| NEW TECHNOLOGY |

Can Equine Stride Data be the Key to Ensure Horse Safety When They Race?

PIERCE DARGAN OF EQUINEMEDIRECORD INTRODUCES US TO STRIDESAFE, DATA THAT MAY PLAY A VITAL ROLE IN EQUINE WELFARE IN THE FUTURE.

With horse welfare and the safety of our equine superstars being of paramount importance, can data hold the key? An American and Australian joint venture would argue that point and that they have the real-life evidence to prove it. StrideSAFE has started to use stride data when horses race to automate welfare screenings at several different racetracks.

The idea of StrideSAFE came from a combination of the companies StrideMASTER and Equine Analysis Systems. StrideMASTER began in 2010 when they were the first to capture detailed biometric data from thoroughbreds in races. The team knew that most professional sports were capturing this sort of information on their athletes 'in play', as that is when they were under maximal load. The team was confident that capturing the same sort of data from horses when they were at maximal load during races

would be valuable data for the racing industry.

In late 2018 StrideMASTER was a delegate and sponsor of ICEEP (the International Conference on Equine Exercise Physiology) being held that year in Australia. Dr David Lambert from Equine Analysis Systems in Kentucky was a keynote speaker at the conference. He had been applying similar sensor technology to horses in training from 2005 and had successfully used the data to analyse and predict future performance in young thoroughbreds. When the discussion turned to the challenge of identifying horses that were at risk of injury, the StrideMASTER team realised that both parties had an extensive amount of sensor data available, Dr Lambert 1,000 track gallops and the StrideMASTER team 40,000 starts in Tasmania, enough to start developing a solution. In 2019 the StrideSAFE company was established in the USA under the joint-ownership of StrideMASTER and Equine Analysis Systems and development of the StrideSAFE welfare screening system began.

Analysing biometric signal data is a specialised field. So the StrideSAFE team engaged experts such as Prof. Kevin Donohue, the DataBeam Professor for Signal Processing & Machine Learning at the University of Kentucky. Dr Lambert had worked with

Prof. Donohue on other projects so he was well-acquainted with his expertise in this field. Also involved was Dr Mikael Holmstrom from Sweden who is a partner in Equine Analysis Systems and an expert in equine exercise physiology. With this team assembled they then set about refining their hypothesis of how the thoroughbred was moving at speed, and how that was reflected in the data that had already been captured, as that could hold the key to being able to flag horses who were of risk of injury.

They knew they had to challenge the veterinary profession's age-old practice of trotting horses up to assess their soundness and identify lameness. This was obvious, as horses that were found to be sound at the trot were still breaking down in races. So clearly, some of the problems that afflicted horses at the gallop were not always being revealed at the trot, but horses don't give up their secrets easily at the gallop! There are a number of reasons for this. The first reason is changes at the gallop are happening too fast for the human eye to apply the same observational techniques that are used when trotting horses up. The human brain processes visual stimuli at around 60Hz. Things are happening much faster than that and in a more subtle way at the gallop.

The second reason is that at the gallop, horses give up autonomy over some important functions. Breathing

is one. At the gallop, horses become mechanical breathers. They can only breath once per stride, exhaling during their forelimb stance phase and inhaling during their flight phase, when all four legs are off the ground. In addition, they give up autonomy over their foot fall. At the gallop they must put each foot down when required. This is a key difference to the trot, for instance, where horses can change their footfall and loading, and in doing so show you when they are lame. This can't happen at the gallop. The horse has to put each foot down regardless of what's going on in terms of soundness. The only way a horse can accommodate issues affecting it at the gallop is through postural change and that is ultimately what the StrideSAFE system is monitoring.

However, to make the system work in a meaningful way, the sensors had to operate at very high sample rates, as they knew they needed high resolution data to be able to capture the changes. Their sensors operate at 800Hz on three axis, meaning they are capturing 2,400 measurements per second from the galloping horse. On average this equates to around 1,000 measurements per stride. With this much data they are able to deconstruct every stride into its component parts and compare it to the horse's previous strides from this and previous runs.

There are three main components of the stride; the hind limb stance phase where the power for the stride is generated, the fore limb stance phase where the horse is 'catching' that power, and the flight phase where the horse is preparing itself for the next stride. The hind limb stance phase is the foundation of the stride. If the power and/or timing of the hindlimb spring function is 'off', this gets translated on the diagonal into the fore limb stance phase and must be corrected before the horse gets to the start of its next stride and it happens all over again.

So how has the StrideSAFE system been implemented? The system now consists of a non-invasive, simple to operate and cost-effective sensor and software. The sensor weighs about 120 grams and is about the size on

an iPhone. It's simply inserted into a pocket on the saddle cloth and the data is downloaded and processed after the race. It doesn't interfere with any existing race day processes and trainers, jockeys and racegoers wouldn't know it's there. Reports are generated at the end of the day and sent to the regulatory veterinarian, who then instigates further diagnostic work on the horses that are flagged as high risk for injury in the future.

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Just like human athletes, each horse has a unique way of moving and generating power. StrideSAFE calls this the horse's stride fingerprint. They can establish a stride fingerprint for each individual horse or for a cohort of similar horses, for example by age group, two-year-olds or three-year-olds who race a similar race distance, stakes-level horses or Group One horses. The fingerprint for sound Group One horses is notionally the optimum against which all horses can be measured. If a horse is having its first start, or if the StrideSAFE team don't have any historical data for that horse, they can still assess its injury risk against the appropriate cohort fingerprint.

They look specifically at the amount of power a horse is generating and the vibration that goes with that power, as this can accelerate wear and tear. They also measure the symmetry of the horse on each of the three axis – dorsoventral (vertical), mediolateral and

longitudinal. By identifying how many standard deviations (SD) the horse is from the mean of the fingerprint they can calculate the level of injury risk for that horse. They then run a simple traffic light system. GREEN to indicate when the horse is within normal limits. AMBER when the horse is marginally outside normal limits. In this case the horse should be monitored closely. And RED for when the horse is significantly outside normal limits and there should be a more thorough veterinary examination.

To date, the system has been extremely well-received by all accounts, by racetracks and particularly by trainers, owners and jockeys where it has been used. There is increasing demand for data of this kind, as participants understand the importance of improving welfare standards and the implications for the industry's social acceptance (licence to operate) if those standards are not met. The system started operating on racetracks in the USA in late 2020 with a proof of concept trial at Emerald Downs in Washington State, followed in 2021 with all three tracks in New York, then Kentucky Downs and finally on all thoroughbred tracks in Tasmania, Australia.

During the initial 10-month period operating on New York tracks, data on 6,458 starts was captured from 2,659 individual horses. It was a 'blind' trial, so the data was only monitored by authorities and not relayed to trainers. Of the horses that sustained serious injuries, StrideSAFE predicted more than 90% of those injuries in advance. Out of 27 horses that suffered a serious injury or were euthanised following a race, StrideSAFE red-flagged 25 of those horses in races preceding the race in which they were injured. Results are now being communicated to trainers and protocols are being developed for veterinarians to follow in the investigation of 'at risk' horses. Interest continues to grow, with a number of racing jurisdictions expressing interest to trial the system for 2023.

It would seem that StrideSAFE has the data and analytical module required to improve the welfare of our horses.