Summary

This PhD dissertation is part of the European Research Council (ERC)-funded HUMYCO (grant ID 946192), a holistic, multidisciplinary project that integrates large-scale epidemiology with mechanistic approaches to understand how mycotoxins affect human health. Leveraging an integrative, multi-exposure, and multi-omics framework, the PhD research investigates how mycotoxin exposure contributes to the risk of cirrhosis and hepatocellular carcinoma (HCC), and how the exposure relates to mortality among kidney transplant recipients.

The **Preface** highlights a broad perspective on food contamination as a quiet burden that can produce loud outcomes. **Chapter 1** outlines the core concepts underpinning this dissertation, including mycotoxins, human biomonitoring, hepatocellular carcinoma, and kidney transplant outcomes. It also introduces a brief history of the evolution of intelligence to guide the careful, context-aware application of statistical and machine-learning models for exploring exposure–health relationships. **Chapter 2** describes the theoretical framework and research objectives, outlining the scientific rationale and hypotheses that drive the investigation. In **Chapter 3**, a review that maps the data-analytic challenges and statistical methodologies for linking multiple mycotoxin exposures to health outcomes emphasizes the importance of careful method selection in high-dimensional settings. **Chapter 4** details an observational case–control study in Blantyre, Malawi, examining how multiple environmental exposures—including mycotoxins and viral infections—affect the risk of cirrhosis and HCC. The study also integrates metabolomics within an exposomics framework to identify metabolic biomarkers predictive of HCC and cirrhosis. In **Chapter 5**, a prospective study nested within the TransplantLines Biobank and Cohort Study investigates the association between mycotoxin exposure and post-transplant mortality by integrating gut metagenomics and metabolomics, elucidating how mycotoxins relate to gut dysbiosis and plasma metabolic alterations that, in turn, influence overall survival in kidney transplant recipients. **Chapter 6** synthesizes the main findings, drawing overarching conclusions on the role of mycotoxin exposure and the development of cirrhosis and HCC, as well as the increased mortality after kidney transplantation. Finally,

the broader international context and relevance of this PhD dissertation are discussed in **Chapter 7**, along with suggestions for future research.