CHAPTER 3
ANALYSE BONE MARROW TRANSPLANT DATA WITH COX REGRESSION

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3.1 INTRODUCTION

The statistical method of data analysis known as survival analysis is used to analyse the period before an occurrence that is of interest. The term "time" typically refers to how old a person is in years, months, weeks, or days from the start of the follow-up until the event happens. While an event is an interesting experience that a person has, such as death, the onset of a disease, relapse after remission, or recovery. Although more than one incident may have been considered, the survival analysis typically only analysed one event. It is presumptive that there will be multiple events in the study, either as recurring events or competing risks. Most applications for survival analysis are in the medical profession, such as the examination of leukaemia patients' remission over a period to determine how long they remain in remission. For instance, Delen (2005) even employed a survival model to predict the survivorship of breast cancer patients.

The phrase "survival analysis" refers to a broad range of statistical methods for studying positive-valued random variables (Miller Jr, 2011). The development of mortality tables hundreds of years ago is credited

with inspiring the use of survival analysis. The use of engineering fifty years ago has improved in the current period. Engineering statistical research places more of an emphasis on parametric models. It led to an increase in clinical trials in medical research, which changed the statistical emphasis to a nonparametric approach.

According to Song (2021) and González-Del Hoyo and Rossello (2022), survival analysis is a statistical method of data analysis in which the period before an event happened is the subject of interest. The term "time" typically refers to the length of time from the start of the follow-up to the occurrence, measured in years, months, weeks, or days. While an event is a noteworthy occurrence, such as a death, the onset of an illness, a recurrence after a period of remission, or a successful recovery.

Aplastic anemia (AA), a severe non-cancerous condition, develops when bone marrow is damaged and stops creating the necessary number of new blood cells for the body. A bone marrow transplant (BMT) can be used to treat AA. AA can advance quickly or attack slowly over weeks or months, causing very serious or even fatal consequences. Lack of energy, shortness of breath with effort, a rapid or irregular heartbeat, pale skin, easy bruising, nose or mouth bleeding, a skin rash, dizziness, and headaches are all signs of AA. Patients with AA may benefit from receiving bone marrow from siblings who are human leukocyte antigen (HLA) identical. HLA is a gene type that controls how the human immune system responds.

Patients who undergo transplant surgery run the risk of developing graft versus host disease (GVHD). Patients with SAA who have a BMT may develop either chronic GVHD or acute GVHD (CGVHD). When there are discrepancies between donors and receivers, GVHD development may be at risk. Due to the discrepancies, recipient (patient) cells may mistakenly label donor cells as alien, which could trigger an immune reaction that damages the patient's tissues and organs. The age of either the recipient or the donors, as well as other factors like a female donor who has previously been pregnant, raise the risk of developing GVHD. Receiving bone marrow from a related donor who is HLA mismatched or from an unrelated donor who is HLA matched increases

the recipient's risk of having GVHD. Cyclosporine and methotrexate are two medications that help monitor and improve GVHD. To stop T lymphocytes from attacking bone marrow stem cells, cyclosporine inhibits their activation. Methotrexate, in contrast, suppresses the immune system and is a chemotherapy drug. Acute Graft versus Host Disease has significantly decreased in previous investigations of two dogs given dog leukocyte antigen (DLA) nonidentical unrelated and DLA-haploidentical littermate marrow grafts (AGVHD). The pups received therapies that increase their chances of survival, such as methotrexate (MTX) alone or cyclosporine and methotrexate (CSP+MTX).

Age, laminar airflow isolation room (LAF), decontamination, history of prior transfusion, and findings of relative response are just a few of the variables that affected the AGVHD of AA' s patients following transplant operation. The dataset of patients with severe AAs who have bone marrow transplants is used in this study to consider both therapy and LAF variables. Cox regression is used to analyse the data, which is produced by Gibb Sampler in MCMC utilising OpenBUGs.

3.2 REVIEWING MODELLING APPROACHES IN APLASTIC ANEMIA RESEARCH

The term "survival analysis", which has a broad statistical definition, refers to several statistical methods for examining random variables with positive values (Miller Jr, 2011). The early work on mortality tables from centuries ago is responsible for the application of survival analysis.

The prospective study of androgen and bone marrow transplantation for the treatment of severe AA was conducted by Camitta et al. in 1979. In this study, two groups of patients were randomly assigned: 47 patients received bone marrow transplantation from HLA-identical siblings and 63 patients without donors were given oral androgen (27 patients), intramuscular androgen (23 patients), or no androgen (13 patients). The study's conclusion is that bone marrow transplantation with a compatible donor can extend patients' lifetimes. However, androgen does not seem