# Jon Lester, Mario Lemieux, Lance Armstrong—Why do so many athletes in their prime get cancer?

Belgium's Thomas van der Plaetsen ended up in eighth place in the decathlon at the Rio games this year, and while this strenuous and painstaking effort undoubtedly took a toll on his 25-year old body, van der Plaetsen has faced tougher challenges. At 23, he was diagnosed with testicular cancer.

He was not the only cancer survivor who competed in Rio. There was Jillion Potter, the American rugby player, who was diagnosed with sarcoma in 2014. Lawrence Brittain of South Africa who last year beat Hodgkin's lymphoma. Dutch swimmer Inge Dekker was diagnosed with cervical cancer just seven months prior to the games.

And it's not just the Olympics that's filled with cancer survivors; professional sports is filled with people who overcame various types of cancers during their playing days. American cyclist Lance Armstrong, former baseball greats Mike Lowell and Andrés Galarraga, Kansas City Chief's safety Eric Berry, Chicago Cubs All Stars Jon Lester and Anthony Rizzo, and Pittsburgh Penguin's forward Phil Kessel all beat cancer during their playing careers. Arguably one of the greatest hockey players of all time, Penguin's forward Mario Lemieux, missed time in the middle of his prime with Hodgkin's lymphoma.

I could go on, but the point is why do we see so many people at their physical peak being diagnosed with cancer—especially when we know physical activity is linked to a lower cancer risk? Is this just a case of the media overwhelming us with anecdotal stories?

**Digging deep in data**

There's an abundance of robust data from large studies that shows the opposite: elite athletes tend to have less cancer:

- A study of 4,100 men in Finland, male elite athletes on average had significantly less cancer than other men in the country.
- A study of 3,400 Norwegians turned up similar results: world class athletes had less cancer.
- A meta-analysis consisting of 42,000 done by researchers at the Mayo Clinic also found that athletes get cancer less than the general population—and live longer.

Three large studies find athletes from different countries get cancer less. Case closed? Not so fast.

While statistically significant lower cancer rates was the main finding of all three studies, if we dig into the data the story becomes more complicated. Both the Finnish and Norwegian studies found that the reduced incidence of cancers was due to one factor that had nothing to directly do with athletics: most of the athletes in the cohorts weren't smokers. A separate study of Finnish elite athletes, which focused on individual cancer types, found risk reductions only for lung and kidney cancer among elite athletes compared to the national cancer rate of the country.

**Different diseases**

Looking at cancer rate or risk for any population is effectively useless because cancer is not one singular disease like, say, cystic fibrosis. There may be be hundreds of different manifestations of cancers. So when we look at the rates for individual cancer types, some are elevated among this group.

**Bone cancer:** The second Finnish study found that the risk for sarcomas of the bone and soft tissues was elevated among elite hurdlers. The authors believe that this could be due to injuries sustained during competition. There has been a long held belief that injury repair is a fertile setting for new tumor growth. However, this idea is very controversial and the American Cancer Society states on its page that there is no evidence linking physical trauma and cancer risk. The reason for the apparent link is that when a person (athlete or not) visits the doctor for the trauma their inconspicuous cancers is often found.

**Testicular cancer:** If you look at the list of athletes listed earlier, you will see that several had testicular cancer. Kessel, van der Plaetsen, Lowell, and Armstrong. Testicular cancer is most prominent in men during their teens and 20s, which is when all these men had the disease. Data are not abundant on the issue, but one study by researchers at John's Hopkins found an increased risk of testicular cancer among men participating in strenuous occupational activities compared to men who participated only recreationally. There has also long been speculation that performance enhancing substances (e.g. anabolic steroids, blood doping) by athletes can increase the risk for testicular cancer, which many believe was the cause of Armstrong's.

**Lymphomas**: Outside of testicular cancer, the other most common cancer among athletes is lymphoma, particularly Hodgkin's lymphoma and non-Hodgkin's—both cancers of white blood cells, the difference being the presence (Hodgkin's) or the absence (non-Hodgkin's) of a specific abnormal cell. The data are poor on this question and there is a particular dearth of data on women (both diseases affect more men than women). One study did find that Hodgkin's lymphoma was associated with higher strenuous physical occupational activity, while another found no such relationship for non-Hodgkin's.

The data are too scanty on many of these cancer types to make definitive statements about why athletes may be more prone to these cancer types. At least one study suggest that elite athletes are not likely to share in any genetic factors that would elevate their cancer risk.

One hypothesis gaining tread is that consistent, strenuous physical activity (aka being a professional elite athlete) can cause, at least temporary, immune impairment. A number of studies appear to show that athletes are more likely to have decreased levels of B and T cells, natural killer cells, and antibodies under certain conditions. Here is how the authors' of one review on the subject describe how this could happen:

> Whereas athletes are not clinically immune deficient, it is possible that the combined effects of small changes in several immune parameters may compromise resistance to minor illnesses such as [upper respiratory tract infections].

Some lymphomas including both non-Hodgkins and Hodgkins lymphomas, are believed to be caused by

Epstein Bar Virus (EBV). In elite runners, one study suggested that half of the upper respiratory symptoms in elite runners comes from EBV. Other cancers can be caused by viruses too, like the Human Papilloma virus (HPV), which causes almost all of cervical cancers. The mumps virus is a risk factor for testicular cancer, HPV, cytomegalovirus and EBV might be too.

Interestingly, immune suppression does not occur after more moderate physical activity. In fact, immune enhancement is generally seen after moderate and strenuous physical activity and immune suppression only seems to occur after longterm strenuous activity—and even then data the suggest it only happens when the athlete doesn't get sufficient rest, as one study found.

> Whether or not the "open window" in the immune system occurs is dependent on the intensity and duration of exercise. One reason for the "overtraining effect" seen in elite athletes could be that this window of opportunism for pathogens is longer and the degree of immunosuppression more pronounced. It is being hypothesized that severe immunodepression may occur if athletes does not allow the immune system to recover, but initiate a new bout of exercise while still immunodepressed

The take home message is clearly not that athletes get more cancer; rather, when participating in physical activity, we all need to be mindful of our bodies and know when to take a break and let our body—and our immune system—recover.

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