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TALKING SAFETY

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We welcome your feedback: medical@fiainstitute.com



Welcome to the latest issue of AUTO+ Medical, bringing you the latest developments and research in motor sport medicine. This forward will rotate between the members of the editorial board and I'm delighted to go first.

I'm really excited about the Medicine in Motor Sport smartphone app, revealed in this issue. The project has been a long time in the development phase but thanks to Dr Ian Roberts, Formula One's medical rescue co-ordinator, it has finally been launched. Designed for motor sport medical personnel working at events around the world, you can download it right now. This is a living app and a valuable tool which will be constantly updated and refined. It is there for you and we want your feedback.

Elsewhere in this issue we speak with Prof. Rob Seal, President and Medical Director of the Canadian Motorsports Response Team and Chief Medical Officer of the FIA World Rallycross of Canada, whose rescue management expertise and knowledge of motor sport make his interview a worthwhile read.

Our series of scientific papers continues with a fascinating study recording the incidents reported to the medical centre at the UK Silverstone circuit over a four-year period. Finally, please look at the results of our survey on concussion, which produced some very enlightening data. I'm delighted so many of you took the time to participate.

I hope you enjoy the latest issue.

Dr Paul Trafford
Chairman
AUTO+ Medical Editorial Board

LETTERS

In this section, we print the best letters and emails received from readers around the world. We welcome comments on articles as well as suggestions for future content or insight into an area of motor sport medicine you feel would be relevant. If you wish to send in a letter or email, please direct it to: medical@fiainstitute.com

Dear Editor,

I have seen AUTO+ Medical and thought it would just be for the doctors, but a lot of it is interesting for me. I am the driver of the Medical chase car for the Macau GP and the articles on the medical cars have been good for us to see what is used around the world and in different series.

In Macau we use two medical chase cars, four other medical cars and four extrication vehicles. We don't have permanent medical cars as our event is once a year, so it would be good to see the medical cars that are not full time with a series; as well as well as finding out if others change the brakes and other technical details. Thank you for making it interesting for all of us involved in safety.

Thanks,

Sérgio Jorge
Medical Chase Car Driver
Macau Grand Prix

Editor: Thanks for your comments and suggestions. There are many different types of medical cars used in events around the world and we will continue to profile them and their unique set ups for each event.

This will certainly include those that are not used full-time such as at the Macau Grand Prix and many other events around the world.

Dear Editor

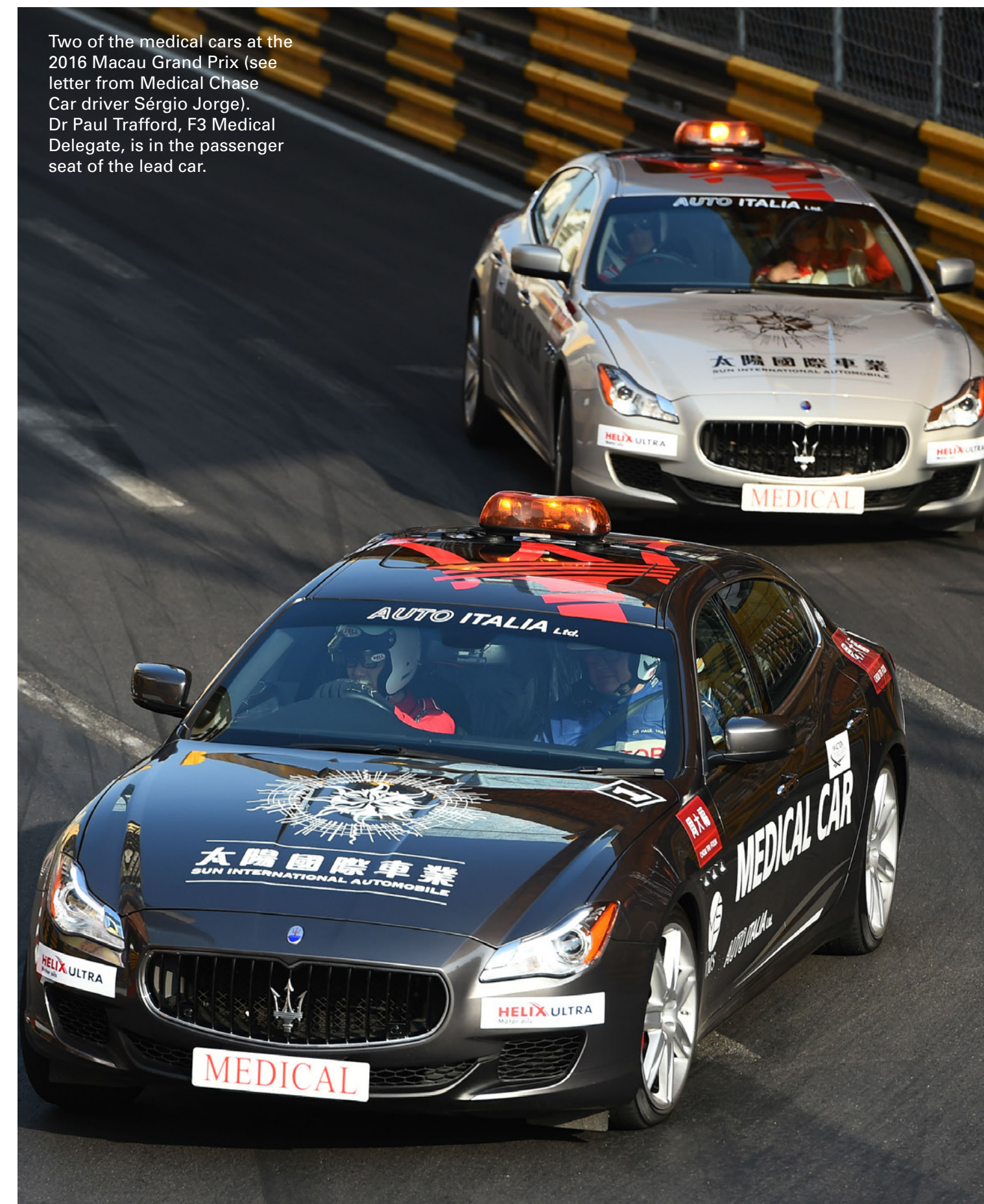
The ICMS Board of Directors is always looking for ways to provide our members with educational information and the FIA Publication AUTO+ Medical is a prime example of continuing education in a motor sport medicine format. This international journal of motor sport medicine represents the latest in research, position statements and articles from the most knowledgeable practitioners around the globe. Many of the contributors are FIA Medical Commission and Advisory Panel Members as well as ICMS Directors and Members.

We believe this publication is an up-to-date composite of information beneficial to all providers of medical and safety services worldwide. This is why we are happy to share it with our members.

Thank you for providing a subscription link so motor sport medical professionals can easily sign up to receive this important publication.

John Sabra MD
Chair, Membership Committee
International Council of Motorsport Sciences
CMO Formula One US Grand Prix

Editor: It is fantastic that ICMS is supporting AUTO+ Medical in this way. We'll be reporting from the ICMS Annual Congress in our next issue, where no doubt there will be the usual high level of presentations and discussion.



Two of the medical cars at the 2016 Macau Grand Prix (see letter from Medical Chase Car driver Sérgio Jorge). Dr Paul Trafford, F3 Medical Delegate, is in the passenger seat of the lead car.

GLOBAL NEWS



Formula E is one of the championships that will take part in the Race True programme next year

DRIVERS TO RECEIVE ANTI-DOPING GUIDANCE

The FIA will commence deployment of its Race True anti-doping educational programme in 2016 and drivers competing in FIA championships throughout the world will receive anti-doping group training as part of it.

The programme will be provided to competitors driving in Formula One, the World Rally Championship, the World Endurance Championship, World RallyCross, the World Touring Car Championship, Formula E and European Formula 3.

"It is essential for a driver to follow the anti-doping rules," said the FIA's head of medical affairs, Sandra

Silveira Camargo. "Ignorance of those rules can lead to an ineligibility period of up to four years in motor sport and all sports. In spite of this extremely serious risk, many drivers do not know the anti-doping regulations well. The main reason for this alarming situation is the lack of knowledge of anti-doping."

The training sessions are responses to results from 2014 where 3.6 per cent of the doping tests carried out by the FIA led to a positive result. If the programme proves to be successful it will be expanded to include more championships in future years.

MSA PLANS NEW RULES ON CONCUSSION

The UK Motor Sports Association (MSA) is working to produce new guidelines for dealing with competitors who suffer concussion at a motor sport event, which could include temporarily confiscating their licences.

High profile motor sport championships, such as Formula One, test drivers for symptoms of concussion by using a series of questions and tasks to assess the state of their brains. This is known as the ImPACT test, which must be passed before a competitor can drive again.

But the ImPACT test is generally considered to be too expensive and too complex to be used at national level events, so the MSA is considering suspending drivers for a period of three weeks to allow concussions to clear, before they are allowed to return to competition.

FIA Institute Medical Consultant Paul Trafford explained some of the problems ASNs have in implementing the current guidelines on concussion in lower-category racing.

He said: "Every sport has some regulations on concussion except motor sport. If you're concussed, you're out for a period, [so] drivers try hard to convince themselves they are all right.

"[If they] go to a different circuit, unless you tell that circuit or someone's taken your licence off you, nobody's got a clue what's happened."



QATAR PLAYS HOST TO HIGH-LEVEL MEDICAL SEMINAR

The latest FIA Institute medical seminar for the Middle East and North Africa (MENA) region took place at the Losail International Circuit in Qatar on 7-8 October and featured two days of presentations and practical demonstrations.

Delegates at the conference were made up of motor sport medical personnel from around the region who listened to talks given by senior motor sport safety officials. These included Dr Michael Scholz, who discussed planning and safety protocols at motor sport events, Jean Duby who spoke about rally safety, and Dr Amjad Obeid, who explained accident management procedures and medical team selection.

The delegates also took part in workshops and simulations to practice important extrication skills. These exercises in extrication utilised the FIA's medical extrication simulators for closed car and open wheel racing. On the second day of the event, the simulation work moved onto the track, with an exercise involving a car going into barrier and a difficult extrication.

Nasser Al-Atya, President of Qatar Motor and Motorcycle Federation (QMMF) and FIA Vice President for MENA, who opened the event, said: "As our delegates return home, I ask them not to stop communicating with each other and the FIA, as together we can continue to develop better equipment, medical skills and safety practices throughout the motor sport world."

BAHRAIN TO PROVIDE MEDICAL SUPPORT TO AZERBAIJAN GP

The Bahrain motor sport federation will help the organisers of the inaugural Azerbaijan Grand Prix set up their medical facilities and safety plans when the race joins the Formula One calendar next year.

Representatives of the Bahrain organisation visited the Baku street circuit last month and agreed to help co-ordinate the organisation of fire, rescue and medical services and facilities, as well as help to recruit and select track marshals and manage race control.

Arif Rahimov, chief executive officer of the Baku City Circuit, said: "The insights gained by our team from the Bahraini

experts will be invaluable in the further months of planning and preparations that lie ahead for Baku City Circuit. The Bahrain motor sport federation has set a world-class standard for sporting operations and organizational excellence, and our team fully intends to meet that standard."

The Baku street circuit, which has been designed by track architect Hermann Tilke, will be 6.05km long and feature 20 corners that will run through the historical part of the city during one section. The first ever Formula One race in Azerbaijan is scheduled to take place on 19 June 2016.

Marshals at the 2015 Bahrain Grand Prix



COTA APPOINTS DR JOHN SABRA AS CMO

Dr John Sabra has been made the Chief Medical Officer at the Circuit of the Americas in Austin, Texas.

Sabra, who had previously worked as the track's deputy CMO for the last three seasons, was promoted to his current role earlier this year.

Speaking to AUTO+Medical at the recent US Grand Prix, Sabra said: "I just got the role in June of this year. It's been exciting. I have a military background, I was in the navy for a while on ships with helicopters doing things, and it brings some of that same level of excitement and preparedness."

Sabra, who works for the Seton Surgical Group, explained that the vast majority of medical procedures at the Austin track were for spectators.

He said: "In a study on our inaugural year in F1 in 2012, we did 580 evaluations for that event and there were no drivers. It's a well maintained track with huge run-offs, and of course the cars are incredibly safe."

Sabra and his team reveal the equipment in the F1 medical rescue helicopter at the US Grand Prix on p28



John Sabra, Chief Medical Officer at the Circuit of the Americas

ILCOR ISSUES GUIDELINES FOR RESUSCITATION

The International Liaison Committee On Resuscitation (ILCOR) has completed its latest five-year periodic review of the evidence on resuscitation and issued the 2015 Consensus on Science and Treatment Recommendations (CoSTR) documents.

Resuscitation groups use this information worldwide to tailor region-specific resuscitation guidelines. The 2015 recommendations include: a strong push to minimise interruptions to good quality cardiopulmonary resuscitation (CPR); the use of mechanical CPR devices; and the promotion of the role of end-tidal CO₂ (EtCO₂) waveform capnography.

Dr Matthew MacPartlin, deputy CMO at Rally Australia and assistant CMO at the Australian Grand Prix, explained why these new guidelines would be useful to motor sport medical personnel.

He said: "Of particular interest in the motor sport context is the formulation of a traumatic cardiac arrest algorithm which reflects where much of the current thinking in trauma is at. Now is the time to start thinking about this as it is directly relevant to trackside motor sport clinical practice."





Safety demonstrations and discussions will take place at the 2015 ICMS annual congress

ICMS ANNUAL CONGRESS REVEALS PROGRAMME

The 2015 International Council of Motorsport Sciences (ICMS) Annual Congress will take place at the Performance Racing Industry (PRI) trade show in Indianapolis on 9-11 December.

Delegates attending the event will listen to presentations and practical demonstrations organised by the Curriculum Committee: Dr Hugh Scully, Dr Rob Seal, Dr Richard Jennings, Dr Steve Olvey and Dr Terry Trammell.

On the first day of the event, discussion will cover several motor sport safety innovations developed by the FIA Institute, including the Accident Data Recorders (ADRs) and the in-ear accelerometer study.

During the second day of the congress,

Formula One race director and FIA safety delegate, Charlie Whiting, will give a presentation on how to fully prepare for a race and Dr Paul Trafford will discuss knowledge-sharing platforms.

On the final day of the meeting, the focus will be on racetrack safety programmes. During the morning session, safety equipment and training programmes will be discussed and in the afternoon, Dr Rob Seal will lead a demonstration of elite safety response teams.

The ICMS is hosting a reception for congress delegates, in conjunction with the PRI, on the evening of Wednesday 9 December at the nearby Lucas Oil Stadium.

UPDATE ON NOVEL ORAL ANTICOAGULANTS' USE IN MOTOR SPORT

Medical personnel working at all motor sport events should have an understanding of the latest generation of novel oral anticoagulants (NOACs) and their reversal agents, according to Dr Matthew MacPartlin, Deputy CMO at Rally Australia and assistant CMO at the Australian Grand Prix.

NOACs (anticoagulants for conditions such as atrial fibrillation and pulmonary venous embolisms) are seen as an improvement on existing anticoagulant drugs as they are low maintenance and relatively inexpensive.

It is possible that spectators, officials, and even competitors may be taking these drugs and if they are involved in an accident then they could bleed more as a result. So it is important to understand that new drugs are becoming available to counteract their effect.

MacPartlin said: "Alternative antidotes such as pouring in fresh frozen plasma, vitamin K, pooled platelets, cryoprecipitate, factor VIIa and even tranexamic acid may shorten the bleeding time of the Xa inhibitors somewhat. But they're expensive, deplete a scarce resource and can be logistically difficult; especially at motor sport events where the storage and waste of blood products can be very challenging.

"So the emergence of NOAC antidotes such as Idazucizamab and Andexanate alfa could become increasingly relevant for motor sport medical personnel, especially at events with older competitors who may be taking these medications."



Chaz Mostert recovering in hospital

DRIVERS PRAISE MEDICAL TEAM AT BATHURST

Australian V8 Supercars driver Chaz Mostert has praised the medical and safety crews who treated him following his enormous accident in qualifying for the Bathurst 1000.

Mostert, who won the race in 2014, suffered a broken leg and wrist after he crashed on his first qualifying lap, destroyed his car and damaged a marshals post.

The Ford driver was airlifted to hospital following the 50g accident and track action was suspended for the rest of the day as a result.

After spending nine days in hospital, Mostert said: "A big thanks to all the transfer crews and Orange Hospital for putting up with me, now to chuck some shorts and flip flops on and start healing."

In a separate incident, Aussie Racing Car driver Damien Flack was also hospitalised in a huge crash in the Bathurst support race.

Flack's car flipped 12 times and caught fire in a crash sparked by his brother Adrian. Flack was conscious when he arrived at the medical centre but suffered broken ribs and a punctured lung.

Aussie Racing Cars category manager Brad Ward said: "We are very thankful of the efforts of the track medical staff and emergency response teams who assisted when the incident occurred."

FEATURES

TALKING SAFETY

The FIA's safety team went to the US Grand Prix for a crunch meeting with Formula One's drivers. Both groups were surprised by the outcome.



The meeting was set weeks in advance. Two of the FIA's leading safety researchers would be heading to the 2015 US Grand Prix in Austin to meet all of the Formula One drivers and their team managers to discuss the latest developments in the sport. Then Carlos Sainz had a major crash at the Russian Grand Prix.

During practice in Sochi, the Toro Rosso driver suffered a frontal collision at 153kph with the high-speed barrier, which then appeared to ride up and over the car. The F1 drivers were worried. They had heard reports (mainly false) about the efficacy of these crash barriers and the general safety of F1.

But rather than be put off, this made the FIA safety team even more determined to set the record straight. Step forward Laurent

Mekies and Andy Mellor. Mekies, the FIA's Safety Director, has over 15 years' experience working in F1 as an engineer and then as Head of Vehicle Performance at Toro Rosso, before joining the FIA in 2014. Andy Mellor, research consultant, has spent his entire career developing safety, first for road cars and then for racing. Together they headed to Austin armed with data.

Alex Wurz, Chairman of the Grand Prix Drivers Association, spoke to Mellor soon after Sainz's crash and knew that it was even more important to get the facts to the F1 drivers. "When I spoke to Andy Mellor about Carlos' accident in Sochi, and when I started to understand the matter in more detail – whilst at the same time hearing the concerns of the

drivers – I knew that I had to get this research in front of the drivers," he says.

It was Wurz who had requested the meeting a few weeks earlier. He put that request straight to the top and FIA President Jean Todt was happy to oblige. "I am very pleased Jean kindly agreed to send Laurent and Andy to host this workshop and share the data," says Wurz.

Mekies adds: "Jean Todt was absolutely pleased to take this opportunity to further strengthen the relations with the drivers and to have a chance to involve them in these important matters."

They sat down with the drivers following their briefing at the US Grand Prix. Mekies and Mellor were joined by F1 Race Director Charlie Whiting, who is ultimately responsible for safety in the championship. But this was not just a discussion, it was important to show the drivers the hard data so they could understand the science behind the safety.

PROJECT FOCUS

Mekies decided straight away that it would be important to present a range of projects and not just focus on Sainz's accident. The FIA is continually researching safety but due to the sensitive nature of this it is not always possible to communicate the latest developments. But here was an opportunity to do so.

"We selected four main topics for the drivers," says Mekies. "These were the cockpit protection project; high-speed cameras; the Carlos Sainz crash from Sochi; and our future work on track limits, a project that will be starting soon."

Of course, it was important to set the record straight on the Sainz accident. The Spanish driver walked away from a 153kph frontal collision and Mekies confirmed that it was the highest speed impact this year with a 42G peak. Contrary to reports, the high-speed Tecpro

barrier performed extremely well to absorb the energy of this impact within four metres.

"It was quite an extreme stop, and an outstanding performance from both the car and barriers that allowed the driver to walk away from the crash," says Mekies.

"The numbers are quite mind-blowing," adds Wurz. "[Stopping from] 153kph in four meters and the driver races the next day. This is really impressive and it is thanks to all the intensive work that has been done."

However, one area of concern is that after absorbing the impact, the TecPro barrier rebounded off the steel guardrail and landed on top of the car. "This is very important for us to improve and solve because it gave quite a few concerns to the rescue team," says Mekies.

“IT WAS QUITE AN EXTREME STOP, AND AN OUTSTANDING PERFORMANCE FROM BOTH THE CAR AND BARRIERS”

What was clear from the data and the slow-motion replays of the crash was that the upwards movement of the barrier had nothing to do with the low nose of the car.

"There's been a lot said about the low-nose project," says Mekies. "The object is to reduce the car's tendency to launch when you have a nose-to-wheel contact. From video analysis of Sainz's crash, you see signs of the barrier rising but this is at the very end of the impact almost once the car has stopped because the car is rebounding from the ArmCo."

"But it is a different situation compared to the car submarining under the barrier. It is a good challenge to take on, how to avoid



FIA Safety Director Laurent Mekies presents the latest developments in frontal protection

that rebounding barrier, but it also gave us confidence in the energy absorbing systems and car components in the crash.”

PROTECTING THE COCKPIT

One of the most important safety projects currently being worked on by the FIA is in cockpit protection. This is also a project that the drivers were particularly interested in.

“For some time now we have been trying to bring additional protection to the cars, the main objective being to avoid large objects making contact with the cockpit environment and with the driver’s head,” says Mekies. “We would like to do that without introducing other concerns, typically without adding consequences for extrication, for visibility and so on.”

This project is divided into three categories: helmet protection, lateral protection and the frontal protection.

The helmet protection programme was accelerated after Felipe Massa’s accident in Budapest in 2009, where a stray 1kg spring hit him in the head at 250kph. This led to the development of a zylon panel to reinforce the area where the visor meets the helmet.

The lateral protection programme has also gained traction and will lead to an important development for 2016. This involves raising the cockpit side height of F1 cars by another 20mm to 150mm and the strengthening of this area is also going to treble from a 15k newton test to a 50k newton test.

The frontal protection programme is perhaps the most important but also the most complicated. A number of potential solutions have been tested over the last few years but none have been taken forward.

The first test was on a jet fighter-style canopy and then a roll cage type solution called AFP (Additional Frontal Protection). Further tests



An important future project will look at track limits, finding ways to ensure drivers stay within areas of the track they are supposed to, without affecting their safety. Below: Mercedes' Halo concept.

are being planned with these and other solutions.

This series of tests will include a Halo Concept developed by Mercedes. But the difficulty with all of these solutions is that whilst offering increased protection in one area, it could cause other safety issues, such as affecting the visibility of the driver.

“We have several versions of the AFP that we will test,” says Mekies. “The purpose is to see if

“FOR SOME TIME NOW WE HAVE BEEN TRYING TO BRING ADDITIONAL PROTECTION TO THE COCKPIT ENVIRONMENT OF THE CARS”





GPDA chairman Alex Wurz discusses the drivers' viewpoint with safety researcher Andy Mellor

they deflect the wheel without any integration and visibility difficulties for the driver.”

Mekies is fully aware of the difficult task but is determined to make progress in this area. “What we are trying to do is first find concepts that can do the job and then we will find a way of dealing with the other matters. As you can see we are scanning quite a broad range of solutions and trying to learn from each.”

This is why it is important to get feedback from the drivers. It is certainly appreciated by Wurz. “We have seen solutions that are maybe not pretty, but it’s function first and then later you have to work on style,” he says. “But at the

moment what you are seeing is that the FIA is really open and honest, this is a research project. This is showing you what is happening and we learn so much from that.”

Mekies would like to see a solution developed for the 2017 season. But he will not rush through a decision until it is proven through testing by both the researchers and the drivers.

HIGH-SPEED ANALYSIS

One project that will be delivered next season is the introduction of a miniature high-speed camera, which will be mounted on the front roll hoop of the car facing the driver’s head.

This was track tested for the first time at the US Grand Prix by McLaren’s Fernando Alonso and Red Bull’s Daniil Kvyat, with positive results.

The camera is the final piece in a puzzle that will ensure the FIA has all the necessary data in the case of an accident.

“We have had for a number of years the Accident Data Recorder in the car that records the cars accelerations and forces,” says Mekies. “Last year in F1 we introduced the ear accelerometer which records the accelerations on a driver’s head in case of a crash. Now we have another piece of that puzzle with the camera being able to be connected to this to help us understand the dynamic of the first point of contact between the driver’s helmet and the environment in the cockpit.”

“THE CLOSER ALL PARTIES COOPERATE THE MORE EFFICIENT OUR RESEARCH AND DEVELOPMENT PROCESS WILL BECOME”

There is clear limitation with TV footage, which offers only 25 frames per second. The new camera offers 400 frames per second and will help researchers to understand the dynamics of head and neck movement to help with future safety equipment design.

TRACK LIMITS

An important future project will look at track limits, or finding ways to ensure drivers stay on the areas of the track they are supposed to without affecting their safety.

As Mekies explains: “Track limits are easy to enforce from a sporting point of view, you put

higher curbs on the track and nobody goes over them, but this gives us safety concerns when the car hits the curbs.

“So as a result, curbs are getting thinner and thinner and lower and lower and we do eventually get issues with track limit management.

“What we are doing is to try to have a broad approach at this issue and look at how we could combine new curb solutions with electronic solutions and see if a combination of these two things can help.”

Whiting has been very much leading the effort so far on this topic and will be working closely with Mekies. Testing has already begun on different types of curbs that offer increased resistance without diminishing safety.

DRIVER RESPONSE

Rather than being sceptical or antagonistic, the F1 drivers were interested and appreciative of the presentation of these safety plans.

“I must say that they were extremely attentive, interested and constructive in the debates, which went for more than an hour,” says Mekies. “They asked a lot of questions and were willing to go into a certain level of detail so it was very positive and a two-way exchange where we gathered feedback.”

Wurz was delighted with this collaboration. “I am thoroughly impressed by the work and research of the FIA and FIA Institute experts,” he says. “But equally impressive is their curiosity and acceptance of the drivers’ opinions and inputs. The closer all parties cooperate the more efficient our research and development process will become.”

No doubt this is the first of a series of research meetings involving the drivers to maintain the link and feedback in both directions. And motor sport will become safer for it.

DR ROB SEAL

President and Medical Director of Canadian Motorsports Response Team;
Chief Medical Officer, FIA World Rallycross of Canada

Dr Rob Seal, a paediatric anaesthetist by day, has been involved in motor sport since 1995 when he volunteered to work at the Canadian Grand Prix in Montreal. Since then he has gone on to work as the Chief Medical Officer (CMO) at IndyCar races in Edmonton and is currently the CMO for the Grand Prix de Trois-Rivières, the Canadian round of the FIA World Rallycross Championship, as well as the Medical Director for the response team at the F1 Grand Prix.

AUTO+Medical: How and why did you get involved in motor sport?

Rob Seal: There's a long history of anaesthesiologists being involved in motor sport because of their skills in resuscitating patients. At the Canadian Grand Prix, one of the physicians, who has always been involved, was a friend of mine and in 1995 we were both on the board of directors for the Canadian anaesthesiologist society.

One evening after a board meeting we were talking about motor sports and he told me the history of his involvement with the Grand Prix and I said I'd always loved motor sport and would love to volunteer. He said he'd talk to his colleagues at the Grand Prix du Canada and see if I could join them, which I did that season and I started going back year after year.

The first year I was based in the medical centre and then in the pitlane before I eventually worked at every rescue corner on the track. Then in the last decade I've been positioned in the pursuit vehicle for all the support races. After a few years I thought I'd like to know more about the other side of the guardrail. I got my racing licence and drove Formula Fords and Formula 2000s to view racing from the driver's perspective. It actually

made spectating more interesting to understand as I learned what drivers do mentally and physically as they're racing.

A+M: Did you have any success as a racing driver?

RS: It was all at a very amateur level and I was mainly racing with friends. We didn't do any competitions, we just spent a lot of days lapping tracks and having a few informal races.

A+M: How did you become involved in the IndyCar races that were held at Edmonton?

RS: In 2005, Champ Car came to Edmonton; the race had formerly been at Vancouver before that, but it was put back on the calendar at Edmonton. Professor Hugh Scully came in to be the medical director for that race, but he felt it was an awkward pain to have a physician from Toronto being the medical director in another city because as medical director you really need to have a lot of links to the local infrastructure. Hugh and I once counted those links and it's around 41 connections that you might need to organise the medical aspects of a race event.

You've got the emergency medical services, the paramedics, the rescue services, the police department, the race series, the promoter, the



communications and then everything right down to the medical examiner's office. Then within each series you've got to establish a relationship with their communications people. You also have to make links within the hospital system, and the chiefs of the hospitals and the chiefs of the significant departments that you might have to have on alert during the event.

A+M: You went on to become medical director at the Edmonton IndyCar race?

RS: Scully had brought me in as his deputy medical director to help make sure that all of the on-ground links happened for the Champ Car races in Edmonton. Then as the series transitioned to IndyCar in 2008, I became the medical director for the five years that we had IndyCar in the city. It was quite interesting, as you get a completely different view of how the

race event goes when you're on track in a race vehicle versus being in race control. There is also the amount of pre-event work that you have to do if you're the medical director, especially at temporary circuits such as in Edmonton or Montreal. The amount of pre-planning that goes on is more than if you have a permanent circuit that constantly has activities on it all year long.

The other thing that adds to that complexity is that just like the organisers are building the circuit, you're building all of your rescue vehicles and equipping them. You need to get the medical centre equipped from scratch and you may not know what you even have for your building until it arrives.

Things also crop up and need to be fixed, such as adding a ramp so you can get a stretcher up and down into the medical centre, or finding

that the building doesn't have a door wide enough for a stretcher. There are a lot of problems to solve and things to work out.

But I really enjoyed both sides. Fortunately in the Grand Prix de Trois-Rivières in Québec, where I'm currently the chief medical officer, I have a really good deputy who is one of the local physicians and it might well be that as she learns more about motor sports, she takes over and I'll fall into the background.

A+M: On that note, how did you become the CMO for the Canadian WorldRX event?

RS: The organisers of the Grand Prix de Trois-Rivières had a gap in their coverage, plus they had never done an FIA event before.

They wanted somebody who had experience of being chief medical officer and they knew I'd had eight years of doing it in Edmonton and the experience in Montreal. My company, the Canadian Motorsports Response Team (CMRT), was already doing the rescue services for the event, so through the promoter, Dominic Fugere, then went on to approach me.

I think he is probably the king of promoters because he actually gets all aspects of the event very well and he's very supportive.

When you identify what you need in order to provide the kind of safety services that meet the requirements, he and the team he surrounds himself with really do everything they can in their power to make it happen.

They're sort of the dream promoter, whereas in Edmonton in eight years we went through different promoters year after year. Some of them were really good and understood racing and the safety aspect, but some were more used to doing rock concerts and didn't really understand why controlling where people wandered was important and they asked why we needed what we needed.



“ WE PROVIDE ALL OF THE EQUIPMENT AND PERSONNEL NEEDED FOR THE RESPONSE VEHICLES ON RACE CIRCUITS.”

A+M: What is your role as the director of the response team at the Canadian F1 race?

RS: When I'm at the Canadian Grand Prix I wear more than one hat. I'm on the medical team but I'm also the president and medical director of the rescue company. There is a group of five of us that are business partners in the CMRT and we formed the company to provide all of the equipment and personnel that are needed for the response vehicles on race circuits. We cover the Canadian Grand Prix in Montreal, the Edmonton IndyCar and the Grand Prix de Trois-Rivières and in each of those, the trucks will have fire fighters, paramedics and a physician

onboard. We're responsible for supplying all of the personnel, other than the physician, who will come from the medical team at the Grand Prix du Canada, but we're pretty tight knit.

A Formula One event is different because we always end up having to put all of our equipment into the vehicles provided by the promoter and that can change from year to year. Over the course of the last number of years the vehicles have been Mercedes and so we have to gently fit all of our heavy stuff into those cars. For the other events we can use skid units that we build a platform on and then slide them in and out of pick up trucks.

A+M: What are the main differences, from a medical safety point of view, between a Grand Prix and a WorldRX event?

RS: In a lot of ways they are very similar. But the biggest challenge is that in Formula One you're dealing with open cockpit cars, so if you have to extract the driver you don't have a lot of stuff in your way. Whereas, when you're dealing with Rallycross, you have to extract the driver from a confined space, so the biggest difference is the closed cockpit versus the open cockpit.

The types of injuries we would see at the two events are also different. Luckily we've not been faced with any yet in WorldRX, but the potential

injury pattern would be different because they are doing jumps and they also race a lot more closely and bump each other quite a bit.

Whereas in Formula One they tend to try and be mindful of each other and contact isn't quite as much as it is in Rallycross.

One of the first things that we noticed in the inaugural year of Grand Prix de Trois-Rivières, that became somewhat of an issue, was that the people that travel to Rallycross come from a rally type of background. This means they are a little bit more accustomed to being right on the edge of the racing circuit and there was one particular corner that was near the paddock and we would have people venturing out onto the edge of the track. That really worried me greatly and we had a lot of trouble trying to get the message out from race control to get these people out of the way. In Formula One the whole track access is really well regulated and

so I found that a little bit loose the first time in Rallycross, but it's now much better.

A+M: What has been the biggest challenge you've faced as a motor sport doctor?

RS: One of the more difficult things I've seen was actually when I wasn't directly involved. It was as a spectator when Dan Wheldon had his fatal IndyCar crash. That was hard. I was seated with a close motor sport friend, Doug Hill, on one side and my daughter on the other. She's an avid racing fan who would always get up early with me and come to the track.

It was tough on all of us, but Doug and I had watched what was happening. Just two laps prior to the crash they were starting to race three wide and we said we didn't like what we were seeing. We'd barely got the words out of our mouths when the accident happened. Just talking about it brings up very visual memories

in my mind. I knew that although I wasn't involved with dealing with the accident, the people who were on the frontline were all people that I knew very well and were close friends. So that was tough.

A+M: What has been the biggest challenge that you have had to deal with yourself?

RS: The thing that has struck me the most has been trying to educate promoters about what we actually need to provide for medical and safety services. With the CMRT, when we get involved, it's not just the medical aspect but also fire-fighting and cutting cars apart, so we have to actually impress upon them how much infrastructure you need.

There's also the concern about where you place those resources and we've had times where we've had to gather other people of influence from our ASN to meet with a promoter to say that we're going to have to build a wall differently because we can't put safety vehicles where they'd like us to put them. This was because they were right in the line of where cars could come and crash into them, we needed help explaining that we had to put them in another spot where it's actually safe to go ahead and deploy them.

A+M: Would you say that's the most rewarding part of your work?

RS: I like building things, so what's quite fun about having an event at a temporary circuit is that you can actually see the plans come together. That was the case at the temporary circuit at the Grand Prix de Trois-Rivières and the temporary airport circuit in Edmonton. When the circuit is coming together, I often take lots of photos and watch it be built, watching the fences come up, our safety accesses and the hideouts for the vehicles be put in place, as well as the placement of the medical centre.

Often, when we do something over a number of years, we'll try more than one configuration for the medical facilities. During the first Grand Prix de Trois-Rivières we had a medical centre that wasn't quite partitioned correctly and it wasn't in the optimum position once the paddock filled up with people and with race traffic. So we had to alter the organisation of the building as it was not optimal and that's a fun part of the creative element.

The other thing that I find rewarding is going around and seeing what other people are doing. I've never been to a race and not learned things or not come away without ideas about what I could do better and how we do things at CMRT. Often what we put in place at the Grand Prix du Canada is influenced by what we've seen people do in Brazil or at Suzuka. We just pick up great ideas from everybody and use them to make our stuff better.

A+M: In what ways would you improve motor sport medicine?

RS: That question ties into my biggest fear as a chief medical officer. I'm always fearful for the safety of the people who volunteer and work at events. We get nurses, anaesthesiologists, emergency physicians, paramedics and they know their day job but they don't necessarily know how to be safe in racing environment until they gain the experience.

A priority for me is therefore the safety orientated education of people who come and work in the environment. I know that when we prepare for a Formula One event, there's a real focus on doing the extraction exercises. But I would actually like to put more time, or at least an equal amount of time, into preparing people and re-familiarising them with how to be safe in a motor sport environment. I see a need for an education programme to do that and a way of verifying it.



Rob Seal and WorldRX Permanent Medical Delegate, Dr Pedro Esteban, at the 2014 Grand Prix de Trois-Rivières

KNOWLEDGE AT YOUR FINGERTIPS

The FIA Institute has released a mobile app designed to aid the work of medical and safety officials at motor sport events around the world

The textbook is dead. At least, that is the view of Dr Ian Roberts, Formula One's medical rescue co-ordinator, who has led a project to develop an app for motor sport medicine.

"We wanted something that we could keep updating more often than a book," he says. "It also had to be fairly user friendly, with a nice web-based interface."

The result is the Medicine in Motor Sport app, which is aimed at providing important information to motor sport medical personnel in an easily accessible way.

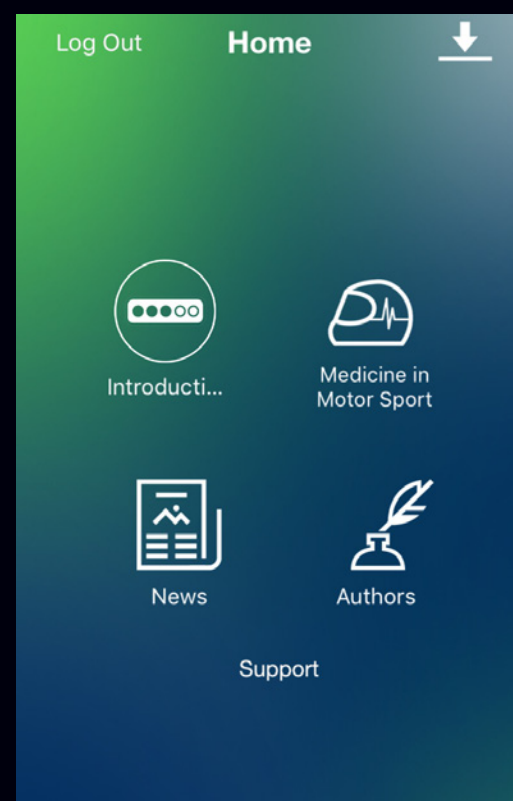
The deliberately simple design of the app, which launched in October, makes it easy for users to dip in and out of subjects. One feature that Roberts believes will be particularly useful for safety officials is the inclusion of push notifications.

This means users will be alerted about the latest research, updates and additional content. It also means that Roberts and the editorial team can provide updates regularly. "I can go in and change it and release an update whenever I need to," he explains.

Part of the enduring appeal of mobile devices is their compactness and portability, which means medical personnel can use the app while preparing to work at motor sport events as well as using it as a reference tool while on location.

The app is split into several sections. Content can be viewed by theme, topic or even by author and there are areas for news, videos and bookmarks. The analysis and guidelines included in the app cover a range of topics from advice for dealing with injuries sustained in a race environment, to extrication techniques and guidance on medical infrastructure at events.

"I'm hoping that the references chapter will be one that people will look at when



The Medicine in Motor Sport homepage is divided into four simple themes

Dr Ian Roberts, Formula One's medical rescue co-ordinator, led the project



they're at the trackside," says Roberts. "As it gets more and more populated there will also be more guidelines."

One of the first chapters, which was included with the app when it was initially released, is related to head injuries and concussion, and was written by Dr Stephen Olvey and Professor Peter Hutchinson. The article is split into chapters that discuss the background to incidents and management of competitors suffering from concussion as well as a summary of recommendations and suggestions for further reading.

For every article, the app has the capability to link to a related topic – in this case: Head Trauma. Videos of motor sport crashes and incidents are also included, in a separate section of the app, to accompany the chapters and serve as useful illustrations.

The first iteration of the app included just ten chapters but Roberts explains that this was a deliberate decision. "What we wanted was to launch something that had content for people to read but wasn't complete," he says. "It was never ever intended to be a complete thing, like a book, because it's something that's going to grow. It's a bit of cliché but we wanted a living document and that's what it's supposed to be, it's meant to grow."



That growth is already evident. Medicine in Motor Sport's latest update adds an article on first interventions at a rally event, written by Dr Matthew MacPartlin and Jeff Woods. This new chapter focuses on medical officials who are first to arrive on the scene of an accident at a rally and explains the procedures for dealing with driver extrication and the next steps to allow the event to continue.

More chapters are also on the way. Roberts is part of the app's editorial board alongside Dr Jean Duby, Professor Jean-Charles Piette, Dr Michael Scholz, Dr Alain Chantegret and Dr Terry Tramell, who will decide on future content. They will encourage medical personnel from around the world

“IT'S A BIT OF CLICHÉ BUT WE WANTED A LIVING DOCUMENT AND IT'S MEANT TO GROW.”

to contribute. This process will be faster than traditional publications because once the editorial board has approved a topic the app does not need to be sent for a series of reviews and assessment processes.

The editorial board has already chosen 30 topics that it wants the app to feature in the future but Roberts is keen for users to contribute their own ideas for content. "If people have suggestions for chapters, then we would certainly listen," he says. "If it's something that we haven't thought of, then we will consider it and would try to appoint an author to write it."

In that case, each topic that is suggested and produced by users will consist of a lead author and one, or more, co-authors who will



Safety officials extract Carlos Sainz from his wrecked car at the 2015 Russian Grand Prix

work together to produce the content before the editorial board approves it. "The whole idea is that they sort of self-edit and they're working together," Roberts says. "They also agree to review their work regularly, to keep it up to date, and submit necessary updates."

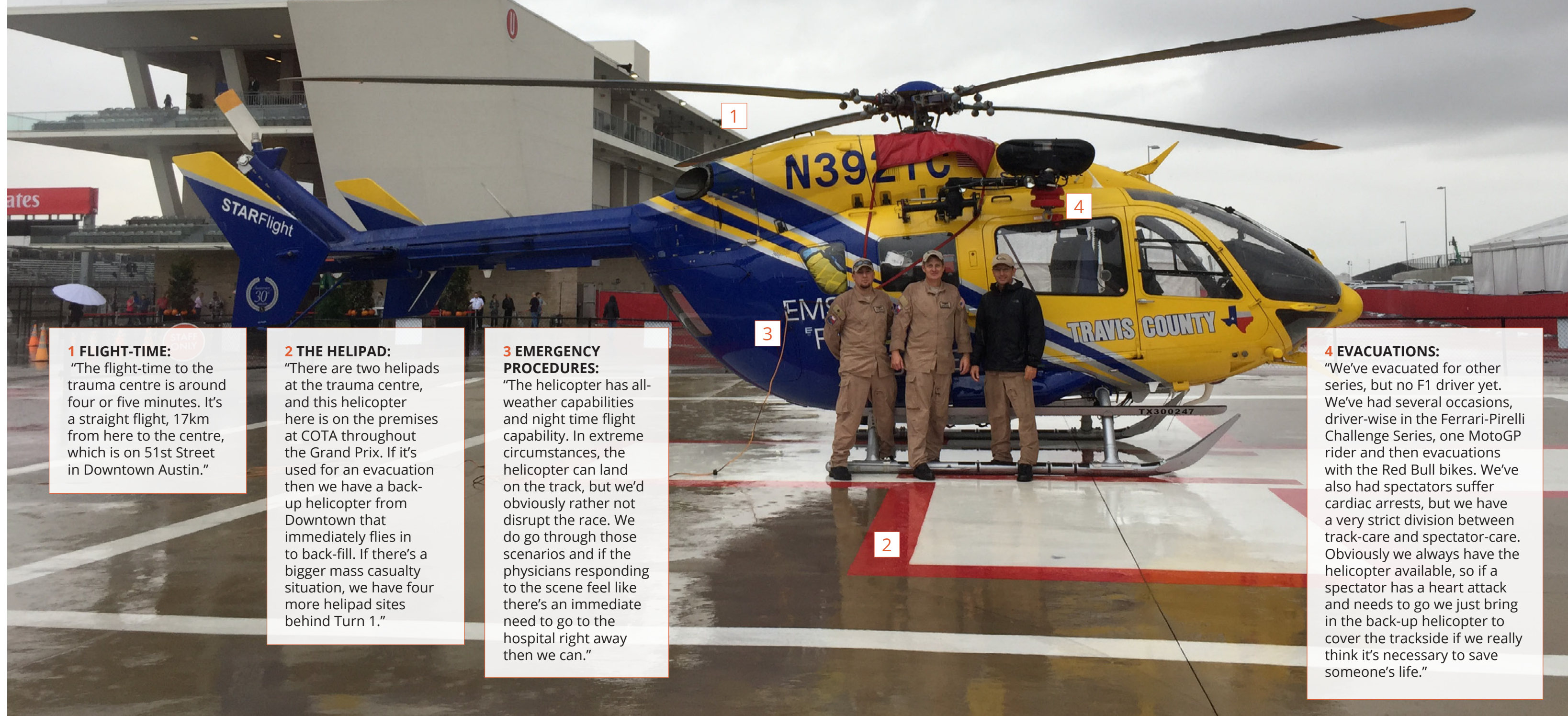
He is keen to point out that the app is not a textbook for medicine, but rather a guide that medics can turn to for advice while working at motor sport events: "We're trying to get expert opinion," he explains. "What I'm absolutely adamant about is that we're not trying to write another textbook of medicine, but instead something more relevant to us."

As part of the app's growth, Roberts would like see the reference section grow to include links to international sites and circuits so that officials using Medicine in Motor Sport on location can get detailed information about the locations where they are working across the world and that can then help to inform their decision-making. "We could have people from circuits writing about their individual place of work and someone else can click on that circuit and get relevant information for where they are immediately," he says. "I think that's the beauty of it, it will link in with everywhere else."

INSIDE A FORMULA ONE MEDICAL HELICOPTER

Emergency evacuation is one of the most high-profile safety procedures in motor sport. The Circuit of the Americas' chief medical officer, John Sabra, takes us inside the medical helicopter used at the US Grand Prix, along with the aircraft's chief medical Supervisor, Patrick Phillips, and its pilot, Joe Lebreccque.

JOHN SABRA, CHIEF MEDICAL OFFICER, EXPLAINS THE HELICOPTER'S CAPABILITIES



1 FLIGHT-TIME:

"The flight-time to the trauma centre is around four or five minutes. It's a straight flight, 17km from here to the centre, which is on 51st Street in Downtown Austin."

2 THE HELIPAD:

"There are two helipads at the trauma centre, and this helicopter here is on the premises at COTA throughout the Grand Prix. If it's used for an evacuation then we have a back-up helicopter from Downtown that immediately flies in to back-fill. If there's a bigger mass casualty situation, we have four more helipad sites behind Turn 1."

3 EMERGENCY PROCEDURES:

"The helicopter has all-weather capabilities and night time flight capability. In extreme circumstances, the helicopter can land on the track, but we'd obviously rather not disrupt the race. We do go through those scenarios and if the physicians responding to the scene feel like there's an immediate need to go to the hospital right away then we can."

4 EVACUATIONS:

"We've evacuated for other series, but no F1 driver yet. We've had several occasions, driver-wise in the Ferrari-Pirelli Challenge Series, one MotoGP rider and then evacuations with the Red Bull bikes. We've also had spectators suffer cardiac arrests, but we have a very strict division between track-care and spectator-care. Obviously we always have the helicopter available, so if a spectator has a heart attack and needs to go we just bring in the back-up helicopter to cover the trackside if we really think it's necessary to save someone's life."



CHIEF MEDICAL SUPERVISOR PATRICK PHILLIPS TALKS THROUGH THE MEDICAL EQUIPMENT IN THE BACK

5 LOADING

"This is a H145, twin-engine helicopter and it's a really great Air Ambulance platform. We like it because it's rear loading so the stretcher comes right out and that makes it easy, to go right into the medical centre to wait for a patient. While we are transferring a patient over, the pilot will have the aircraft running so we can load it up and be gone."

6 MONITORS AND VENTILATORS

"We have a ReVel ventilator, that does all the common modes of ventilation, and we use a Zoll X-series monitor that does 12 lead defibrillation and three invasive lines."

7 CONFIGURATION

"We can take two patients, so if two people were injured, and we have the weight requirements, one stretcher folds out and a seat slides forward and turns around."

8 STORAGE

"Most of our laryngoscope blades (an instrument used to examine the larynx) are kept in Dr Sabra's compartment. Everything is stored compactly like that on this aircraft because we use it for so many different things."

PILOT, JOE LEBRECQUE REVEALS THE COCKPIT

9 THE COCKPIT

"We're a single-pilot helicopter. The aircraft is fully capable with Instrument Flight Rules (IFR) and has auto-pilot. We are outfitted with the top-of-the-line electronics, the auto-pilot on a helicopter isn't very common. We do not fly IFR, by instruments, but we have all the capability of doing so. We have two GPS systems and a moving map that will show us radar weather and will also show us all of our intended heights in the area. We also have three different tools to show us all of our obstructions in our airspace."

10 TRACKING

"We have a satellite tracking system that sends our position, every thirty seconds, to our communications centre so they are continually tracking us. If something were to happen, wherever we stop or land, they'd be able to dispatch aid to us anywhere immediately. We are equipped with what we call a glass cockpit. A lot of aircraft only have analogue gauges, but we have all these gauges in front of the pilot so I don't have to look around as it's right in front of me."



THE ROAD BACK:

TOM KRISTENSEN

Nine-time Le Mans winner Tom Kristensen looks back at his accident during the first DTM race at Hockenheim in 2007 and gives his thoughts on concussion and safety



AUTO+Medical: What do you remember about the accident?

Tom Kristensen: I remember everything until I was knocked out. I remember going into turn two and fighting for fourth position. Then I was given less room than expected and I had to go over the kerb. The car spun and the field streamed by on the first lap. Then one of the cars way down the field hit me at 192kph. I was not completely stationary, I was still spinning a little bit but I was hit around the A-pillar [behind the front right wheel]. I just remember seeing the car and then it hits me and I felt like I was passing out. I don't remember from then on but I've seen the on-board camera footage so maybe in my mind it's a bit of those two things combined.

A+M: How did the safety features on the car work during the accident?

TK: That DTM car had quite a strong, stiff and heavy monocoque and this was very important because the biggest impact occurred at the A-pillar. But at the same time I was hit from behind so I would say the headrest was probably more important than the HANS device I was wearing in that one. But the HANS was very important with the initial Premat impact because Premat t-boned me and that's where I had the biggest pain and fracture. The g-forces were quite high - in the car it was up to around 80g - which means

On the first lap of the opening DTM race of the 2007 season, Tom Kristensen was squeezed off the track at the second corner and as his car spun around, Alexandre Premat hit the Danish driver with such force that both drivers required hospital treatment. After the initial impact, Kristensen was also hit by another car before he lost consciousness. He spoke to AUTO+ Medical about the crash and shared his thoughts on recovering from concussion.

that although the car did absorb some of the shock, it could have been fatal.

A+M: What is the next thing you remember after the crash?

TK: I was talking to our team doctor and other people at the medical centre, but at the time I didn't know where I was. I realised that the cars were still running and the race was going on, but plenty of minutes had gone by.

A+M: Were you then taken to hospital?

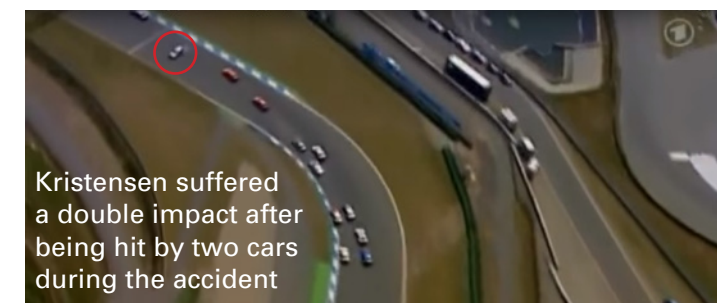
TK: Then I got transferred to hospital but the helicopter went with the other driver, as they feared for his back. I was driven on the road to the hospital. I think that maybe it would have been better to have more helicopters, but at the end of the day I then spent quite a few days in the hospital.

A+M: What was the diagnosis?

TK: I had severe concussion and whiplash at the same time. In a way I had that twice because I had a huge impact and then I was hit a small amount from another driver. There was marginal bleeding from my front and I had to rest for a long time. The race was at the end of April, and after that I went and visited some good people to get scans and advice. Everyone said I needed to rest and be very calm. I wanted to be back in the cars but I missed three DTM races and my pre-Le Mans test. Then, the weekend before Le Mans, I decided to drive a little bit in a go-kart and I tried to put myself under more and more stress in that last week. I felt I was ready but I was still in the aftermath of those exercises and I had some issues, so it was very difficult.

A+M: Was there a mental element to overcome?

TK: No, it was physical, it was like when you



Kristensen suffered a double impact after being hit by two cars during the accident





Kristensen impressively managed to put his Audi on pole on his return to Hockenheim during the 2007 DTM championship

don't feel well after exercise if you have a high-pulse or you are very sensitive to noise. All of the elements of your recovery are very important to go through and you have to take it step-by-step throughout that. But I wanted to race, and mentally it is important that you do what you want to do, but you have to be careful and listen to your body and feel how it has gone after two months of recovering.

A+M: Were you listening more to your body or to the advice of the doctors?

TK: In the first two months I listened a lot to the doctors and definitely respected that

advice, as that was very important. But when I started to do a little bit more exercise I knew I couldn't do a lot flat out as I had dizziness when turning around. But I tried to do things to test myself and I was asking myself, 'where am I from where I was before?' But from there you have to be strong and concentrate and go on your way, so I went with a friend to do some indoor karting. I knew the guy's place and I was driving there alone and I was also doing all sorts of push-ups, running, jumping. I did those physical tests and then drove again to check the lap times and also driving the circuit the other way around.

A+M: When did you decide you were ready to come back?

TK: It was later that afternoon that I called [Audi motor sport boss] Dr Wolfgang Ullrich and I said, 'ok'. He had given me time and said there was always space available for when I decided to return. I had stayed in contact with him all the time as I recovered. That's very important as well, you need to have that freedom and support and know they won't put your job under pressure if you are not coming back right away. I would say that was very important for my recovery and I'm lucky to drive for a company like Audi and with a boss like Dr Ullrich.

I spoke with Dr Ullrich on the phone before and he agreed to let me fly to England on the Friday before Le Mans to drive the DTM taxi at the race at Brands Hatch. We did this secretly and nobody knew it was me driving. Straight after that the doctor looked at me again and then later that afternoon I flew back to Denmark.

The decision for me to return for Le Mans was taken and on the Monday we had a press conference in Copenhagen to announce that I was coming back and I would attend the race at Le Mans with Alan McNish and Rinaldo Capello. It was a good decision and we came close to winning the race. We lead by almost four laps when, unfortunately, Capello lost a rear wheel and was in tears as we didn't win.

I have to say that it was a good decision to be back but throughout the rest of the year when I returned to the DTM, with all the noise and heat coming from that car, I did struggle with headaches every evening after driving. I had to deal with it but I was very happy to come back and drive again because I think that helped with some other things. You could definitely say that after an accident like that one something changed in me, and mentally

you have to be very strong and determined and passionate to get over that. It really is that combination of determination and passion that brings you back.

A+M: What advice do you have for other drivers if they go the same experience?

TK: Listen to the doctors and then try to test yourself with physical activities before you then come back. At the end of the day, only you can make the final decision, so you have to be strong yourself and you have to be passionate and determined to do it, otherwise you need to rest a little bit more. When you do go back and race you should not blame anyone but yourself afterwards, that's very important. I was out for less than three months and throughout that time I saw in the press stories and rumours I was retiring or had a disability. There were all sorts of stories coming out and that was difficult, but that has happened with other people who endured much worse situations than mine. I was determined not to let an accident decide the end of my career.

A+M: Is there any advice you have for doctors who are dealing with drivers who are recovering from big accidents?

TK: Doctors always look differently at different people but I would say always ask the driver about the final decision to come back. Look them in the eyes and ask them twice. But when you are a racing driver you're a competitive person and the doctors have to know how to deal with that. It doesn't have to be a racing driver, anyone can be competitive, but the doctors really need to ask them, look them in the eyes and make sure that they understand the diagnosis and the process of recovery. But only the driver can make the final decision.

SCIENCE

KEEPING COMPETITORS SAFE: A FOUR-YEAR STUDY

A team of British doctors conducted a four-year cross-sectional observational study of racing incidents at Silverstone Race Circuit, with fascinating results

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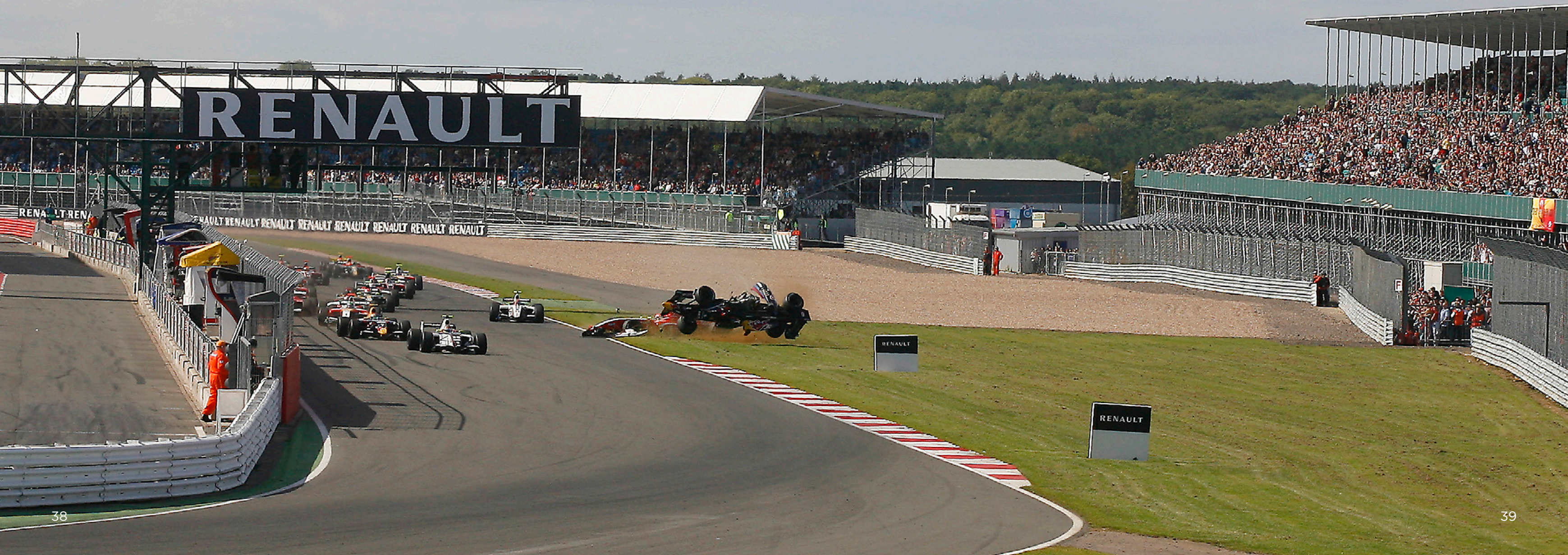
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BACKGROUND/AIM

Motor sport competitors are consistently exposed to the risk of injury, yet there is little research outlining where and why incidents occur, or how injured competitors are managed. This study investigates competitive incidents at the Silverstone Racing Circuit (Northamptonshire, UK), an international venue for motor sport racing.

METHODS

All data was extracted retrospectively from the Silverstone Medical Centre patient record forms. The initial study looks at patient status for all attenders (2005–2012). The full study includes competitors from 1 March 2009 – 31 December 2012, four racing seasons.

RESULTS

Initial study (eight years): N=10,004; with 500 patients per year attending the on-site facility. Patient status was predominantly spectator (46%, N=4,673 spectators) or competitor (26%, N=2,578 competitors).

Full study (eight years): N=1,079; 694 competitors represented at more than 30 events, including four British Grands Prix. Competitor age range was 8-98 years and 96 per cent were male. Incidents were most common at the Copse (n=101) or Beckett's corners (n=76). Common reasons for incident were loss of control independently or contact with another vehicle, whilst contact with preventative trackside measures was commonly with a wall or barrier.

A total of 11 competitors were unconscious at the scene and competitors spent between zero and two hours in the Medical Centre. There were no deaths; 81 per cent of competitors returned to their event and 74 competitors were hospitalised.

CONCLUSIONS

This retrospective analysis presents the demography of competitive motor sport incidents and their management at an international circuit. New location of incident data can inform deployment of medical resources and contribute to improvements in future circuit design. Serious injuries (including loss of consciousness) were relatively rare, with the majority of competitors referred back to event.

INTRODUCTION

Despite the enduring reputation of motor sport as potentially 'dangerous', competitive incidents are infrequent [1]. However when crashes occur, they have the potential to be severe, as exemplified by the recent injury and subsequent deaths of Formula One driver, Jules Bianchi, and IndyCar driver, Justin Wilson. In contrast to the high profile of motor sport, only a handful of studies have characterised competitive racing incidents. However, many official recommendations exist for medical staffing and facility provision at competitive events worldwide.

The Silverstone circuit is an international venue for motor sport racing, hosting Grand Prix events for both cars and motorcycles and averages 30 competitive race meetings per year. Medical assistance provided on site (from first aid through to full resuscitation and capability for surgery) is co-ordinated by the Silverstone medical team. The Silverstone Medical Centre operates seven days a week for 355 days a year and is equipped to care for upwards of 100,000 spectators, in addition to any competitors involved in racing incidents. The Medical Centre is maintained according to Fédération Internationale de l'Automobile (FIA) and Motor Sports Association regulations; equipped with a



The Silverstone Medical Centre at the Northamptonshire circuit

treatment room, two medical wards, a surgical theatre and four resuscitation bays. In addition, there is a burns room and imaging facilities – x-ray and ultrasound. Following an incident on-track, patients are assessed and stabilised using pre-hospital and Advanced Trauma Life Support (ATLS) principles [2], then transported to the Medical Centre for triage, treatment and referral.

The objective of this retrospective cross-sectional study is to analyse the competitive racing incidents, which have occurred at the circuits of the Silverstone complex over a recent four-year period.

In particular, we aimed to investigate where these incidents occurred on track and how the competitors were managed, both at scene and in the Medical Centre. Additionally, we compared the incidents and safety management of racing car drivers versus competitive motor bikers.

METHODS

All data entry was conducted at the Silverstone Medical Centre between August and December 2012 and extracted retrospectively from three sources: Medical Record Forms, ambulance service forms and Simple Assessment forms. White copies of the Medical Record Form were the main source (usually kept for storage); Ambulance service forms were sourced from three local services; Simple Assessment forms were introduced in March 2012 and contributed data for the final nine months of the study.

INITIAL STUDY – AN OVERVIEW OF ALL ATTENDANTS TO THE MEDICAL CENTRE

The initial study was conducted in August 2012, recording 'patient status', be they competitor, spectator, or contractor, for all attendants to the Silverstone Medical Centre from 2005 to 2012, inclusive.

FULL STUDY – COMPETITORS ONLY

The data collection period was defined by the introduction of an updated Medical Record Form and the end of the most recent calendar year (1 March 2009 – 31 December 2012, inclusive). All patient records were extracted from storage and manually assessed for inclusion. Selection criteria included, but were not limited to, ‘patient status’ (competitor) and ‘location of incident’ (on track). The final cohort therefore included all competitors attending the Medical Centre, as well as those assessed trackside.

All data were anonymised and manually put into an encrypted Microsoft Excel database (Microsoft, Seattle, USA), utilising either a binary code or numbered key system, where up to 144 variables were recorded per competitor, encompassing all information recorded for each patient. Each patient was allocated a unique four-digit identifier, preserved across the four spread sheets.

The entire cohort was analysed in Microsoft Excel and the full dataset split into two

daughter sets utilising ‘competitor’ in the patient status field. The remaining non-competitive racing activity was excluded. In total, the medical team assessed 694 competitors, during 762 consultations.

REDUCING BIAS

Data collection bias was limited by restricting data collectors to two individuals. Quality control methods prevented input of spurious values into the Excel database.

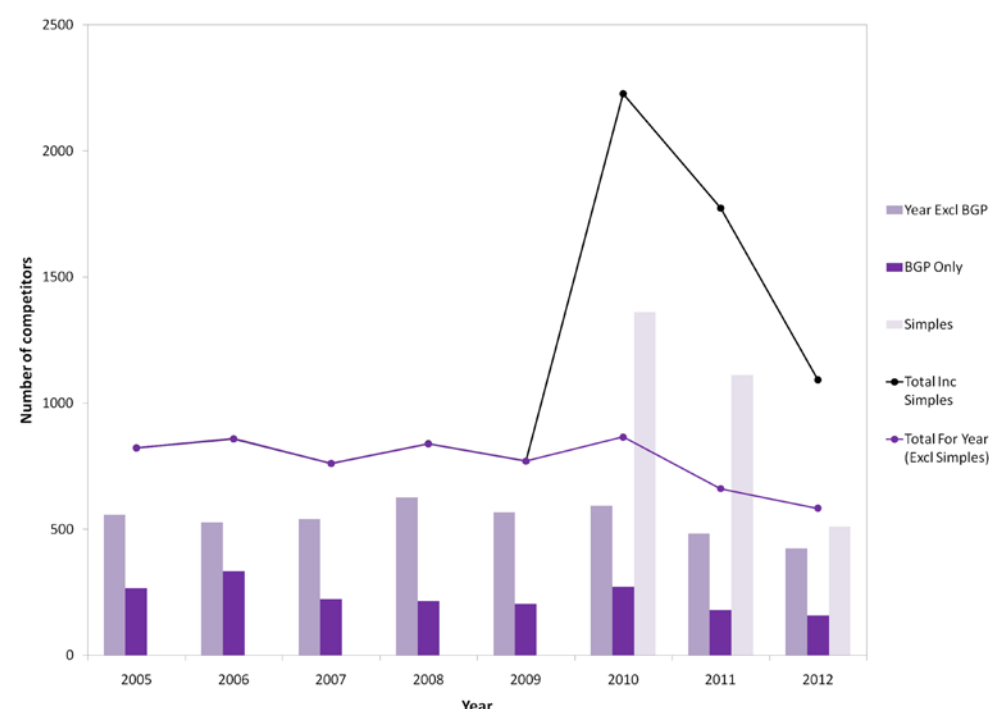
RESULTS

Initial study – all attendants to the Medical Centre

During the eight-year initial study (2005 to 2012, inclusive) a total of 10,004 patients were assessed by Medical Centre staff. Approximately 500 patients attended the Medical Centre per year, with 200-300 extra patients assessed annually during the four-day British Grand Prix (**Figure 1**). Patient status (n=10,004) was largely spectator (46%, n=4,673) or competitor (26%, n=2,578)

FIGURE 1

Initial study results; number of presentations each year to the Silverstone Medical Centre, 2005 – 2012, inclusive. N = 10,004. ‘Excl’ = excluding; ‘BGP’ = British Grand Prix; ‘Simple’ = Simple Assessment forms; ‘Inc’ = including



CAR	
Total	492 (71.2%)
BRSCC	102 (20.7%)
Classic (CSCC)	55 (11.2%)
Historic	47 (10%)
750MC/relay	45 (9.6%)
MGCC	37 (7.5%)
Walter Hayes	27 (5.5%)
BARC	26 (5.3%)
BTCC	24 (4.9%)
FIA GTs	20 (4.1%)
Formula races	19 (3.9%)
BGP/F1	17 (3.5%)
Renault (WS)	17 (3.5%)
LMS	13 (2.6%)
BDC	11 (2.2%)
Britcar	9 (1.8%)
VSCC	5 (1.0%)
Mini	5 (1.0%)
AMOC	5 (1.0%)
Club meet	3 (0.61%)
BRDC	2 (0.41%)
Rally	2 (0.41%)
Ford	1 (0.20%)

MOTORCYCLE	
Total	153 (22.1%)
BSB/SBK	79 (51.6%)
Moto GP	38 (24.8%)
BMCRC (Bernsee)	27 (17.6%)
ACU	6 (3.9%)
Supermoto	2 (1.3%)
NG road	1 (0.65%)
MIXED	
Total	41 (5.9%)
MSVR	25 (61.0%)
Races	16 (39.0%)
MOTO-CROSS	
Total	6 (0.87%)
Moto-X	6 (100.0%)

TABLE 1: EVENT/ACTIVITY

Overall n = 692; data is in the format ‘number (percentage of total)’ where total for bold rows is 692 and for all others is the total in the vehicle category; accuracy is to one decimal place, unless value is less one per cent, in which case two decimal places are given; data not included in the table: ‘NOT event’ n = 2

otherwise contractor (4.5%, n=454), race team (3.8%, n=386) or official (3.0%, n=306).

Full study – competitors only

During the four-year full study (2009 to 2012, inclusive), 1,079 patients were assessed by Medical Centre staff, of which 64 per cent (n=694) were competitors and all of who were eligible for analysis.

Data are given in the format: field (n = number of competitors for whom data was recorded), data entry (percentage of recorded data, total n).

Competitor demographics

Competitor gender (n=606) was 96 per cent male (n=583) and 4 per cent female (n=23). The mean age (n=672) at presentation was

35.7 years; range was 90 years (8 – 98) and the modal 5-year age group was 15-19 years (15%, n=100). Of note, 10 per cent of competitors were aged less than 18 years at the time of incident (n=67).

Competitors represented 31 different events or activities, categorised by vehicles driven into four categories (**Table 1**): car (22 events), motorcycle (6 events), mixed (2 events) and moto-cross (1 event). Competitive car events (n=492) contributed 71 per cent, most commonly BRSCC (21 per cent; n=102), Classic/CSCC (11 per cent; n=55), Historic (10 per cent; n=47) and 750MC/relay (9 per cent; n=45). Of note, only 2 per cent of competitors presented during the four British Grand Prix meetings (n=17). Competitive motorcycle events (n=153) represented less than a

quarter of the total competitors (22 per cent; n=153); most commonly BSB/SBK (52 per cent; n=79), Moto GP (25 per cent; n=38) and BMCRC/Bernsee (18 per cent; n=27). Mixed car or motorcycle events represented only 6 per cent of the total (n=41), with moto-cross less than 1 per cent (n=6).

Competitor protection

Helmet use (n=495) was present in 100 per cent of competitors. Helmet damage (n=112) as assessed by Medical Centre staff was none (48%, n=54), 'minor' (24%; n=27), 'severe' (8%, n=9) or 'fine' (0.02%, n=3). Of note, 16 per cent of helmets were not examined (n=19). The use of a HANS device (n=369) was either confirmed (52%; n=193) or refuted (47%; n=173). A few entries stated that a HANS device was 'not applicable' to the competitor (0.005%; n=2) or only 'partial' in its use (0.003%; n=1). Back protectors (n=330) were utilised by 36 per cent of competitors (n=120), but not by 63 per cent (n=310); protective clothing (n=471) was utilised by 97 per cent (n=458), but not by 0.03 per cent (n=13).

Incident details

Location of incident (n=628) was on one of the three main circuits (Grand Prix, National or International) for over three-quarters of competitors (73%, n=460; **Figure 2**). Of these, the most common location of incident was at Copse (16%, n=101), followed by Becketts corner (11%, n=74). Further incidents occurred on Stowe circuit (n=29) or generic track locations (n=51) for which the majority occurred at the 'flag off/start line' (n=25).

The number of vehicles per incident (n =121) was mainly two (77%, n=93), followed by 'multiple' (12%, n=14), three (4%, n=5) or one, four or six (0.1% each). The reason for each incident (n=220) is listed in **Table 2**.

Medical management on scene

On scene retrieval (n=141) was largely by self-extrication (91%, n=129), otherwise the competitor was immediately immobilised (0.03%; n=4), assisted (0.02%; n=3), scooped (0.01%; n=2) or formally extricated (0.007%; n=1) from the vehicle or debris. Two competitors (0.01%) suffered extensive vehicle damage, which affected retrieval. On scene conscious level (n=273) was normal in 97 per cent (n=264). Minutes unconscious (n=11) where recorded was as follows: one-two (64%, n=7), two-three (18%, n=2), greater than five (18%, n=2) or 'momentary' (9%, n=1).

Presentation to the Medical Centre

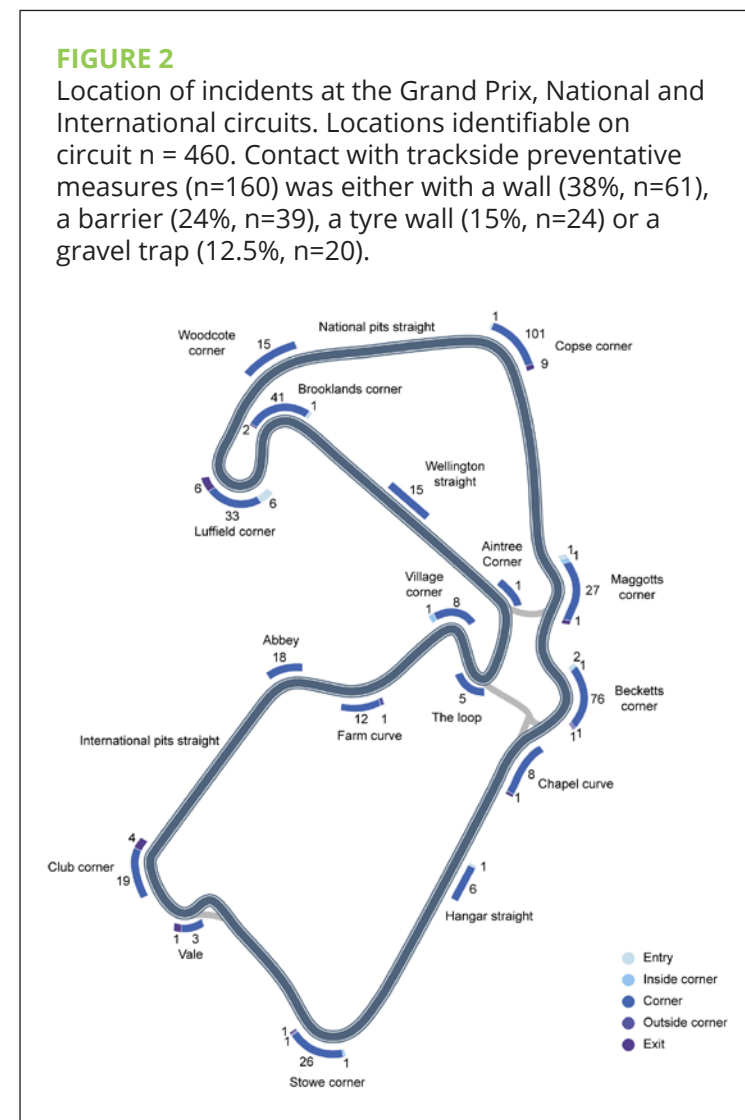


TABLE 2

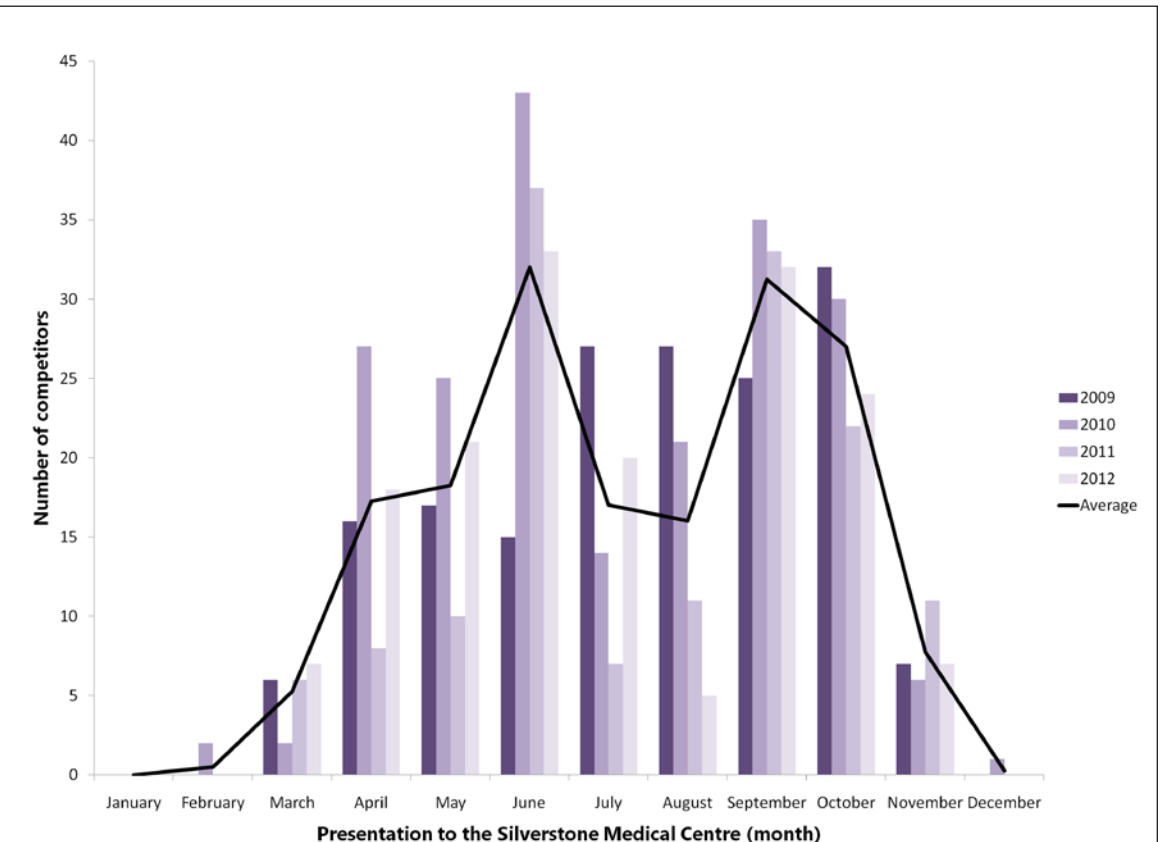
REASON FOR INCIDENT n = 220	
Lost Control	44 (20%)
Contact (competitor/barrier)	41 (19%)
Spun	35 (16%)
Fell	27 (12%)
Collected spinning vehicle	27 (12%)
Evasive action	13 (5.9%)
Weather	10 (4.5%)
Mechanical failure	8 (3.6%)
Driver error	5 (2.3%)
Debris	4 (1.8%)
Wear & tear	3 (1.4%)
Drifting	2 (0.9%)
Ambitious move	1 (0.5%)

Competitors presented to the Medical Centre throughout the calendar year, producing a bi-modal distribution with peaks in both June and September (**Figure 3**). Except for October in 2009, the mode month of presentation was June throughout the study period. The vast majority of presentations occurred between 9am and 7pm (97%, n=627), with almost three quarters of these between 11am and 5pm (73%, n=489).

Monitoring and treatment

Proxy measures for level of monitoring and treatment were the numbers of basic observations (heart rate, blood pressure, respiratory rate, oxygen saturations) and the numbers of drugs or fluids prescribed. The number of basic observations recorded (n=693) ranged from none to more than six, 21 per cent none (n=146), 55 per cent one (n=382), 13 per cent two (n=87), 6 per cent three (n=39), 3 per cent four (n=20), 2 per cent five (n=11), 1 per cent six (n=7), 0.001 per cent

FIGURE 3
Incident distribution by month. N = 694; date was not recorded for n = 4. 'Average' indicates monthly average across the four-year study period (2009-2012, inclusive).



cent more than six (n=1). The number of drugs prescribed (n=692) ranged from none to nine, 75 per cent none (n=517), 16 per cent two (n=112), 2.3 per cent three (n=16), 1.2 per cent four (n=8), 0.1 per cent five (n=1), 0.1 per cent nine (n=1). The number of fluids prescribed (n=692) ranged from none to two 98 per cent none (n=675), two per cent one (n=14), 0.4 per cent two (n=3). Time spent in the Medical Centre (n=581) ranged from zero minutes to more than two hours (Figure 4).

Outcome

There were no deaths. Final referral destination (n=613) was: back to event (81%, n=498), hospital (12%, n=74), home (4.6%, n=28) or advised to see a General Practitioner (2.1%, n=13); mode of transport (n=34) was ambulance (44%; n=15), own (29%, n=10) or helicopter (26%, n=9).

Car-motorcycle comparison

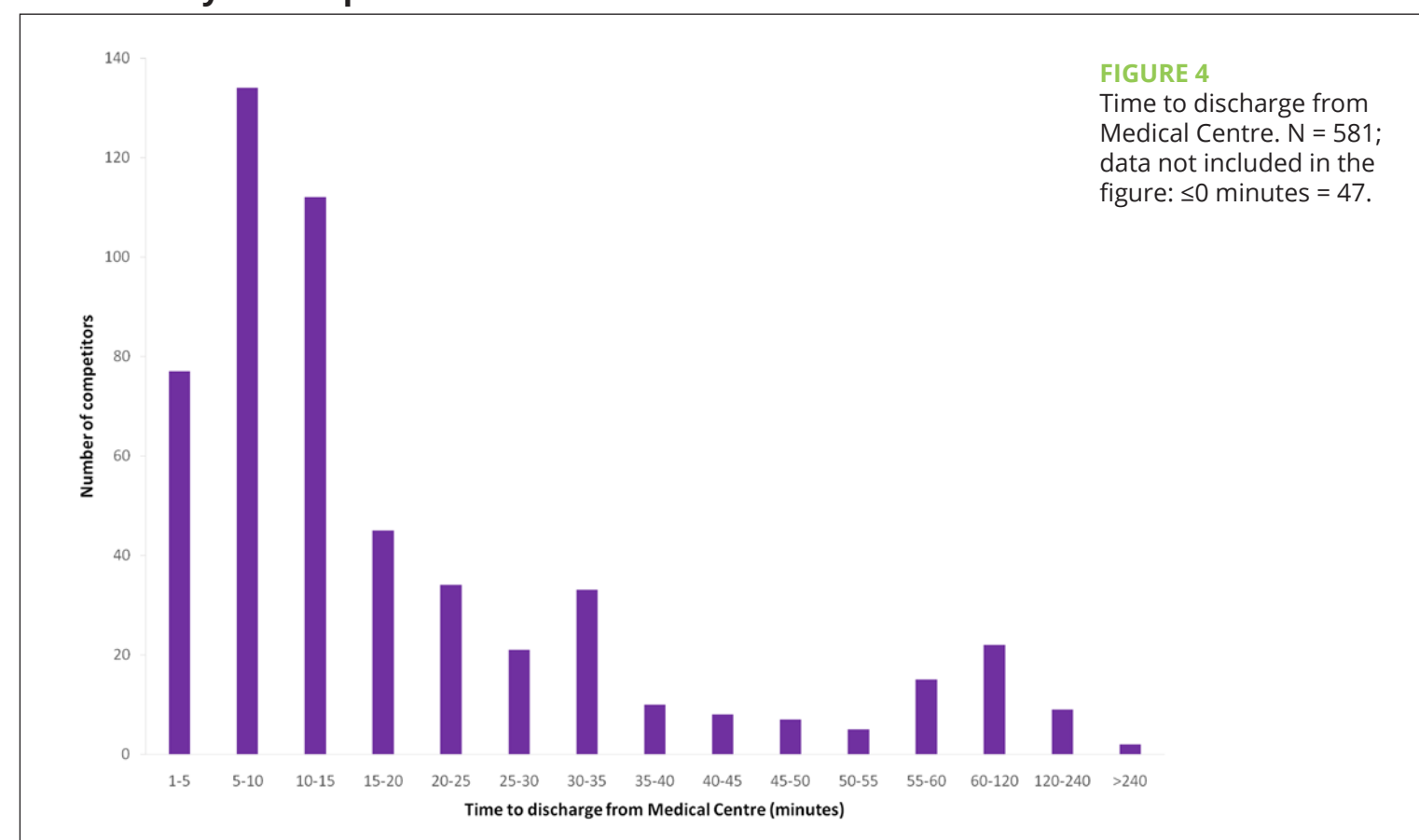


FIGURE 4
Time to discharge from Medical Centre. N = 581; data not included in the figure: ≤0 minutes = 47.

Comparisons of the above fields are made between 201 car drivers and 103 motorcyclists (Table 3).

DISCUSSION

Context of other literature

The strength of public response to Jules Bianchi’s crash at the Suzuka International Racing Course highlights the infrequency of serious incidents in Formula One; the risk having been quantified in smaller competitive series as less than 0.2 per cent[3]. However, global research investigating competitive racing incidents and their medical management remains sparse. In fact, only a handful of studies have characterised incidents in the American IndyCar [4-8] and NASCAR [9, 10] series, with even fewer European studies published. Of the latter, the most relevant either rely on comparatively small patient numbers [11] or relate only to

DEMOGRAPHICS	CAR		MOTORCYCLE	
Age (years)	Total	198	Total	103
Age range (years)	13 - 98	85 years	8 - 61	53 years
Mode age (years)	18	10 (0.05%)	16	9 (0.09%)
Competitors <18yrs	13 (7%)		22 (21.4%)	
Gender	Total	171	Total	90
	Male	164 (96.0%)	Male	83 (92.2%)
	Female	7 (4.1%)	Female	7 (7.8%)
Competitive event	Total	694	Total	694
	BRSCC	29 (14.7%)	BSB/SBK	33 (32.0%)
	750MC/relay	26 (13.1%)	Moto GP	16 (15.5%)
	Walter Hayes	14 (7.1%)	BRSCC	12 (11.7%)
	Classic (CSCC)	13 (6.6%)	Classic (CSCC)	10 (9.7%)
	Historic	12 (6.1%)	BMRCC (Bernsee)	10 (9.7%)
INCIDENT DETAILS	CAR		MOTORCYCLE	
Location of incident	Total	678	Total	684
	Copse	30 (15.2%)	Copse/Beckett's	12 (11.7%)
	Beckett's	24 (12.1%)	Abbey	10 (9.7%)
	Abbey	15 (7.6%)	Brookland's	6 (5.8%)
	Brookland's	13 (6.6%)	Club	4 (3.9%)
	Maggot's	12 (6.1%)	Hangar straight	4 (3.8%)
	Farm outside	10 (5.1%)	Stowe	3 (2.9%)
No of vehicles / incident	Total	201	Total	103
	Two	61 (30.3%)	Two	18 (17.5%)
	Multiple	21 (10.5%)	One	3 (2.9%)
	One	4 (2.0%)	Three	1 (1.0%)
	Three	3 (1.5%)		
	Six	1 (0.5%)		
Time to discharge, from Medical Centre (minutes)	Total	180	Total	73
	5 - 10	51 (28.3%)	5 - 10	10 (13.7%)
	10 - 15	35 (19.4%)	10 - 15	10 (13.7%)
	1 - 5	21 (11.7%)	< 0	9 (12.3%)
	20 - 25	13 (7.2%)	1 - 5	7 (9.6%)
	15 - 20	11 (6.1%)	30 - 35	7 (9.6%)
OUTCOME	CAR		MOTORCYCLE	
Deaths	0	0.00%	0	0.00%
	Total	180	Total	83
	Event/work	157 (79.3%)	Event/work	53 (51.5%)
	Hospital	15 (7.6%)	Hospital	20 (19.4%)
	Home	7 (3.5%)	Home	7 (6.8%)
Referral destination	GP	1 (0.5%)	GP	3 (2.9%)

TABLE 3:
Car versus motorcycle comparison
n = 694; data not included in the table: 'NOT event' n = 2; for event key, please see Table 1. All percentages are rounded to one decimal place, unless the value is less than one per cent, where accuracy is to two decimal places

Silverstone hosts both car and motorbike races on its three main circuits.



regional [3] or national circuits [12]. Additionally, there is a relative paucity of research evaluating injuries during competitive driving activity at racing circuits within Great Britain and Ireland [12, 13]. This retrospective four year study therefore is the largest of its kind to date, describing the medical management of almost seven hundred competitors assessed during four racing seasons and incorporating data from both national and international race events at the UK's leading motor sport circuit.

LOCATION OF INCIDENT

Previously, the on-track location of incident for competitive racing events has been overlooked in published studies. Indeed, the most relevant paper neglects to publish the specific locations, instead focusing on the pattern of competitor injuries despite investigating changes in incident characteristics following

the introduction of a chicane [3]. In contrast, the current study collates detailed location of incident data to a resolution of corner entry and exit, over a variety of different competitive racing events. This information has already been utilised to inform the deployment of medical resources on track and will be an invaluable contribution to further improvements in circuit design.

MEDICAL CENTRE ASSESSMENT

Medical provision at competitive motorsport events is mandatory, with the majority of circuits' coordinating care from permanent on site medical centres. Despite this extensive coverage, surprisingly few published studies have explored this necessary provision [14, 15]. Indeed, the main focus of the published literature centres upon circuits hosting Formula One events; in neither of these three studies was there investigation of the provision of on-site

“THE PUBLIC AND REGULATORY DEMAND FOR HEIGHTENED SAFETY IN MOTOR SPORT IS PERPETUAL, AND HAS PREVIOUSLY BEEN PUBLISHED EXPLICITLY IN RECENT YEARS”

medical resources, instead focusing on competitor assessment [16], anticipatory planning for mass casualties [17] and assistance intervention procedures [18]. The data presented in the current study describes quantity at the Silverstone Medical Centre, producing invaluable annual presentation figures which can assist in prediction of medical staffing requirements and the proposition of expanding resources on site, as well as informing development of similar facilities at newer circuits.

COMPETITOR SAFETY

The public and regulatory demand for heightened safety in motor sport is perpetual, and has previously been published explicitly, even in recent years [19]. At competitor level, helmet use is mandatory for all competitive racing events, regardless of vehicle, with incidents in recent years resulting in extension of this regulation to mechanics in the pit lane. Furthermore, additional protective measures, such as the HANS device (developed in the mid-1980s, but at the time of the study not compulsory for UK national events) are now routinely employed by car drivers. Such protective measures are constantly evolving to further enhance competitor safety, as exemplified by the new integrated iHANS device [20], yet there remains a stark contrast to some historic

events where a harness is exempt. An additional avenue explored in this current study is the provision of trackside safety measures, encompassing speed and impact reducing mechanisms, such as gravel traps and Armco barriers, respectively.

During the four-year study period there were no fatalities during any competitive racing activity and serious injuries (including loss of consciousness) were relatively rare, with the majority of competitors being referred back to their event.

DRIVER/MOTORCYCLIST COMPARISON

Despite the fact that motor sport encompasses a diverse range of vehicles separated into an almost innumerable number of classes, the majority of previously published research focuses on only a single vehicle type; largely cars [11] or motorcycles [13, 21], which restricts conclusions to only a subset of the competitive activity occurring at race circuits. Indeed to our knowledge, prior to this study only a single publication has attempted to characterise incidents involving more than one type of vehicle [12]. In contrast, the current study illustrates that data collection can encompass a variety of different competitive vehicle types, thus providing a larger and more globally applicable platform for further analysis.

LIMITATIONS

Firstly, this is a retrospective observational study, which carries unavoidable methodological flaws. Secondly, the primary role of the Medical Centre documentation is the record of clinically relevant information, thus perhaps resulting in a degree of information bias, possibly exemplified by poor capture of severely ill competitors due to a focus on provision of life-saving care.

Thirdly, variation in the nature of the data recorded, resulting in small numbers of data recorded in some fields, may misrepresent the overall dataset. Fourthly, the inability to retrospectively establish the track configurations utilised by each race may have resulted in artificial inflation of location of incident data for track locations commonly utilised. Finally, the lack of off-site follow-up prevents conclusions being made regarding competitor morbidity and mortality.

CONCLUSION

In summary, race circuit medical centres are at a unique vantage point to analyse the medical management of competitors following racing incidents. This study, albeit a retrospective analysis, presents the demography of competitive racing incidents at an international circuit, supplemented by an in-depth analysis of the incidents, as well as investigation of competitor and trackside preventative safety measures. This novel study provides a

platform for future prospective research, both at Silverstone and other circuits worldwide.

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Competing interests: Professor Peter J Hutchinson is Chief Medical Officer for the British Grand Prix at Silverstone. Dr Ian Roberts is Formula 1 Medical Rescue Co-ordinator for the FIA.

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Contributorship: PJH was the study instigator. ND and DF were data collectors for the initial and full studies and analysed all data presented. AC facilitated extraction of patient record forms. ND wrote the final report, which was reviewed prior to publication by IR, AC, DF and PJH.

Ethical approval: This retrospective observational study extracted anonymised data from patient record forms at Silverstone Medical Centre, upon which data was routinely recorded for patient management purposes. Therefore, there was no requirement for ethical approval.

Data sharing: Additional unpublished data is available from the corresponding author who can be contacted by email (naomi.deakin@cantab.net).

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+ SURVEY ON CONCUSSION

Last issue we conducted a survey on concussion in motor sport. It produced some interesting results which were presented to the FIA Medical Commission in November, prompting a request for further investigation by an expert group.

Overall Responses

- 163 completed surveys (80% medical officials, 20% competitors)
- 31 Countries represented

Medical Responses

- 90% of medical staff had seen a competitor with concussion
- 50% had seen 6 or more competitors with concussion
- 65% found it difficult to assess a competitor for concussion and 99% would like some guidance
- 40% had used some assessment tool, mostly SCAT, but many commented on the need for something specific for motor sport
- 36% had some guidelines about when a concussed competitor should be hospitalized, although not motor sport specific
- 30% had withdrawn a competitors licence, however 90% felt a competitor with concussion should have their licence withdrawn
- Over 99% felt there should be some guidelines about this

Competitor Responses

- 45% had suffered a concussive episode in motor sport but only half had discussed this with a doctor
- 28% had withdrawn voluntarily from competition after concussion
- Only 2 competitors had their licence withdrawn by a doctor
- 70% did not feel completely normal when they attempted to return to competitive motor sport
- 76% would like to know more about concussion
- 45% had experienced some of the symptoms associated with concussion following an accident; dizziness, headache and confusion being the top three
- Only 36% of those with symptoms had sought medical advice

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