly, accelerated by the surge in needs during the pandemic era⁴⁰.

Commuters: Among those who ride a bike to work, safety and accident rates greatly vary by the location, road conditions, local regulations, and other factors. A study by researchers at the University of Glasgow found that commuting by bike yields a 45% higher risk of injury than other commuting options⁴¹. A statistics report found that people in the UK are less likely to die from cycling than walking on the street, although the injury rate for cyclists is three times higher than that of pedestrians⁴².

Recreational bikers: In this analysis, a recreational biker is any individual who cycles only occasionally as a hobby – riding mostly in parks, neighborhoods, travel destinations, etc. There are no statistics to show the exact number of recreational bikers, but studies estimate that 42% of households around the world own at least one bicycle, accounting for 580 million households, which makes the potential population of this group very large⁴³. Their health and accident risk, however, may not be as high as other types of cyclists due to the low frequency and intensity of their bicycle use.

Endnotes

1. Leszek J. Sibilski, "Why We Need to Encourage Cycling Everywhere," World Economic Forum, February 5, 2015, <https://www.weforum.org/agenda/2015/02/why-we-need-to-encourage-cycling-everywhere/#:~:text=The%20Netherlands%20holds%20the%20record>.
2. Jeff Balton, "Bike Statistics & Facts For...," Bicycle Guider - Bikes, Bike Reviews, Cycling Advice, Best Picks | Mountain, Road, Hybrid Bikes (Bicycle Guider, September 10, 2019), <https://www.bicycle-guider.com/bike-facts-stats/>.
3. "UCI: Beginning Monday, Pros Must Wear Hard-Shells," VeloNews.com, November 30, 1AD, <https://www.velonews.com/news/uci-beginning-monday-pros-must-wear-hard-shells/>.
4. Mahsa Esmaeilikia, Raphael Grzebieta, and Jake Olivier, "A Systematic Review of Bicycle Helmet Laws Enacted Worldwide," ResearchGate 29 (August 16, 2018): 30–38, https://www.researchgate.net/publication/327050885_A_Systematic_Review_of_Bicycle_Helmet_Laws_Enacted_Worldwide.
5. Alena Høye, "Bicycle Helmets – to Wear or Not to Wear? A Meta-Analysis of the Effects of Bicycle Helmets on Injuries," Accident Analysis & Prevention 117 (August 2018): 85–97, <https://doi.org/10.1016/j.aap.2018.03.026>.
6. Alejandro Lucia, Jesus Hoyos, and Jose L. Chicharro, "Physiology of Professional Road Cycling," Sports Medicine 31, no. 5 (2001): 325–37, <https://doi.org/10.2165/00007256-200131050-00004>.
7. Norma Devarie Díaz, "El Ciclismo Y La Salud Cardiovascular," Revista Salud y Cardiología, June 3, 2020, <https://saludycardiologia.com/el-ciclismo-y-la-salud-cardiovascular/>.
8. [1] Mats Borjesson et al., "Recommendations for Participation in Leisure Time or Competitive Sports in Athletes-Patients with Coronary Artery Disease: A Position Statement from the Sports Cardiology Section of the European Association of Preventive Cardiology (EAPC)," European Heart Journal 40, no. 1 (January 1, 2019): 13–18, <https://doi.org/10.1093/eurheartj/ehy408>.
9. Milo Hollingworth, Alice Harper, and Mark Hamer, "An Observational Study of Erectile Dysfunction, Infertility, and Prostate Cancer in Regular Cyclists: Cycling for Health UK Study," Journal of Men's Health 11, no. 2 (June 2014): 75–79, <https://doi.org/10.1089/jomh.2014.0012>.
10. Oliver, Chris. (2014). Cycling, the prostate and erectile dysfunction. https://www.researchgate.net/publication/322419953_Cycling_the_prostate_and_erectile_dysfunction.
11. Claire H. Pernar et al., "A Prospective Study of the Association between Physical Activity and Risk of Prostate Cancer Defined by Clinical Features and TMPRSS2:ERG," European Urology 76, no. 1 (July 2019): 33–40, <https://doi.org/10.1016/j.eururo.2018.09.041>.
12. Mohannad A. Awad et al., "Cycling, and Male Sexual and Urinary Function: Results from a Large, Multinational, Cross-Sectional Study," Journal of Urology 199, no. 3 (March 2018): 798–804, <https://doi.org/10.1016/j.juro.2017.10.017>.
13. Coldman AJ, Elwood JM, Gallagher RP, Sports activities and risk of testicular cancer. Br J Cancer. 1982 Nov;46(5):749-56. Doj:10.1038/bjc.1982.267.PMID:6128995; <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2011166/>

14. "Fatality Facts 2022: Bicyclists," IIHS-HLDI crash testing and highway safety, May 2022, <https://www.iihs.org/topics/fatality-statistics/detail/bicyclists>.
15. "Fatality Facts 2022: Bicyclists," IIHS-HLDI crash testing and highway safety, May 2022, <https://www.iihs.org/topics/fatality-statistics/detail/bicyclists>.
16. Sandar Tin Tin, Alistair Woodward, and Shanthy Ameratunga, "Incidence, Risk, and Protective Factors of Bicycle Crashes: Findings from a Prospective Cohort Study in New Zealand," *Preventive Medicine* 57, no. 3 (September 2013): 152–61, <https://doi.org/10.1016/j.ypmed.2013.05.001>.
17. "Fatality Facts 2022: Bicyclists," IIHS-HLDI crash testing and highway safety, May 2022, <https://www.iihs.org/topics/fatality-statistics/detail/bicyclists>.
18. Sandar Tin Tin, Alistair Woodward, and Shanthy Ameratunga, "Incidence, Risk, and Protective Factors of Bicycle Crashes: Findings from a Prospective Cohort Study in New Zealand," *Preventive Medicine* 57, no. 3 (September 2013): 152–61, <https://doi.org/10.1016/j.ypmed.2013.05.001>.
19. Sandar Tin Tin, Alistair Woodward, and Shanthy Ameratunga, "Incidence, Risk, and Protective Factors of Bicycle Crashes: Findings from a Prospective Cohort Study in New Zealand," *Preventive Medicine* 57, no. 3 (September 2013): 152–61, <https://doi.org/10.1016/j.ypmed.2013.05.001>.
20. Derek Roberts et al., "Severe Street and Mountain Bicycling Injuries in Adults: A Comparison of the Incidence, Risk Factors and Injury Patterns over 14 Years," *Canadian Journal of Surgery* 56, no. 3 (June 1, 2013): E32–37, <https://doi.org/10.1503/cjs.027411>.
21. Paul Visentini and Ben Clarsen, "Aspetar Sports Medicine Journal - Overuse Injuries in Cycling," *www.aspetar.com*, December 2016, <https://www.aspetar.com/journal/viewarticle.aspx?id=339#.YqnYjaHP02w>.
22. Austin Lee and Benjamin N. Breyer, "Bicycle Riding: Good or Bad for Men's Health?," *Urology Times* 48, no. 3 (March 11, 2020), <https://www.urologytimes.com/view/bicycle-riding-good-or-bad-mens-health>.
23. Kristen Dams-O'Connor et al., "Traumatic Brain Injury as a Risk Factor for Alzheimer's Disease: Current Knowledge and Future Directions," *Neurodegenerative Disease Management* 6, no. 5 (October 2016): 417–29, <https://doi.org/10.2217/nmt-2016-0017>.
24. Sarmiento K, Haileyesus T, Waltzman D, Daugherty J. Emergency Department Visits for Bicycle-Related Traumatic Brain Injuries Among Children and Adults — United States, 2009–2018. *MMWR Morb Mortal Wkly Rep* 2021;70:693–697. DOI: <http://dx.doi.org/10.15585/mmwr.mm7019a1>.
25. Jonathan Elliott et al., "Sports-Related Concussion (SRC) Assessment in Road Cycling: A Systematic Review and Call to Action," *BMJ Open Sport & Exercise Medicine* 5, no. 1 (April 2019): e000525, <https://doi.org/10.1136/bmjsem-2019-000525>.
26. Bellal Joseph et al., "Bicycle Helmets Work When It Matters the Most," *The American Journal of Surgery* 213, no. 2 (February 2017): 413–17, <https://doi.org/10.1016/j.amjsurg.2016.05.021>.
27. Joe Lindsey, "Pro Cycling Has to Address Its Concussion Risk," *Bicycling*, May 17, 2017, <https://www.bicycling.com/racing/a20039227/pro-cycling-has-to-address-its-concussion-risk/>
28. American Lung Association, "Toxic Air Pollutants," *www.lung.org*, July 13, 2020, <https://www.lung.org/clean-air/outdoors/what-makes-air-unhealthy/toxic-air-pollutants>.

29. Robert Wright, Federica Cocco, and John Burn-Murdoch, "Is Urban Cycling Worth the Risk?," *ig.ft.com*, September 2, 2016, <https://ig.ft.com/sites/urban-cycling/>.
30. Ángela Luciana De Bortoli and Robélius De Bortoli, "Enfoque de La Utilizacion de Los Farmacos: Dopaje O Salud?," *Efdeportes.com*, March 2003, <http://www.efdeportes.com/efd58/dopaje.htm>.
31. P. Fernández-Díaz and R. Domínguez, "Efectos de La Suplementación Con Testosterona Sobre El Rendimiento En Resistencia," *Revista Andaluza de Medicina Del Deporte* 9, no. 3 (September 2016): 131–37, <https://doi.org/10.1016/j.ramd.2015.02.011>.
32. "COVID 'Long Haulers': Long-Term Effects of COVID-19," *Johns Hopkins Medicine*, April 1, 2021, <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/covid-long-haulers-long-term-effects-of-covid19>.
33. Gloria Modica et al., "Myocarditis in Athletes Recovering from COVID-19: A Systematic Review and Meta-Analysis," *International Journal of Environmental Research and Public Health* 19, no. 7 (April 2, 2022): 4279, <https://doi.org/10.3390/ijerph19074279>.
34. Global Cycling Network, "Cycling after Covid: The Risks & How to Get back to Riding Safely," *www.youtube.com*, February 13, 2021, <https://www.youtube.com/watch?v=KHu0rkQ1QJM&t=1s>.
35. Bojana Galic, "95 Cycling Stats Every Biking Buff Needs to Know," *LIVESTRONG.COM*, November 3, 2021, <http://livestrong.com/article/13730398-cycling-statistics/>.
36. Jeff Balton, "Bike Statistics & Facts For...," *Bicycle Guider - Bikes, Bike Reviews, Cycling Advice, Best Picks | Mountain, Road, Hybrid Bikes* (Bicycle Guider, September 10, 2019), <https://www.bicycle-guider.com/bike-facts-stats/>.
37. Aude White, "On the Cover of New York: The Revolt of New York City's Delivery Workers," *New York Press Room*, September 13, 2021, <https://nymag.com/press/2021/09/on-the-cover-of-new-york-nyc-delivery-workers-revolt.html>.
38. Jack Tigh Dennerlein and John D. Meeker, "Occupational Injuries among Boston Bicycle Messengers," *American Journal of Industrial Medicine* 42, no. 6 (November 18, 2002): 519–25, <https://doi.org/10.1002/ajim.10144>.
39. Mitchell N Sarkies et al., "The Human Impact of Commercial Delivery Cycling Injuries: A Retrospective Cohort Study," September 30, 2021, <https://doi.org/10.21203/rs.3.rs-934169/v1>.
40. Martha Pskowski, "Deaths and Injuries Don't Slow Uber Eats' Rapid Expansion in Mexico," *The Verge*, July 3, 2019, <https://www.theverge.com/2019/7/3/20679004/uber-eats-mexico-delivery-courier-death-injury-insurance-expansion>.
41. Katie Hunt, "Biking to Work Appears More Dangerous than Other Commuting Options, Study Finds," *CNN*, March 11, 2020, <https://www.cnn.com/2020/03/11/health/cycling-to-work-benefits-injuries-wellness/index.html>.
42. Robert Wright, Federica Cocco, and John Burn-Murdoch, "Is Urban Cycling Worth the Risk?," *ig.ft.com*, September 2, 2016, <https://ig.ft.com/sites/urban-cycling/>.
43. Bojana Galic, "95 Cycling Stats Every Biking Buff Needs to Know," *LIVESTRONG.COM*, November 3, 2021, <http://livestrong.com/article/13730398-cycling-statistics/>.

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July 2022