NINDS CDE Project
Biomechanical Devices in TBI
Impact Video Subgroup

The Impact Video subgroup used the following approach to develop their recommendations: First, the main application of video in the context of biomechanical devices in TBI was determined to be the use of video information to confirm device measurements. Applications such as use of standalone video information to reconstruct head impacts or count head impacts were not considered in this set of CDEs. Then, the published video-device confirmation protocols and protocols utilized by subgroup members were surveyed to identify the relevant data elements and will be used for drafting recommendations.

We should note that the use of video information to confirm device measurements may not be feasible for all populations at risk for TBI. It is commonly used in sports-related TBI scenarios since video recording is relatively easy with a fixed field size, and it may be already utilized by athletics staff or media entities. It should also be noted that there are few to no existing standards for video used with biomechanical devices in TBI research. The video is only used for device measurement confirmation and is closely related to the accelerometry device applications.

An issue unique to data collection with biomechanical devices in TBI, generally, is that there are a variety of different devices used, data collection methods, and data processing methods being used by researchers. There is no 'validated' clinical standard approach for any of these aspects. In collecting human TBI data using devices, data quality may be enhanced with the cross-confirmation/verification of information from independent measurements. Currently, the use of video information to confirm biomechanical device measurements is a most common approach.

However, there are a lot of concerns over how data can be combined from different sources (e.g. video and biomechanical device). The data provided can be very different depending on the way the they were collected and handled. A first step towards helping to address this concern is to clarify some common data elements to help specify the exact methodology employed, as well as recommended approaches to ensure quality of the data.

Issues specific to the video-device confirmation subgroup are that this is a unique scenario where independent sets of information (from video and from device) are used to try to cross-verify device measurements. One challenge is matching these two sets of information such that they can be cross-verified (e.g. the need to time-synchronize the measurements and video). Another challenge is that neither set of information may provide ground truth information. In different scenarios, there may be higher confidence in confirming exposures with either the video information or device measurements. Common data elements are to comprehensively address how exactly the two types of information are cross-referenced.

In regards to any issues unique to biomechanical devices used in TBI in the CDE development process, the following observations were noted: In general, there are also some differences in whether research is looking at severe TBI versus mTBI/concussion versus sub-concussive work. For biomechanical devices in general, recording the exposure of a severe TBI event seems like it should be much simpler (far fewer events of a magnitude likely to cause a severe TBI); however, the odds of having someone instrumented

when they suffer a severe TBI seem small due to the types of situations this would be expected (car crash, major falls/accidents, etc.). Conversely, recording exposures for sub-concussive impacts may be significantly more difficult because the magnitude of the recorded exposure should be much smaller (potentially confounded in sensor data from other activities/motions). For both situations, the method of analysis and/or use of the data would be different and one standard may not apply to all situations or types of TBI. The use of biomechanical devices for different types of TBI may not be feasible due to the difficulty in instrumenting someone all the time versus during predefined periods.

The unmet needs that were identified via the biomechanical devices in TBI CDE development process and apply generally to the working group's recommendations are include: Validation standards/criteria for biomechanical devices; and, Identify the best injury risk criteria/predictor(s) to derive from biomechanical device measurements.