Seasonality in disease was first recognised by Hippocrates (460–370 BC) who said, “All diseases occur at all seasons of the year, but certain of them are more apt to occur and be exacerbated at certain seasons.” We first encountered seasonality when examining time series of cardiovascular disease. We found a strong seasonal pattern with increases in winter and decreases in summer. Rather oddly, we found that warmer climates showed the biggest seasonal changes. This odd pattern was explained by studies which found that populations in colder climates had better insulated homes and wore more clothes in cold weather. Recent studies that improved home insulation found an improvement in residents’ general health and reductions in their blood pressure.

By investigating seasonal patterns in disease it is possible to generate hypotheses about aetiology. The changes in the seasons cause changes in many environmental and social variables. These changes are repeated year after year and create a natural experiment for studying links between seasonal exposure and disease.

This book details a wide variety of methods for investigating seasonal patterns in disease. We use a range of health examples based on data collected daily, weekly and monthly, and using Binomial, Poisson and Normal distributions. Chapter 1 introduces the statistical methods that we will build on in later chapters. In Chap. 2, we define a "season" and show some methods for investigating and modelling a seasonal pattern. Chapter 3 is concerned with cosinor models, which are easy to apply but have some important limitations. In Chap. 4, we show a number of different methods for decomposing data to a trend, season(s) and noise. Seasonality is not always the focus of the study; in Chap. 5, we show a number of methods designed to control seasonality when it is an important confounder. In Chap. 6, we demonstrate the analysis of seasonal patterns that are clustered in time or space.

We hope this book will be accessible to non-statistical researchers as well as statisticians. To aid its implementation we have created an R library “season” that contains most of the functions and data.

The methods shown in this book are all based on the Gregorian calendar running from January to December, but any of the calendar-based methods could be equally applied to the Islamic calendar.
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