**INTRODUCTION:** In order to accurately apply injury risk curves in an experimental and modeling program to develop safety design criteria, it is critical to understand how these functions are developed, and how to critically evaluate published injury risk functions.

**TOPIC:** Statistics are fundamental. For example, knowing the weight of one person in the US does not help us design for everyone else. Even knowledge of the statistical means has limited value. Imagine the consequences of designing a bridge for a mean load of 10,000 lb without knowing that peak loads may exceed 50,000 lb. So, detailed statistical knowledge, particularly in characterizing injury risk, is essential. These assessments often combine disparate sources of data, perhaps experimental data or computational model outputs. Together, these components help establish the physical responses to a range of applied conditions, and these may be used to develop injury risk assessments across a wide range of possible exposures.

In injury risk modeling, input variables, such as force, load, and windspeed, must be correlated with injury. These injuries may be binary (injured/uninjured), ordinal (mild, moderate) or continuous (percentage loss). There are several ways to develop the injury risk curve; the choice has a strong effect on the usefulness of the risk function. One long-used method of generating these curves is a logistic regression. However, severe shortcomings in representing and fitting data cause this method to be unrealistic under many conditions. A better alternative is survival analysis. This method has a major advantage in its ability to account for the inclusion of non-injury data and overkill scenarios. Further information can be incorporated using Bayesian survival analysis, which may include prior information, including injuries or even informed heuristic assessments.

**APPLICATION:** The need for injury risk functions should be considered during the planning stages of a program to assess injury risk. The predictive power can be improved using a well-planned exposure range and by specifically collecting measurements to improve the quality of the data in the model. These techniques are broadly applicable in many medical research situations.
