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Measuring direct and indirect treatment effects using safety performance intervention functions

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Abstract

Recent traffic safety research has advocated the use of the Full Bayes (FB) approach to conduct controlled before – after safety evaluations. The FB approach was shown to offer both methodological and data advantages. However, there is still a lack of complete understanding of the role that the model parameters play in the formulation of treatment effectiveness. This paper offers a novel approach to compute components related to direct and indirect treatment effects under a linear intervention model for the Safety Performance Function (SPF). The isolation of a component corresponding to the direct treatment effects enables the analyst to assess the effectiveness of the countermeasures apart from local (site-related) environmental factors. Two case studies are used to demonstrate the approach. The first case study is based on the results published from a previous safety evaluation in Iowa and the second uses a new data set from British Columbia based on the Insurance Corporation of British Columbia Road Improvement Program. The various direct and indirect components have yielded valuable insight into the effects of the model parameters on treatment impacts. Moreover, the calculation of the treatment effectiveness indices have been simplified by providing straightforward equations in terms of model parameters for the computation of their components without resorting to additional algorithms. More importantly, the results can have a significant impact on the economic evaluation of safety programs and countermeasures by allowing the calculation of collision modification factors (CMFs) that vary with time.

Highlights

► An approach is proposed to decompose the treatment effectiveness index into different components. ► Linear intervention models are used for full Bayes before-after safety evaluations. ► The results yield valuable insights into the effects of the model arameters on treatment impact. ► The approach simplifies the computation of the overall treatment effectiveness index. ► Two case studies from British Columbia and Iowa are used to demonstrate the approach.

Keywords

Intervention models; Full Bayes estimation; Poisson – lognormal regression; Random parameters models; Treatment effectiveness index

Figures and tables from this article:

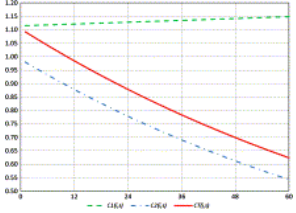

Fig. 1. Monthly treatment components (*y*-axis) for a median site under H1 (w/o a jump) vs. number of post treatment months (*x*-axis), Li et al. (2008).

Figure options

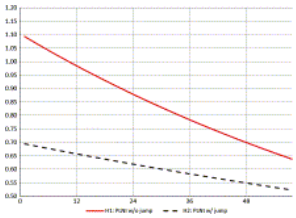

Fig. 2. Monthly combined treatment components (*y*-axis) for a median site under H1 and H2, vs. number of post treatment months (*x*-axis), Li et al. (2008).

Figure options

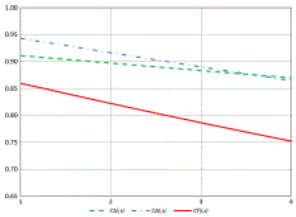

Fig. 3. Yearly treatment components (*y*-axis) under the random parameters PLNI model vs. number of post treatment years (*x*-axis), (completion year 2004).

Figure options

Table 1. Annual collision injury frequency for treated sites.

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