Statistical modeling to evaluate the use of a new treatment in colorectal surgery

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SUMMARY

Colorectal surgeries are associated with risk of infections and other severe health complications, including mortality. To implement preventive measures in a patient, we must know the patient's risk of perioperative complications, which requires a thorough evaluation of comorbidities and the surgical protocol [1]. The aim of this work is to evaluate the effectiveness of a new treatment to deal with secretions in the post-surgical phase. In particular, the risk of infection and other complications will be compared to the usual procedure.

The data for this study is divided into two databases. The first database contains data from roughly 100 individuals who received the new treatment. The second database includes data from roughly 2,000 individuals who were treated using usual methods.

To evaluate the effectiveness of the new treatment approach and avoid bias, a case-control design must be considered [2]. We developed a matching algorithm to ensure comparability between individuals who received the new treatment (cases) and those who underwent usual treatment (controls). Exact matching is not possible for all the variables considered important by expert knowledge, so the proposed matching design only requires exact matching for some of them and uses a propensity score model to find an optimal design. Following the matching process, appropriate statistical models were proposed to examine the effects of the new treatment on mortality and surgery-associated complications.

The results of the matching procedure allowed us to evaluate the benefits of the new treatment in reducing the risk of colorectal post-surgical complications. Also, the statistical procedure could be used to evaluate the effects of new treatments in other medical contexts.

Keywords: causal inference, logistic regression, matching, propensity score

AMS Classification: 62D20, 62J12, 62P10

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