Contents

Acknowledgements		
Preface		

1. Containing the Spread of Epidemics

- 1.1 Introduction 2
- 1.2 Disease Control in Italy: The Plague Centuries, 1342–1851 2
 Surveillance 3
 Cordon Sanitaire 4
 Quarantine and Isolation 8
 Foreward Planning and Control 10
- 1.3 Prato, 1630 11
- 1.4 Models of Control 13
 Spatial Mass Action Models 13
 Barriers to Spread 13
 Sicily, 1743: The Plague of Messina 15
- 1.5 Conclusion 17 Appendix 1.1: Map Sources 18

2. The Surveillance of Communicable Diseases 21

- 2.1 Introduction 22
 Layout of Chapter 22
 2.2 Disease Classification
- 2.2 Disease Classification and Recording:
 General Considerations 22
 Disease Classifications 22
 Disease Collecting Systems 24
 Time Span of Disease Records 24
 Sources of Disease Data 24
- 2.3 Early Surveillance Systems: Local Bills of Mortality 24
 The London Bills of Mortality 24
 Bills for Other Cities: Continental Europe and North America 29
- 2.4 National Surveillance: The United States 30

 Background 30

 Morbidity and Mortality Weekly Report (MMWR), 1952–2005 32

 Primary Data Generation 32

- 2.5 International Health Cooperation: Before the League of Nations 37
 Proto-Systems: Regional Health Bodies in the Nineteenth Century 37
 The Office International d'Hygiène Publique (1907–46) 38
 The International (Pan American) Sanitary Bureau 42
- 2.6 Wireless Technologies: The League of Nations Health Organisation (1923–46) 42
 The Epidemiological Intelligence Service 43
 Expanding Horizons and New Technologies: The Eastern Bureau 43
- 2.7 Wireless to Internet: The World Health Organization (1946–) 47
 Epidemiological Intelligence and Surveillance, 1940s–1970s 48
 International Patterns of Communicable Disease Surveillance, 1923–83 50
 Developments in Programme-Oriented Surveillance 55
 Twenty-First-Century Approaches: Electronic Network Systems for Global Disease Detection 57
- 2.8 Evolving Surveillance Practices 60
 Informal Internet-Based Global Reporting Systems 60
 Regional Disease Threat Tracking Tools: The European
 Commission 61
 Sentinel Practices 61
- 2.9 Conclusion 62Appendix 2.1: Communicable Disease Categories 62

3. Quarantine: Spatial Strategies 64

- 3.1 Introduction 65 Quarantine 65 Isolation 65
- 3.2 History of Quarantine 65
 International Sanitary and Health Regulations 65
 Quarantine The United States, 1878–2010 66
 Quarantine Islands 73
- 3.3 Isolation 75
 Isolation: Theory 75
 Isolation: Practice 77

wi	CO	NT	FN

3.4	Quarantine and Isolation Today 87		
	The Role of Movement 87		
	Communicable Disease Consequences of Change	89	
	Estimating the Impact of Quarantine and Isolation		
	Summary 97		

3.5 Conclusion 97

4. Vaccination: Interrupting Spatial Disease Transmission 98

- 4.1 Introduction 99
- 4.2 History of Vaccination 99 Early Vaccine Developments to 1900 Post-1900 Developments 102
- 4.3 Vaccination Strategies and Disease Control 102 Critical Community Size, Vaccination and Disease Elimination 102 Vaccination Impact on Epidemic Cycles 102 Ring Vaccination Strategies 105
- 4.4 Global Programmes: The Expanded Programme on Immunization (EPI) 106 EPI and the Global Immunization Vision and Strategy (GIVS) 106 Trends in Global Vaccine Coverage 107 Regional Contexts: WHO Western Pacific Region 108 Beyond the EPI: Towards Second-Generation Programmes? 109
- 4.5 National Programmes: Mass Vaccination and Disease Elimination in the United States 109 Poliomyelitis 109 Measles 113 Economic Evaluations of Vaccination Programmes 115
- 4.6 Vaccination Risks 115 Faulty Vaccines 115 False Alarms and Declining Herd Immunity 116 Spatially Heterogeneous Vaccination Uptake 120
- 4.7 Conclusion 121 Appendix 4.1: Vaccine Developments

5. Eradication 124

- 5.1 Introduction 125 Defining Eradication 126 Indicators of Eradicability 127 Spatial Strategies for Eradication 127
- 5.2 Smallpox Eradication 128 The Eradication Campaign 128 Smallpox as a Model for Eradication 128
- 5.3 The Global Polio Eradication Initiative 130 Progress Towards Eradication (1988-2010) 131 Obstacles to Eradication 132

- Global Eradication and the Strategic Plan 2010-12 134 The Long-Term Benefits of Eradication 135
- 5.4 Other Global Eradication Campaigns 136 Campaigns Underway: Dracunculiasis 136 Failed Campaigns 137
- 5.5 Prospects for Future Eradication 139 International Task Force for Disease Eradication (ITFDE) 139 Regional Elimination Campaigns: Measles 140
- 5.6 Hostile Threats: Disease Eradication and Bioterrorism 143 Smallpox 143 Poliomyelitis 144
- 5.7 Towards Extinction 144 The Destruction of Known Variola Virus Stocks 145 5.8 Conclusion 145

6. Intervention: Modelling, Demographic Impact and the Public Health 147

- 6.1 Introduction 148
- 6.2 The Basic Reproduction Number, R 148 Herd Immunity 149 Spanish Influenza: Australia, 1918-19 149 Pandemic Influenza A/Swine/H1N1, 2009 152
- 6.3 The Spatial Basic Reproduction Number, Roa Swash-Backwash Models 153 Cyclical Re-Emergence: Spotting Influenza Pandemics 155 Pandemic Detection 163 Swash Model and Other Infectious Diseases 164
- 6.4 Forecasting for Intervention 165 Iceland as an Epidemiological Laboratory 165 Lag Maps 168 Models of Disease Spread 169 SIR Models 170 Spatial Time Series Approaches 170 Model Assessment 173
- 6.5 Intervention, Value-for-Money and Demography 174 Measuring Intervention Impacts 174 Global Immunization Vision and Strategy: Intervention Costs and Benefits 175
- 6.6 Conclusion 177

Appendix 6.1: Swash-Backwash Model Equations

References and Author Index 179 Index 189