When the surgeon does not cut straight.
Delta method and bootstrap to model rare events and to estimate a proportion when no event is observed.

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Resecting bone tumors within the pelvis requires good cutting accuracy to achieve satisfactory safe margins and reduce the risk of local recurrence. With a navigated technology, this risk is significantly reduced and no failure may be observed during an experimental study.
When no success is observed, the commonly used binomial proportion CI (Confidence Interval) fails to estimate such probabilities while the well-known rule of three provides a basic and simple solution. Unfortunately, this CI can be too large and cannot differentiate different probabilities (i.e. when an event is rarer than another one).
This talk will first present briefly different parameters used to assess the quality of a surgical cut. The delta method and different bootstrap procedures will be compared in order to model rare events and to compute a CI for a proportion, especially when no event is observed. An easy to understand example will be introduced and then, the different methodologies will be compared with simulations and applied to a mixed model with real data.