

# Exact Confidence Limits for Mortality Probabilities of Open and Laparoscopic Surgeries

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This paper presents a review of statistical approaches for analyzing binomial data, such as the mortality after colorectal surgery. It uses approaches originally used for an estimation of failure rates in nuclear and/or defense industries [1- 3, 4]. The given real biomedical data sets from several types of surgeries are statistically analyzed, in order to give point estimates and exact confidence intervals for the mortality probabilities. The subsets of the data based on types of surgeries (such us open and laparoscopic) are compared, graphically and by statistical tests.

Examples of the developed MS Excel-based application are given. Presented numerical experiments indicate robustness of analyses with respect to small data sets.

## References

- [1] C. L. Atwood: Hits per Trial: *Basic Analysis of Binomial Data*. EGG-RAAM-1 1041, Department of Energy (DOE), 1994, [http://www.osti.gov/bridge/product.biblio.jsp?osti\\_id=10191270](http://www.osti.gov/bridge/product.biblio.jsp?osti_id=10191270)
- [2] C.L. Atwood: *Constrained noninformative priors in risk assessment*. Reliab Engng Syst Safety. Volume 53, Issue 1, July 1996, Pages 37-46. doi:10.1016/0951-8320(96)00026-9
- [3] S. A. Eide: *Historical perspective on failure rates for US commercial reactor components*. Reliab Engng Syst Safety. Volume 80, Issue 2, May 2003, Pages 123-132. doi:10.1016/S0951-8320(03)00028-0
- [4] J. Rutledge, B. Warner: *Using the Beta Distribution on Confidence Intervals for Proportions*. 1999 Quality and Productivity Research Conference, General Electric, Schenectady NY, USA, [http://www.data-vision.biz/extra/CI\\_Proportion.PDF](http://www.data-vision.biz/extra/CI_Proportion.PDF)