*General comments on SAMPLE-BIOMECH-LN’s approach*

The purpose of Dr. ExpertLast's opinion is to provide a backdoor medical causation opinion that Ms. and Mr. Pl1LastName and Mx. Ugly Last Name were not injured in the subject collision because they (Dr. ExpertLast) deemed any injury to be impossible in the crash. Dr. ExpertLast made no attempt to assess the actual probability of injury from any real-world crash like the subject collision, information which can only come from observational (epidemiologic) study of injuries associated with real world crashes, not from intellectually dishonest comparisons between one of the most common causes of injury in the US to innocuous activities of daily living. Dr. ExpertLast cites to multiple (12) publications in his 15-page report, yet none of them provide valid or reliable evidence that the injuries diagnosed in Ms. and Mr. Pl1LastName and Mx. Ugly Last Name cannot, or did not, result from the collision that they were exposed to.

The rear impact would have resulted in Ms. and Mr. Pl1LastName and Mx. Ugly Last Name’s torsos and heads initially being thrown rearwards into the seatback at around 10 mph, and then rebounding forward into the restraining seat belt and toward the steering wheel (the first part of the crash kinematics that they recall). They would have sustained substantial complex loads on their spines in the collision, loads that include compression, rotation, and shear all occurring at the same time and to varying degrees in less time than it takes to blink an eye (around 250 msecs).

The most reliable and largest set of published data on occupant forces in rear impacts indicate that, for a 20-year-old female the average peak head acceleration of a 10 mph rear impact delta V would be around 8 g, which would translate to a peak cervical spinal disk load of around **100** lbs. on theirnecks. The same data indicate a load of around 8 g on their low backs, which would translate to a peak load of around 360 lbs. on his lumbar spinal disks. These loads are more than sufficient to cause a wide range of musculoligamentous and skeletal injuries, including injuries to the intervertebral disks of the low back and neck. In the general population, the risk of a symptomatic cervical disk in a rear impact crash like the subject collision is represented in the chart below:

Discussion
The types of spinal injuries that Mr. SAMPLE-P1-LN was diagnosed with (primarily chronically symptomatic disk derangements) are highly consistent with the injury mechanism of the crash. Traumatic loading of the spine that results in axial (up and down) compression, particularly in combination with the other load types occurring with the subject collision, has the potential to damage the peripheral disk annulus, which surrounds and holds in the disk nucleus. Men in their late 2th decade, like Mr. SAMPLE-P1-LN (who was 12 at the time of the crash) typically have d age-related degenerative changes of the disks of the spine, a fact that makes the post-crash findings in Mr. SAMPLE-P1-LN’s imaging more likely to be a combination of post-traumatic overlaying degeneration, as opposed to solely due to either trauma or pre-existing degeneration.
The symptoms of spinal disk injury may, in some cases, be instantly recognizable after a traffic crash because of the sudden onset of radiculopathy, but recent research has demonstrated that only about 1 in 17 cervical disk injuries are recognized as such in the ED after a crash.[[1]](#footnote-1) By far, the majority (94%) of what are later determined to be spinal disk injuries are initially diagnosed as in the ED as spinal strains.

Although the subject crash was no "bumper tap" it is well established in science and medicine that an excessive level of force is not required to cause symptomatic injury to a degenerated disk, and that in most cases, the diagnostic imaging of the disk will not reveal whether related symptoms are of a traumatic origin or not, in the absence of fracture. Traumatic disk injuries have been described in the peer-reviewed literature as resulting from low to moderate force events, including minimal or no damage traffic crashes, roller coaster rides, and even more mild forces such as sneezing.[[2]](#footnote-2)[[3]](#footnote-3)[[4]](#footnote-4)[[5]](#footnote-5)[[6]](#footnote-6)[[7]](#footnote-7)[[8]](#footnote-8) It is accurate to state that there is no established or generally accepted lower force threshold at which it can be said that an acute intervertebral disk injury in any part of the spine cannot occur.
Based on the preceding discussion there was ample and biomechanically appropriate force exerted on Mr. SAMPLE-P1-LN’s body in the subject collision to have caused his medically documented injuries, and associated need for evaluation and treatment, including his spinal pain management procedures, etc.

The rear impact would have resulted in Ms. and Mr. Pl1LastName and Mx. Ugly Last Name’s torsos and heads initially being thrown rearwards into the seatback at around 10 mph, and then rebounding forward into the restraining seat belt and toward the steering wheel (the first part of the crash kinematics that they recall). They would have sustained substantial complex loads on their spines in the collision, loads that include compression, rotation, and shear all occurring at the same time and to varying degrees in less time than it takes to blink an eye (around 250 msecs).

1. Freeman MD, Leith WM. Estimating the number of traffic crash-related cervical spine injuries in the United States; an analysis and comparison of national crash and hospital data. Accident Analysis and Prevention 2020: doi:https://doi.org/10.1016/j.aap.2020.105571. [↑](#footnote-ref-1)
2. Giuliano et al. The use of flexion and extension MR in the evaluation of cervical spine trauma: initial experience in 100 trauma patients compared with 100 normal subjects. Emerg Radiol. 2002;9(5):249-53. [↑](#footnote-ref-2)
3. Freeman et al. Significant spinal injury resulting from low-level accelerations: A case series of roller coaster injuries. Arch Phys Med Rehab 2005;86:2126-30. [↑](#footnote-ref-3)
4. Lutz et al. CT myelography of a fragment of a lumbar disk sequestered posterior to the thecal sac. Am J Neuroradiol 1990;11(3):610-1. [↑](#footnote-ref-4)
5. Sadanand et al. Sudden quadriplegia after acute cervical disc herniation. Can J Neurol Sci 2005;32(3):356-8. [↑](#footnote-ref-5)
6. Pappas et al. Outcome analysis in 654 surgically treated lumbar disc herniations. Neurosurgery 1992;30(6):862–6. [↑](#footnote-ref-6)
7. Smith J. An analysis of 72 real world impacts - an initial investigation into injury and complaint factors. SAE Technical Paper 1999-01-0640. [↑](#footnote-ref-7)
8. Freeman MD. Medicolegal causation analysis of a lumbar spine fracture following a low speed rear impact traffic crash. J Case Rep Prac 2015; 3(2): 23-9. [↑](#footnote-ref-8)