17th World Conference on
Infectious Diseases, Prevention and Control
April 25-26, 2022 Amsterdam, Netherlands

Mycobacterial Diseases
ISSN: 2161-1068

VOLUME 12
ISSUE 4

Appropriate Models for Infectious Disease Management

Wrait Scott
Department of Biological Sciences, University of Warwick, Coventry, United Kingdom

Abstract (600 Words)

The past decade has seen a dramatic increase in the significance attached to infectious diseases from the public health perspective. This trend is due in part to the emergence of new and highly pathogenic infections such as Ebola M, West Nile virus, and SARS. There are also well-publicized concerns surrounding the deliberate introduction of pathogens as bioterrorism weapons, and the continued persistence and resurgence of older infections, several of which now boast strains resistant to more than one drug. In addition, there have been a number of high-profile and economically expensive disease outbreaks in domestic livestock as well as wildlife populations. The process of isolating infected individuals results in a reduction in the mean infectious period. It is much more effective when the infectious period is exponentially distributed because it essentially truncates the tail of the distribution, so that the infectious period of a few individuals is dramatically reduced. This effect is not as pronounced in the gamma-distributed models because there is less variation in the infectious periods. In the same way, a longer delay in detecting infected individuals has fewer consequences for the exponentially distributed model because during this time many individuals will have naturally left the infectious class. Under the assumption of a gamma-distributed infectious period most individuals are infectious for a minimum period of time so early detection is more important. While the predicted difference between the exponential and gamma-distributed models depends on the duration of the infectious period and the fraction of contacts traced, it is generally true that models with an exponentially distributed infectious period will give rise to overly optimistic predictions concerning the effectiveness of isolating infected individuals. To focus on the effects of the infectious period distribution on different courses of intervention we have assumed that all those who are quarantined and exposed are detected before the end of the quarantine period and are not released back into the general population. We have also formulated a model that takes into account the distribution of the latent period during quarantine and find similar qualitative results. However, if the average latent period is increased relative to the fixed quarantine period and there is only a small amount of isolation of infected individuals, then the control measures are predicted to be more effective for the gamma-distributed model, because more exposed individuals in the exponentially distributed model will leave quarantine before they develop the infection.

Importance of research (200 Words)

The use of models in epidemiology dates back almost a century, and while traditional models have often been highly successful in explaining observed dynamics, our results show that within a strict management setting, epidemiological details can make a crucial difference. Although a body of theoretical work has demonstrated the importance of incorporating realistic distributions of latent and infectious periods into models of endemic disease, few studies have considered the effects associated with making predictions for an emerging disease. The large discrepancies between estimates of R0 from the exponentially distributed and gamma-distributed fits reiterate the importance of accurately determining the precise distributions of latent and infectious periods. Although the data required for such a task are often available from post hoc analyses of epidemics

Mycobacterial Diseases
ISSN: 2161-1068

VOLUME 12
ISSUE 4

they are certainly lacking for a novel emerging infection. Instead, the uncertainty surrounding assumptions about the distributions should be incorporated into quantitative predictions made from epidemiological models, especially since this may well be greater than any uncertainty that arises from noise in the data. Of course, more sophisticated fitting methods than those used in this paper exist, but if the underlying structure of the model is inappropriate, the method of parameterization is largely irrelevant.

Biography (200 Words)

Wrait Scott, M.D., Ph.D. is the Professor of Department of Biological Sciences, University of Warwick, Coventry, United Kingdom. He is a Partner at Flagship Ventures, having joined Flagship in 2005 while completing his M.D. from Harvard Medical School. David was previously awarded a Ph.D. through the Massachusetts Institute of Technology (MIT) Biological Engineering Division, where he studied the biological effects of complex sugars with advisors and Professor Robert Langer. David also did his undergraduate work at MIT, graduating in 2000 Phi Beta Kappa and Sigma Xi, with a degree in brain and cognitive sciences. He was named as a member of the MIT Corporation its Board of Trustees in 2006 and to the MIT Enterprise Forum Global Board in 2010. David's work has led to 12 peer-reviewed publications, over 40 patents and applications, as well as over 30 awards and honors including the prestigious Lemelson MIT Student Prize in 2005 for invention and innovation. David was also named the Innovator of the Year under the age of 35 by Technology Review in 2007. At Flagship, David focuses on investing in and founding early stage life science and cleantech ventures. He was a board member of Flagship portfolio company CGI Pharmaceuticals (acquired by Gilead in 2010). In 2005, as part of Flagship's VentureLabs unit he co-founded and helped launch LS9, and more recently co-founded Joule Unlimited where he previously served as the founding CEO. In addition, David serves on the Board of Directors of Eleven Biotherapeutics and works closely with several other portfolio companies. He is currently co-founder and CEO of Theracrine, a company developing novel drugs to treat metastases.

Information of Institute and Laboratory (200 Words)

The Warwick Systems Biology Centre (WSB) represents an £11m investment by the University of Warwick to create an autonomous centre to capitalise on strengths in multidisciplinary research. We combine experimental and mathematical approaches, focusing on linking models with the huge volume and diversity of contemporary cellular and molecular data; such as that coming from high-throughput, genome-wide and imaging technologies.Our aim is to improve understanding of complex biological systems so that a broad range of biological and medical priorities, such as disease mechanisms, pharmaceutical drug discovery, drug target validation, and challenges in horticulture and agriculture, can be addressed. The Division of Biomedical Sciences has a vision to build world-class Discovery Science and Translational Medicine programmes in partnership with the University Hospital Coventry & Warwickshire (UHCW), deliver interdisciplinary educational programmes and transmit new knowledge to the wider world through an exciting public engagement interface. The divison is home to 41 Principal Investigators including both clinical and non-clinical academics, several jointly appointed with other departments to drive interdisciplinary work. Our Principal Investigators lead key University-wide research centres, externally supported research programmes and innovative education initiatives: MRC Doctoral Training Partnership - Interdisciplinary Biomedical Research, Hooke Science Programme (MSci Integrated Science), Wellcome-Warwick Translational

Mycobacterial Diseases
ISSN: 2161-1068

VOLUME 12
ISSUE 4

Partnership, Wellcome-Warwick Quantitative Biomedicine Programme (QBP), Centre for Early Life & Tommy's Centre for Miscarriage Research, Centre for Mechanochemical Cell Biology

References (15- 20 limit)

1. Frankish H (2003) Death toll continues to climb in Congo Ebola outbreak. Lancet 361: 1020.
2. Daszak P, Cunningham AA, Hyatt AD (2000) Emerging infectious diseases of wildlife—Threats to biodiversity and human health. Science 287: 443–449.
3. Donnelly CA, Ghani AC, Leung GM, Hedley AJ, Fraser C (2003) Epidemiological determinants of spread of causal agent of severe acute respiratory syndrome in Hong Kong. Lancet 361: 1761–1766.
4. Gani R, Leach S (2001) Transmission potential of smallpox in contemporary populations. Nature 414: 748–751.
5. Halloran ME, Longini I, Nizam A, Yang Y (2002) Containing bioterrorist smallpox. Science 298: 1428–1432.
6. Keeling MJ, Gilligan CA (2000) Bubonic plague: A metapopulation model of a zoonosis. Proc R Soc Lond B Biol Sci 267: 2219–2230.
7. Anderson RM, Donnelly CA, Ferguson NM, Woolhouse MEJ, Watt CJ (1996) Transmission dynamics and epidemiology of BSE in British cattle. Nature 382: 779–788.
8. Woolhouse M, Chase-Topping M, Haydon D, Friar J, Matthews L (2001) Foot-and-mouth disease under control in the UK. Nature 411: 258–259.
9. Cyranoski D (2001) Outbreak of chicken flu rattles Hong Kong. Nature 412: 261.
10. Miller MW, Wild MA (2004) Epidemiology of chronic wasting disease in captive white-tailed and mule deer. J Wildl Dis 40: 320–327.
11. Heesterbeek JAP (2002) A brief history of *R*0 and a recipe for its calculation. Acta Biotheor 50: 189–204.
12. Keeling MJ, Woolhouse MEJ, Shaw DJ, Matthews L, Chase-Topping M (2001) Dynamics of the 2001 UK foot and mouth epidemic: Stochastic dispersal in a heterogeneous landscape. Science 294: 813–817.
13. Lipsitch M, Cohen T, Cooper B, Robins JM, Ma S (2003) Transmission dynamics and control of severe acute respiratory syndrome. Science 300: 1966–1970.
14. Ferguson NM, Keeling MJ, Edmunds WJ, Gant R, Grenfell BT (2003) Planning for smallpox outbreaks. Nature 425: 681–685.
15. Fraser C, Riley S, Anderson RM, Ferguson NM (2004) Factors that make an infectious disease outbreak controllable. Proc Natl Acad Sci U S A 101: 6146–6151.