Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Political Geography 28 (2009) 426–435

Contents lists available at ScienceDirect

Political Geography

journal homepage: www.elsevier.com/locate/polgeo

Of plagues, planes and politics: Controlling the global spread of infectious diseases by air

Lucy Budd [a,*], Morag Bell [b,1], Tim Brown [c,2]

[a] Department of Civil and Building Engineering, Transport Studies Group, Loughborough University, Loughborough, Leicestershire LE11 3TU, UK
[b] Department of Geography, Loughborough University, Loughborough, Leicestershire LE11 3TU, UK
[c] Department of Geography, Queen Mary University of London, Mile End Road, London EC1 4NS, UK

Keywords:
Air travel
Infectious disease
International public health
Disease control

A B S T R A C T

In recent years, the implications of globalisation for the spread of infectious diseases has begun to emerge as an area of concern to political geographers. Unsurprisingly, much of the contemporary literature focuses on the multifarious threats posed by human and, increasingly, non-human mobility. Prompted by current geopolitical concerns surrounding the public health implications of regular international air travel, this paper extends such research by exploring the ways in which the technology of the aeroplane stimulated the production of new international sanitary initiatives aimed at safeguarding global public health in an era of mass aeromobility. By tracing the development of sanitary regulations for aerial navigation, from their origins in the 1920s through the twentieth century in particular, we document the emergence of a series of public health interventions that were designed to limit the public health threat associated with increased international air travel and the concomitant rise in the mobility of infectious diseases. From inoculation certificates to quarantine and the routine 'disinsection' of passenger aircraft with powerful insecticides, modern air travel is replete with a complex set of procedures designed to lessen the risks associated with flying between different climatic and ecological zones. Our detailed examination of the historical context in which these procedures were devised and implemented leads us to consider the importance of time and space, power and efficacy, to the development of a more nuanced understanding of the shifting public health response to an increasingly fluid, mobile, and inter-connected society.

Introduction

Since the first heavier-than-air powered flight in 1903, technological developments have enabled aircraft to fly progressively further, faster, longer, and higher, overcoming the tyranny of distance and fundamentally reshaping the patterns and practices of twentieth and early twenty-first century mobilities. Today, nearly two billion passengers a year travel by air and the commercial airline network is routinely depicted as being the metaphorical glue that makes the world go round (Adey, Budd, & Hubbard, 2007; Urry, 2007).

The sheer volume of passenger and freight movements by air combined with, amongst other things, the putative 'mobilities turn' in the social sciences (see Cresswell, 2006; Urry, 2000), has led to a recent surge of academic interest in the multifarious dimensions of aviation. Scholars including Bowen (2002), O'Connor (2003), and Witlox, Vereecken, and Derudder (2004) have shed light on the unfolding networks of air transportation and Adey (2008), Gordon (2008), and others have alerted us to the multiple historical and cultural geographies of the airport terminal. However, while much was made of aviation's importance to the administration and maintenance of 20th century imperial ambitions, including those of Britain (see Cobham, 1926a, 1926b; Hoare, 1927; Salt, 1930; Sykes, 1920), the development of long-haul air routes and the formation of sanitary regulations for aviation is one dimension of the imperial experience that has received scant academic attention to date. This paper addresses this lacuna by tracing what we refer to as the historical 'bio-geopolitics' of passenger aviation.

The 'bio-geopolitics' of aviation

According to Gould (1999), of the near 4000 airports in the world with scheduled international passenger services, no two are more than 36 h flying time apart; leading him to conclude that

* Corresponding author. Tel.: +44 1509 223409; fax: +44 1509 223930.
E-mail address: l.c.s.budd@lboro.ac.uk (L. Budd).
[1] Tel: +44 1509 223725.
[2] Tel.: +44 20 7882 8465.

0962-6298/$ – see front matter © 2009 Elsevier Ltd. All rights reserved.
doi:10.1016/j.polgeo.2009.10.006

airports are not just nodes in a global space of air traffic flows but important transit points for the rapid, worldwide spread of disease. The significance of this calculation is, in part, reflected in research which reveals that, in an era of unprecedented global aeromobility when hundreds, if not thousands, of human pathogens are circulating the world's airways (Leibhold, Work, McCollough, & Cavey, 2006; Pavia, 2007), the global airline network plays an important role in the worldwide spread of infectious diseases (Avila, Said, & Ojcius, 2008; Budd, 2008; Cliff and Haggett, 1995; Colizza, Barrat, Barthelemy, & Vespignani, 2006; Mangili & Gendreau, 2005; Tatem & Hay, 2007; Tatem, Hay, & Rogers, 2006). The epidemiological vulnerability of a closely inter-connected and highly aeromobile twenty-first century world was illustrated in 2003, when the SARS (Severe Acute Respiratory Syndrome) virus rapidly spread from East Asia to over 25 countries around the world along the contours of the global airline network (Bowen & Laroe, 2006; Pang & Guindon, 2004), and again in 2009 with the outbreak of H1N1 influenza.

While geographers, including Roger Keil in collaboration with Harris Ali, have explored the implications of globalisation on international biosecurity, especially as it relates to SARS (Ali & Keil, 2006, 2008; Keil & Ali, 2007), much of the contemporary literature focuses on the ways in which national governments and international organisations like the WHO have sought, and are seeking, to strengthen their international borders against what are regarded as the 'wrong' sorts of *human* mobility. Indeed, though the link between public health and international relations – and here we would include all aspects of border control – is not a new one, with many countries responding to the threats from cross-border diseases since at least the fourteenth century, it is only in the last decade or so that it has (re)emerged as a key geopolitical concern (Fidler, 2004a). For Fidler (2004a: 4), as for others (including Garrett, 1995; King, 2002), this is because national governments, especially those of advanced industrial economies, have come to recognise that one of the 'costs' of globalisation is the "growing threat of the microbial world".

This latter point is taken up by Alan Ingram (2005: 532) who, in an essay in which he discusses the 'new' geopolitics of disease, explains that globalisation has come to be associated, at least in the context of global health debate, with the dissolution of "epidemiological space", with the reframing of sovereign power over national borders, and with increasing health insecurity (see also Sparke, in press). One aspect that Ingram flags up for particular attention in his analysis is the suggestion that the forms of global health governance that have emerged to promote health security reflect a shift from Westphalian to post-Westphalian approaches. As Fidler, a key proponent of this argument, suggests, during the period between the emergence of international public health directives in the 1850s and the end of World War Two the question of disease control, in Europe at least, was regarded as the concern of individual sovereign nations who remained free of external intervention in their domestic affairs; that is, it was conducted on 'classic' Westphalian principles (see Fidler 2004a, 2004b, 2004c, 2007).

The shift away from a Westphalian system to a post-Westphalian regime of global health in the post-world war era is centred on the idea that the existing horizontal regime, one "that sought to regulate cross-border microbial traffic" (Fidler, 2004a: 8), was replaced by a vertical, rights-based approach. Here, individual rights to health, as defined in the WHO constitution (WHO, 1946), and national interests were seen to be interdependent and international strategies designed to promote health and prevent disease *within* sovereign nations, such as the WHO's smallpox eradication campaign and its 'Health for All' strategy, were developed. More recent events, including the global response to the HIV/AIDS pandemic and the 2003 SARS epidemic might, according to Fidler, be interpreted as further illustrations of a shift away from a Westphalian rationality, as the desire to contain both epidemics was/is framed by state and non-state interests alike (Fidler, 2004a, 2004b). Although we concur largely with Ingram in his positive appraisal of Fidler's "innovative and sustained analysis" of this shift, the question of whether or not the international response to the many and varied challenges to global health security are seen in Westphalian, post-Westphalian, or indeed other, perhaps imperial, terms, remains.

As Zylberman (2006) notes, our understanding of the relationship between globalisation and the search for international/global health security – of the multiple and varied actors involved, of the technological devices and public health strategies drawn upon to protect and strengthen borders against the agents of disease, and of the geopolitical rationalities that help to shape such international endeavour – should not be reduced to the "rise and fall of Westphalian public health governance". This is, as he quite rightly states, "only part of the full story" (Zylberman, 2006: 35). This point is underlined by the medical historian Alison Bashford (2006a: 1) who notes that, in addition to an understanding of the historical geography of disease, an analysis of global health governance requires an exploration of the geopolitics of disease management. Put differently, she argues that such an analysis should focus on the measures of disease prevention, reduction, and eradication that are implemented and, more importantly here, their spatial implications.

A further point of interest is Bashford's recognition that the interaction between infectious disease management and geopolitics is one that involves borders: "the politics of disease control concerns the governance of *this side* and crucially *that side*, of the border" (Bashford, 2006a: 2. Emphasis in original). In highlighting the centrality of borders to disease management, and to global health governance more broadly, Bashford alludes to the notion that public health intervention occurred outside of the jurisdiction of a sovereign state in the period that Fidler categorises in Westphalian terms. There are many examples of this, and Bashford refers us to, amongst others, European intervention in the former Ottoman Empire and to US public health campaigns in Cuba, Panama, and Puerto Rico. One reason for our raising this here is that Bashford highlights further the limitations of analyses of global health governance that are limited to a Westphalian/post-Westphalian framework. Further, she points researchers in the direction of what we might refer to as a 'bio-geopolitics' of global health governance; a term which reflects the interweaving of bio-political forms of power and geopolitics.

It is with this in mind that we examine the rapid development of long-haul air travel during the twentieth century, the bio-geopolitical challenges posed by this development, and the extent to which the political responses demonstrated a shift away from a Westphalian towards a post-Westphalian regime. We do so because, from its inception, aviation presented a new and challenging set of public health concerns. As we go on to demonstrate, Western nations, in particular, responded with a series of sanitary directives that variously framed certain destinations as being host to an array of 'exotic' or 'tropical' diseases that represented a threat to health and economic development. These directives prescribed a range of interventions, including quarantine and vaccination certificates, which aimed to secure western nations and their citizens from certain microbial threats. At times, however, this desire to provide ontological and material security created geopolitical tensions between those who thought that all possible measures should be taken to safeguard 'global', though perhaps we should read 'national', public health and those who resented the idea that aviation's continued development should be hindered by expensive and time-consuming health checks. As the concern surrounding

the H5N1 strain of avian influenza (HPA, 2007; Nerlich & Halliday, 2007) and, more recently, the H1N1 strain, have demonstrated, the trade-offs between screening air passengers at airports and the socio-economic costs associated with implementing such practices remain largely unresolved.

In the analysis that follows, we draw on medical and historical aviation material (the latter sourced from Flight International's digitised online archive and documents deposited in the Transport History Collection at the University of Leicester) to map some of the processes through which the smooth spaces of the air(ways) became increasingly striated as the global airline network developed and highlight the growing anxiety that emerged as public health officials and others began to recognise some of the health-related implications of an increasingly inter-connected aeromobile world. We then explore the gradual, and often contested, development of international sanitary conventions for aviation that emerged in response to this anxiety and offer a bio-geopolitical interpretation of their significance, noting that the international regulatory frameworks that emerged not only sought to manage competing geopolitical interests but also to manage the threat of infection from a range of so-called 'exotic' diseases. The paper concludes with a discussion of the ways in which our analysis informs, and is informed by, recent debate on the broader geopolitical rationality described by Fidler as a shift towards a post-Westphalian global health regime and by others as a, perhaps, more nuanced situation in which western nations sought to secure the health of their populations through a complex array of bio-geopolitical strategies.

Wings around the world: aviation and new global health concerns

As a direct consequence of the metaphorical 'shrinking' of the globe by aircraft during the 1920s and 1930s, nations that had long considered themselves reasonably immune to the diseases of foreign nations, in part due to the security afforded to them by a combination of time and space, found themselves under increased threat. For Australia, the United States, and many of the countries of Western Europe, the time-space compression associated with air travel rendered existing epidemiological surveillance networks almost redundant (Weir & Mykhalovskiy, 2006). The accelerated compression of time and space that aircraft effected meant that, "A man [sic] might fly thousands of miles while incubating a disease, pass medical officials at the destination airport, emerge into a new land, and, a day or two later, go down with an infectious disease that he had picked up on the other side of the world" (Stuart & Biard, 1954: 108–109). Despite this risk, pioneering European air transport companies were encouraged to extend the scope of their passenger operations and to link up territories that were scattered across the globe (Sampson, 1984).

At this time, aviation was considered a powerful tool through which European nations could establish their authority and exert their influence over foreign nations. In the British context, this is reflected in the assumption of responsibility for the Cairo–Baghdad airmail route by Imperial Airways in 1927 and the subsequent, and quite rapid, expansion east; first to Karachi, Jodhpur and Delhi in British India in 1929, then to Calcutta, Rangoon and Singapore in 1933, before finally reaching Hong Kong and Australia in 1934 (Davies, 1964). However, the limited speed, range, and technological capabilities of the early propeller-driven aircraft meant that services could only operate during daylight hours and pilots had to make frequent stops to refuel the aircraft and allow passengers and crew time to rest. By 1934, the 8458-mile Imperial Airways' flight from London to Singapore was achieved in eight days courtesy of intermediate stops at Paris, Brindisi, Athens, Alexandra, Cairo, Gaza, Baghdad, Basra, Kuwait, Bahrain, Sharjah, Gwadar, Karachi, Jodhpur, Delhi, Cawnpore, Allahabad, Calcutta, Akgats, Rangoon, Bangkok, and Alor Star (see Sampson, 1984).

Crucially, however, it was not merely the geographical scope of the early airline networks that was significant, but the reduction in total journey times that aircraft effected. As an editorial in '*Flight*' magazine, a publication designed to disseminate news of aeronautical achievement to the British public, cautioned as early as 1920, "Now an aeroplane can cross the Mediterranean from Europe to the African Continent in a night… it would be foolish to ignore the possibility of… pests being introduced into countries hitherto immune by means of the aeroplane… [as]…up to the present time these tropical and Eastern insects and pests had perished before they reached Europe, because the "carriers" had taken days and weeks in a journey" (*Flight*, 1920a: 454). Though slow by modern standards, the speeds attained by early passenger aircraft revolutionised notions of time and distance: journeys that had once taken weeks or months by surface transport could now be accomplished in a matter of days (Table 1).

As a consequence of this rapid time-space compression (see Janelle, 1969; Simonsen, 2005), many parts of the world could now be reached by air within the incubation period of major infectious diseases (Table 2). The rapid expansion and intensification of global air routes in the early 1930s, and the concomitant rise in passengers and (to a lesser extent) freight volumes worldwide, caused considerable concern among public health authorities (Megonnell & Chapman, 1956). "Nowadays", wrote Air Commodore H. E. Whittingham in 1938, "air-travel is so rapid that an aeroplane departing from the yellow fever zones of West Africa reaches the Sudan in two days, Mozambique in four days, Durban in five days and, by another route, Karachi in five, Calcutta in six… There is, therefore, great danger of yellow fever being spread by air passengers incubating the disease or by infected mosquitoes in the aircraft, unless special precautions are taken" (Whittingham, 1938: 461–462).

As the air routes grew, and new airfields were added to the network, the potential for insects, small reptiles, and mammals to stow away in aircraft and be transported to the next port of call increased. This problem was particularly acute in equatorial Africa, where it was noted that all manner of harmful insects were endemic (Handover, 1936).

Rising appreciation of the increased international mobility of disease and the logistical difficulties associated with maintaining surveillance over rising numbers of passengers resulted in the formation of specific national public health regulations governing aviation. As a direct response to the first flight between England and Australia in 1919, Australia became the first country in the world to apply a quarantine code to aircraft by defining a "vessel" as "any ship, boat, or other description of vessel or vehicle used in navigation by sea or air" (cited in *Canadian Medical Association*

Table 1
'Twice as far in half the time' – by 1935 flying offered significant reductions in journey times, a fact which had serious implications for the spread of disease.

London to -	Time by air (days)	Time by surface transport (days)	Time saved by air (days)
Alexandria	2½	4½	2
Calcutta	6½	16	9½
Rangoon	7	19	12
Singapore	8½	22	13½
Nairobi	5½	19	13½
Johannesburg	8½	18½	10
Cape Town	9	17	8
Brisbane	12½	32	19½

Source: derived from Imperial Airways (1935: 8).

Table 2
The relationship between the incubation period for selected infectious diseases and the journey time between selected endemic zones and the United Kingdom 1938.

Disease	Incubation period (days)	Endemic area	Journey time by air (days)
Cholera	2–5	India	4–5
		Iraq	2–3
Plague	2–6	India	4–5
		Iraq	2–3
		East Africa	4
		West Africa	3–5
		South America	4–5
Smallpox	10–14	India	4–5
		Iraq	2–3
Typhus	5–12	Central Europe	2
		Russia	2
Yellow Fever	3–6	West Africa	3–5
		South America	4–5

Source: Whittingham (1938: 3).

Journal, 1933: 307; see also Bashford, 2004; *Flight*, 1920c, 1920d). A similar definition was adopted by the United States and, in November that year, the US Government decreed that all aircraft entering the country were subject to the same quarantine restrictions as ocean-going ships (*Flight*, 1920e).

Clearly, the development of long-haul commercial air travel had highlighted the threats posed to and by an increasingly 'global' community. As the anxiety surrounding the possibility that aircraft could spread noxious agents around the world became progressively more acute as new destinations were added to the aerial network and passenger numbers increased, international measures were added to these national directives. The *Office International d'hygiène publique* (or the 'Paris Office' as it was also known), one of two European-based international health agencies established in the early 1900s (see Bashford, 2006b; Brown, Cueto, & Fee, 2006; Dorolle, 1968), drafted a precautionary programme of measures that were designed to prevent the spread of yellow fever by air because "while it has been shown that the carrying of adult mosquitoes on [maritime] vessels is not the danger it was once supposed to be, nothing is known of airplane conditions, and there is a rather general belief that a real danger exists" (*American Journal of Public Health*, 1930: 1221).

While the prevalence of insects naturally varied with the geographical site and situation of individual landing grounds, research at Kisumu in Kenya in the early 1930s found that almost half of all aircraft arriving from the north harboured insects despite the eradication measures that were undertaken at intermediate aerodromes to try and prevent their spread (Whittingham, 1938). In response, local health authorities along the route to Durban attempted to restrict the movement of insects by hanging curtains impregnated with paradichlorbenzine, a pungent agent usually used to deter moths, over the doorway of aircraft, placing powerful air blowers by aircraft doors to try and prevent insects from flying in, and physically inspecting aircraft, passengers, and cargo for signs of infestation (Whittingham, 1938: 463). However, no method proved infallible and stowaways were invariably transported (*Flight*, 1920b).

Such interventions created a tension between those who thought all available means should be employed to prevent the spread of infectious disease by air, and those who thought the procedures were too restrictive and unduly hindered the continued development of commercial aviation. One aviation commentator wrote at the time that while "the Colorado Beetle is known to travel by road and rail, the tsetse fly has lived in a sleeping car through Central Africa, and the cockroach first went to the East in a ship, [and] there would seem to be a possibility of the movement of similar "beasties" by air…nothing has eventuated" and observed that the "innocuous" house fly "seems at present to be the only insect that travels unasked on an Imperial Air Route" (Salt, 1930: 220). Nevertheless, despite Salt's apparent lack of concern, the first tentative steps towards the internationalisation of sanitary measures for aviation were taken at the thirteenth International Sanitary Conference in Paris in 1926 (Massey, 1933). Here, it was formally agreed that a period of five days should be universally accepted as the infective period of yellow fever and a compulsory period of observation of six days before embarkation and a further period six days observation upon arrival was imposed in the subsequent Sanitary Convention on all passengers flying from an infected area (*American Journal of Public Health*, 1930: 1221).

The formation of and challenges to international sanitary measures for aviation

It is well established that the geopolitics of disease prevention operates through, and is linked with, the policing of sovereign territory and that the inspection of people, their bodies, identities, and the documents that they carry make "borders more than abstract lines on maps, but a set of practices on the ground." (Bashford, 2006a: 7). Though a system of maritime quarantine had been practised since the fourteenth century and was widely regarded as an essential tool in safeguarding public health (see Fidler, 2001), it was apparent by the mid-nineteenth century that a more extensive 'international' public health framework was required (Harrison, 2006). Within Europe, the desire to internationalise the public health effort was in part linked to the growing realisation that developments in transport and communication systems and the steady growth of transnational flows, especially between European nations and their colonial territories, left the continent vulnerable to the spread of infectious diseases. As many commentators have observed, this vulnerability was especially associated with Europe's eastern borders and the apparent ease with which diseases including cholera and plague were able to cross into the West (see Harrison, 2006; Huber, 2006; Zylberman, 2006).

The beginnings of such a framework emerged through a series of 'international' health conferences, the first of which convened in Paris in 1851 (Harrison, 2006). Though the first of these Sanitary Conferences is often regarded as a failure, in part because only three of the twelve nations that attended actually signed the resulting convention, subsequent conferences nevertheless represented early attempts to promote health and prevent the spread of disease through pre-emptive activity both at, and beyond, the border (Bashford, 2006a). More significantly, in the context of this paper, delegates were required to find a solution to a complex geopolitical problem: namely, how to accommodate the liberalisation of international trade and commerce whilst simultaneously containing threats associated with increased transnational flows of goods and people. As Huber (2006) notes in her detailed analysis of these conferences, for many delegates the solution lay beyond traditional public health practices, such as the imposition of relatively inflexible quarantine or *cordons sanitaires*, as these were considered an "intolerable hindrance to international communications and commerce" (Howard-Jones, 1950: 1034).

Ultimately, the model of international public health that was proposed and partially implemented did not involve direct intervention in the domestic health of other nations. That is, the aim of the various conferences was not to improve the health of those living in countries where diseases such as cholera, plague and yellow fever were endemic. Rather, what was put in place was a series of public health initiatives that sought to distinguish

between different types of cross-border enterprise and were sensitive to developments in international communication and transport networks. With regards the former, there was a clear targeting of those 'enterprises' that emanated from the 'East'. Zylberman's analysis of the International Sanitary Conferences and the response of the European delegations to the threat of cholera, particularly after the 1865 epidemic and the opening of the Suez Canal in 1869, are particularly germane here (see also Huber, 2006). As she reveals, political and health-related anxiety, especially surrounding the annual *Hajj* to Mecca, resulted in a 10-day quarantine period being established for the three main pestilential diseases after the 1866 Sanitary Conference in Constantinople. While certain vessels were exempt from such measures, the reality for pilgrims travelling to Mecca along the main sea-routes was that they experienced much longer stays in what Zylberman (2006: 25) describes as a "militarized zone".

Of particular relevance here is the fact that such measures were refined as communication systems became more sophisticated and as transport networks became more advanced. By the time of the 1892 International Sanitary Conference in Venice, delegates were able to agree upon, and subsequently implement, a surveillance system that used telegram communications with ships travelling through the Suez Canal to determine their relative risk. Those ships that carried doctors and appropriate disinfection equipment were allowed to pass unimpeded, those that did not (or contained pilgrims heading for Mecca) were subject to inspection and observation (Huber, 2006). Another, perhaps even more pertinent example came about as a result of the Dresden Sanitary Conference of 1893. Here, delegates recognized that an expanded rail network posed new problems and were forced to consider whether public health inspections, and any resulting isolation measures, should occur at the point of departure or arrival. As Huber (2006: 468) notes, the debate "bore significant parallels to that on passage through the Suez Canal: both were addressing the fact that technology had changed the way in which space was traversed".

The significance of the International Sanitary Conferences, of which 14 were held between 1851 and 1938, is subject to some debate, especially given the failure of some participating nations to ratify many of the conventions that were proposed. As the Editor of *British Medical Journal* (1949: 23) remarked, the conventions "may have been impeccable on the diplomatic level but were often sadly ineffective on the practical level". Though this may be the case, the conferences did represent an early attempt to establish a modern 'international' public health mechanism for dealing with epidemics of infectious diseases in an age of increased trade and mobility, though the conventions designed to tackle threats posed by maritime and rail travel required further consideration before they could deal with the unique challenges presented by commercial aviation (Stock, 1945).

Interestingly, the first multilateral public health agreement to deal expressly with air travel did not come from Europe but from a parallel body, the International Sanitary Bureau, that was established in Washington D.C. in 1902 (García, Estrella, & Navarro, 1999). Following discussion at the (by then renamed) Pan American Sanitary Conference of November 1924, 18 countries in North, Central, and South America signed a Code which called for the "prevention of the international spread of communicable infection of human beings" and, in the event such infections should occur, the adoption of cooperative measures to prevent "the introduction and spread of disease" into other territories that were hitherto unaffected by all means, including the air (cited in García et al., 1999: 28; see also Cheng, 1962).

However, the first truly international, as opposed to regional, public health convention concerned with air travel was the Congress on Sanitary Aviation, which was held in Paris in May 1929 and attended by the representatives of 38 countries (*Flight*, 1930). Six resolutions detailing the extension of sanitary aviation and obligations concerning government assistance were passed (*Flight*, 1930). Four years later, in April 1933, the First International Sanitary Convention for Aerial Navigation was convened in The Hague where the Paris Office and the International Commission for Air Navigation prepared an agreement that provided for the first international sanitary control of aerial navigation (Massey, 1933). The resulting Convention, which became effective in August 1935, contained 67 Articles and dealt with threats posed by Typhus, Smallpox, Plague, Cholera, and Yellow Fever. Medical inspection and control of tropical disease were discussed, and detailed methods of eradicating the vector of Yellow Fever, the *Aëdes aegypti* mosquito, were proposed (Sanitary Convention for Aerial Navigation, 1933). The Convention also established common international sanitary standards for aircraft and landing grounds and provided, amongst other things, for the construction of anti-amaryl aerodromes, the control and/or isolation of air passengers in endemic yellow fever areas, preventative inoculation, and the destruction of insects in aircraft and around aerodromes (Whittingham, 1938).

Significantly, Britain and France, as leading members of the Paris Office, were torn between such hygienic concerns for their populace and the commercial interests of their fledgling airline industries. One of the most contentious issues concerned the treatment of aircraft arriving from endemic disease areas, and opinion polarised between those who favoured stringent regulation and those who did not wish to disrupt air traffic by enforcing time-consuming and expensive disease-control measures (Bell, 1997). This resulted in different interpretations and inconsistent enforcement of the regulations. Some countries demanded that additional disease-control measures, above and beyond those stipulated by the international community, be practised at their frontiers. For example, in the late 1930s, India and the Dutch East Indies prohibited any aircraft from landing that was flying "from areas which can be considered endemic" (Bell, 1997: 169), while the Nigerian health authorities demanded all air passengers provide a week's notice of their proposed departure date and travel itinerary so a decision could be taken on whether to quarantine them prior to departure (Whittingham, 1938). Elsewhere, the Egyptian and Sudanese health authorities required services between Europe and Africa to change aircraft in Alexandria and Khartoum, respectively, to lessen the risk of disease vectors being directly transported into their territory (*Flight*, 1935), while other nations obliged passengers to possess health certificates confirming inoculation against various diseases (Imperial Airways, 1939).

While some of these additional measures can be interpreted as an expression of national autonomy over their borders, some practices, including disinsection (the eradication of insects inside an aircraft using chemical insecticides), had a basis in international aeronautical law and were, theoretically, to be universally applied.

Airlines had first attempted to address the problems of insects, especially the malaria-carrying *anopheles* mosquito, 'hitching rides' in equatorial regions in the late 1920s with hand-held insect sprays, but difficulties regarding the type of insecticide that should be used and the most effective method of delivery took several years to resolve. The legal basis for eradicating insects and other stowaways in aircraft, or 'disinsection' as it was termed, through the application of pesticides and insecticides, was enshrined in Article 5(e) of the 1933 Sanitary Convention. This Article stipulated that all sanitary aerodromes must have the "apparatus necessary for carrying out disinfection, disinsectisation [sic] and deratisation [sic]" of aircraft in order to prevent the spread of disease. However, early experiments with Flit guns, 'Freon bombs', and hand-held aerosols had found them to be largely ineffective as the spray they produced was neither sufficiently fine nor suitably penetrating, while the

larger electrical and petrol-driven pressure sprayers that were employed at aerodromes were too heavy and bulky to be used in-flight (*Flight*, 1947; Whittingham, 1938). Other proposals, including pumping insecticide through special ducts built into the aircraft fuselage were similarly rejected on grounds of weight and cost (Whittingham, 1938) and signatories to the 1933 Convention merely agreed that disinsection should involve the application of "some form of aerial spray containing a rapidly acting insecticide" during flight (*Flight*, 1947: 95).

Under the direction of their medical adviser, Imperial Airways' Experimental Production section devised a new, more effective, system of disinsection. Constructed from lightweight metal and powered by electricity, the Phantomyst Electrical Disseminator or Phantomyst Vaporiser discharged a fine, dry, near odourless cloud of Pyrethrum-based insecticide into the passenger cabin (*Flight*, 1938a; Mackie & Crabtree 1938). It was reported that the device leaves:

> "no unpleasant odour and [has] no harmful effects on people, clothing or upholstery. Being non-inflammable it may be used in aeroplanes and it is through to be the answer to the yellow fever mosquito and other licentious lice, which attempt to stowaway on aeroplanes in the tropics and spread their doctrines in places hitherto immune" (*Flight*, 1938b: 327).

During the Second World War, the work of the Paris Office was disrupted and its functions, including those under the 1933 Hague Convention, were temporarily entrusted to the United Nations Relief and Rehabilitation Administration (UNRRA). In anticipation of the rapid post-war growth of civilian aviation, and in light of new epidemiological conditions, scientific innovations, and enhanced medical knowledge, it was decided that the existing 1933 International Sanitary Convention for Aerial Navigation was outdated and required modification. A revised document, which called for "special measures to prevent the spread by air across frontiers of epidemic or other communicable diseases", was opened for signature at Washington in December 1944 and was ratified by 14 countries including the United States and the United Kingdom (United Nations – Treaty Series 106, 1948: 250). The modified Convention introduced new documentation, in the form of aircraft and passenger health declarations, international certificates of inoculation against Cholera, Yellow Fever, Typhus Fever and Smallpox, and certificates of immunity against Yellow Fever. Yet while it was believed that "the spread of disease can be held in check only by a scheme which is internationally sponsored and internationally controlled" (*Flight*, 1947: 95), the regulations were not uniform in statute or enforcement and the inability to practice global surveillance undermined their effectiveness (Davey, 1948).

As a consequence of the 1944 revisions, the health regulations for air travel became increasingly complex. Not only did the number of required inoculations now depend both on the route that was to be flown, responsibility for complying with the regulations of each country (many of which were contradictory or mutually exclusive) was transferred to individual passengers (Barrett, 1947, 1949). Variations in the validity of immunization certificates, with regards to dates of commencement and cessation (and even the dosage, type, and manufacturer of the serum that could be used), were another source of confusion (Kyle, 1948). For the smallpox vaccine alone, validity varied from a minimum of 12 days to 1 year after vaccination in Thailand to 21 days/2 years in Egypt, even though the international standard was nominally set at 14 days/3 years (Kyle, 1948). One possible explanation for these variations was that the adoption of universal standards would require the partial abrogation of sovereignty on behalf of the individual countries concerned as "the sanitary staff engaged in this work would be responsible not to local directors of medical services, but to the World Health Organisation of the United Nations" (*Flight*, 1947: 95).

Owing to the different medical requirements demanded by individual states, and the inconsistencies in their policing, many airlines advised passengers to be inoculated against almost every conceivable disease. This situation led to confusion, resentment, and excessive inoculation, with one family who wished to fly from Paris to China "forced to submit to inoculation against smallpox, yellow fever, cholera, plague, typhoid, and paratyphoid" (*British Medical Journal*, 1949: 23). Moreover, the acquisition of the correct documentation was both time-consuming and expensive. In the UK, only 11 medical institutions were authorised to administer the required vaccines and issue the resulting certificates (Barrett, 1947), and critics of the scheme argued that "the international traveller is increasingly being harassed by demands for certificates of vaccination against a lengthening list of diseases… and the various processes now linked with such documents constitute a distinct obstacle to the free movement of peoples in many parts of the world" (Gear, 1948: 1092).

Questions regarding the suitability of, and reliance upon, personal health certificates as evidence of inoculation were also raised. As Gear (1948: 1092) remarked, "there is considerable difference between recognizing vaccination… as a reliable procedure and acknowledging the obligatory certificate as beyond reproach". Ironically, the authority vested in the very documents that were designed to ensure unfettered access to international aeromobility was increasingly being challenged. Writing on the British experience, '*Flight*' magazine remarked that at foreign airports "those who examine the certificates are not always provided with specimens of the various types, or with a list of the medical officers empowered to sign such certificates" and thus "it is not surprising to learn that they have, in the past, been forged, and that it is reported…that on the Continent there is a black market with a recognized tariff for these certificates" (*Flight*, 1947: 95). It was also alleged that some individuals made false health declarations to avoid being detained at the airport (Stanley-Turner, 1947). A further concern was the suggestion that travellers may be tempted to bribe health officials to bypass health checks. To counter this temptation, passengers were warned, as early as 1924, that they could face a £200 fine for deliberately withholding information from health officials (Imperial Airways Ltd., 1924). Nevertheless, evidence suggests that those with sufficient money and political influence could (and did) buy their way around the regulations (Cobham, 1978: 131).

Despite sustained attempts to create a universal public health response to the disease threats air travel posed, many countries refused to ratify either Sanitary Convention. Only nine nations ratified both Conventions, 16 remained bound by the 1933 convention only and a further nine only ratified the 1944 convention, leaving 36 States not bound by either. As the editor of the *British Medical Journal* noted with alarm, "since many countries are bound by no particular convention they are free to take the law into their own hands. Some countries refuse to trouble themselves and take few if any precautions, others… have rushed to the other extreme and imposed restrictions which go far in excess of what is required" (*British Medical Journal*, 1949: 22). Some countries, including the United States, practised highly protectionist policies with respect to foreign quarantine (see *American Journal of Public Health*, 1952), while others relied on outmoded practices of frontier disease control that were not consistent at all airports (Megonnell & Chapman, 1956).

In recognition that the international regulations concerning quarantine and disease control were in a state of confusion, a global directive aimed at controlling the spread of diseases by air was enshrined in Chapter II, Article 14, of the 1944 Chicago Convention on International Aviation, which stipulated that:

> "Each contracting State agrees to take effective measures to prevent the spread by means of air navigation of cholera, typhus (epidemic), smallpox, yellow fever, plague, and other communicable diseases as the contracting States shall from time to time decide to designate, and to that end contracting States will keep in close consultation with the agencies concerned with international regulations relating to sanitary measure applicable to aircraft" (ICAO, 1944).

However, in addition to safeguarding global public health, individual states were also responsible, under Chapter IV, Article 22, to ensure that "the administration of the laws relating to immigration, quarantine, customs, and clearance" does not result in "unnecessary delays to aircraft, crews, passengers, and cargo" (ICAO, 1944). States were thus caught between international obligations to enforce new sanitary regulations and a requirement to avoid unnecessary delays.

Further steps towards the internationalisation of public health measures for aviation occurred on July 22nd 1946, when the constitution of the World Health Organisation was signed in New York. The first assembly of the WHO subsequently convened in Geneva in June 1948 and established an Expert Committee on International Epidemiology and Quarantine with the instruction "to revise the existing International Sanitary Conventions…and combine them into a single body of regulations covering the needs of all travellers". The resulting new regulations were based on a number of principles, including the request that individual member states develop their own internal protection against disease through improvements in sanitation, the control of insect vectors, and national immunization programmes. Significantly, it was also decreed that the public health measures that could be adopted at national frontiers should be the minimum compatible with the existing sanitary situation, as excessive measures would not only interfere with the flow of (air) traffic and have serious economic repercussions, but also, by their very excess, "lead to deliberate evasion of the sanitary control" (Cheng, 1962: 155).

In essence, then, such measures reflect what Fidler views as a shift from Westphalian to post-Westphalian public health: after all, member states were required to take measures that would not only control the spread of infectious diseases between sovereign territory but also prevent the emergence of such diseases in the first place. Yet, as we imply in the opening to this paper, such a reading overlooks the limited power that institutions like the WHO had (and arguably continue to have) in affecting change within nation states and also the tensions that continued to arise between individual sovereign powers in matters of infectious disease management (Davies, 2008). An example of this can be found in the tension that arose, albeit before the new regulations were in place, between Britain and India when it was alleged that practices of infection control had taken on a political as well as a biological dimension. More specifically, in response to Britain's routine disinsection of aircraft arriving from India, the government of India decided in 1946 (one year prior to Indian Independence) that all aircraft arriving in the country from Britain must be similarly treated (Barrett, 1947). Encapsulated in this 'tit for tat' response is what we might regard as the 'bio-geopolitics' associated with the materialization of an international public health framework for aviation. In the final section of this paper, we offer a critical reading of this emergence.

Discussion

> "We have reached the stage when we no longer think of countries overseas as being separated by distance, but by time… That is to say that countries where all sorts of unfamiliar diseases flourish are nearer to this country in point of time than the length of their incubation periods" (cited in Stanley-Turner, 1947: 838).

Notions of time and space are crucial to our understanding of the shifting public health response to an increasingly fluid, mobile, and inter-connected society. Referring to Foucauldian-inspired scholarship, Alison Bashford (2004) points, albeit a little sceptically, to the abandonment of crude public health responses to outbreaks of infectious disease in the late-nineteenth and early-twentieth centuries by many Western governments. Here, Foucault's (1977) conceptualisation of a 'plague town', which was defined by the practice of imposing *cordons sanitaires* and concomitant notions of isolation and confinement, was gradually replaced as technological improvements in transport and communications rendered them increasingly ineffective. Developments in shipping, rail travel and, later, aviation, were particularly important in this regard, as they were instrumental in the metaphorical shrinking of space by time.

Clearly, the twentieth century development of air travel had a specific and a profound impact on global public health governance. The technology of the aeroplane, and most notably the speed of travel, has, over the past century, seen 'new' disease threats emerge and 'old' ones appear ever more frightening, in the West at least. As we note in this paper, the realisation that national borders were no longer, if indeed they ever were, 'secure', was highly significant since borders act(ed) both to define the boundaries of a nation and demarcate its lines of quarantine, for it is often at the border where human and non-human bodies and other potentially dangerous 'vessels' are monitored, surveyed, and perhaps excluded. However, as Bashford (2004: 124) rightly observes, "borders aim to regulate and control movement, flow and exchange, not stop it all together". This was a key issue for those trying to establish a public health framework that could respond to the challenges that followed from the emergence of commercial air travel. Of particular concern was how to regulate an increasingly (aero)mobile society while simultaneously accommodating the demand for more liberalised global travel.

Whilst individual countries had instigated their own sanitary procedures by the early 1920s, the first international attempts to bring the public health impacts of aviation under unified control did not occur until the early 1930s. The 1933 Sanitary Convention on Aerial Navigation established the principles and standards on which (inter)national public health measures should be based and, as we reveal above, involved practices that were targeted at both human passengers and at the non-human cargoes that were transported by air. Importantly, the 1933 convention sought to overcome the problem of where such micro-practices of public health should occur. As with other modes of transport, most notably rail travel, the issue was whether public health surveillance should be implemented on departure or arrival; that is at or beyond the sovereign borders of a nation. As we note, one solution was to pass some of the responsibility for implementing public health measures on to the airlines and their passengers. After all, it was the commercial airlines that were required to carry out disinsection, and it was the passengers who were responsible for ensuring that they carried valid documentation detailing the inoculations they had received prior to travel. However, the effectiveness of this system was undermined both by individual passengers and national governments who, frustrated that a supposedly rapid mode of international transport was being hindered by public health bureaucracy, chose to ignore or deliberately circumvent the regulations.

In subsequent decades, the limitations of existing systems of public health regulation became increasingly apparent. The invention of the jet engine, combined with continued innovations in aerodynamics and material sciences, enabled aircraft to fly further, faster, longer, and higher than ever before, revolutionising

understandings of travel time and distance and increasing the need for vigilance: "In a world in which carriers of disease can spread with the speed of an aeroplane. A typhus louse or a plague flea, brushed off the rags of a beggar in an Eastern bazaar, can be in Tokyo or Oslo, New York or Moscow, London or Sydney, within a few hours" (Brockington, 1958: 217). In response to such threats, delegates at the Fourth World Health Assembly of May 1951 unanimously adopted a new set of International Sanitary Regulations (Cheng, 1962). According to these regulations, passengers embarking on an international flight to certain destinations had to be in possession of valid immunization certificates as prescribed by the World Health Organisation (not just the receiving country concerned) and rules regarding the mobility of non-human cargoes were also strengthened (*Flight*, 1951; Whittingham, 1953).

Additional sanitary regulations for aviation were adopted at subsequent meetings of the World Health Assembly, and the International Sanitary Regulations of 1951 (which were subsequently renamed the International Health Regulations (IHR) in 1969 and further modified in 1973 and 1981), remained the only global regulations for the control of infectious diseases during the remainder of the twentieth century (Gostin, 2004). The IHR aimed to "ensure the maximum security against the international spread of disease with a minimum interference with world traffic" and, to this end, required countries to notify the WHO of any case of cholera, plague or yellow fever that occurred within their territory and adopt universal hygiene measures at ports, airports and other frontier posts (Gostin, 2004: 2624). While individual countries could request personal health and vaccination certificates from travellers in respect of these three diseases, the health measures the IHR permitted were the maximum measures a State may take for the protection of its territory (Gostin, 2004). However, the narrow scope of the IHR meant the regulations were not only irrelevant for confronting known international public health threats such as HIV/AIDS and hepatitis, but were also non-responsive to the emergence of new infectious diseases such as SARS (Ashraf, 1999). In recognition of the IHR's limitations, a revised draft, which provided for increased surveillance, flexibility, and the global coordination of disease responses, was approved and adopted by member states in May 2005.

Nevertheless, continued difficulties regarding IHR compliance continue to pose significant challenges for global public health governance. Individual countries may choose to ignore international law on grounds of sovereignty, economic self-interest, or because they are incapable of complying due to war, natural disaster, or a lack of resources. As Gostin (2004: 2626) notes, it may even be in a country's interest to overlook WHO regulations in certain situations as compliance "may risk national prestige, travel, trade, and tourism" and thus "reporting a disease outbreak… and offering full cooperation may incur serious economic harm by impeding the flow of people and goods". Clearly, the commercial airline industry continues to present a number of challenges to (inter)national systems of public health and, as we have shown, it is both issues of time and space *and* power and efficacy that lie at the heart of them.

The conceptualisation of a shift in global health governance informs our reading of the emergence of a new international (later global) regulatory regime for commercial aviation in several key ways. On one level, the idea of a shift is useful because we can find some clear evidence of a Westphalian system in practice during the early years of the commercial aviation industry. Indeed, up until the mid-twentieth century, the regulatory ideas concerning the socio-political geographies of aviation, health and governance were emerging within a context in which the European (and here we might add the American and Australian) body/nation was perceived to be threatened by contact with foreign 'Others' (see Anderson, 1996; Bashford, 2004; Farley, 1991; Lyons, 1992). Yet, the creation of the WHO in 1946, and the subsequent establishment of an expert committee on quarantine in 1948, saw an attempt to challenge this Westphalian mentality through the adoption of new international sanitary regulations that aimed to counter the need for restrictive (and time consuming) national border-controls.

It is here, however, that our reading moves away from Fidler's. For although we can see the traces of what might be regarded as a post-Westphalian regulatory system emerging, there is also a clear suggestion that national interests remained at play; many of which were, and perhaps still are (see Aginam, 2003), framed by geopolitical tensions that existed between imperial and post-colonial nations. Thus, despite our analysis largely focusing on the period leading up to the construction of this new regulatory environment in the mid-twentieth century, we argue that it offers important insights into the contemporary situation. As Braun (2007) shows with reference to SARS and other viruses, contemporary global public health security, even in a post-Westphalian system, remains a highly geopolitical entity concerned with the containment of risk and the protection of international borders from diseases whose origins are believed to lie overseas.

Conclusion

A number of key issues are raised by way of conclusion. As regards our methodology, by tracing in detail the 'historical biogeopolitics' of passenger aviation, including how, when, and why regulations came about, our approach has facilitated a nuanced interpretation of the relations between the rise and expansion of aeromobility as the normal mode of long-distance international travel during the twentieth century and the development of global public health governance. In so doing, we have moved beyond many existing accounts that merely acknowledge that heightened aeromobility was a driver of new international public health regimes.

The paper has also demonstrated how the introduction of various regulatory practices during the opening decades of the twentieth century was an important dimension of the imperial experience and the exercise of power over others (both at the level of the State and the individual). In contrast to many accounts of imperial science and colonial medical practice, however, we have also shown that this regulatory impulse was driven not only by European fears of insects and infectious diseases that were new to western science but, more particularly, by a concern that as a consequence of aeromobility, pathogens in other environments were no longer 'in their place'. Furthermore, our analysis challenges an evolutionary perspective in relation to the expansion of aeromobility and regimes of control. It has illustrated that, during these same early decades of the last century, the impetus to regulate others was accompanied by a broader anxiety that the complexity of commercial air travel posed threats to an increasingly 'global' community, and that national sovereignty must be qualified in an effort to manage the movement of transnational pathogens.

At the heart of this anxiety over the exact place in which border control and surveillance should take place, lies a concern with the enhanced mobility of a range of infectious agents and the vectors that help to transport them. Here our paper engages with current research which explores notions of biopower and biosecurity. Our contribution to this particular discussion has been to identify the emergence of an international regulatory regime for the international commercial airline industry that not only sought to stop the global transfer of non-human disease vectors by the performance of disinsection and other similar methods of insect control but also to enhance the surveillance and regulation of diseased human agents. In this sense, what we highlight are the beginnings of the kind of

bio-surveillance regime that Amoore (2006) refers to her recent discussion of the 'biometric border'. For example, the introduction of vaccination certificates might usefully be interpreted as portable devices that enabled increasingly mobile bodies to be surveilled at either side of a border and which acted to govern (but not unduly hinder) the movements of people and (by association) the disease agents they might carry.

In emphasising the significance of time and space, speed and mobility, to the development of this particular aspect of a new regime for global public health governance, the paper also raises important questions about the exercise of power and the efficacy of supranational decision-making. A recurring theme is the geopolitical tensions that emerged between the imperative to safeguard national and global public health and commercial concerns that the continued development of aviation should not be hindered by supposedly expensive and time-consuming health checks. In effect, there were fundamental differences between the demands of an expanding airline industry, for which heightened aeromobility offered opportunities for greater speed and efficiency of movement, and a regulatory regime of surveillance and control that appeared to constrain these opportunities.

It is clear from our evidence that fear can stimulate collective political action and that developments in scientific and medical understanding have failed to eliminate a sense of global risk and, in some cases, may actually enhance it. Equally our findings emphasise the need to distinguish between regulatory standards and practices associated with aeronautical technology and those dealing with individual (aero)mobile human bodies. Whilst certain elements of the global air transport system, such as airport lighting and signage, air traffic control, and safety standards, have been amenable to a degree of consistent setting, interpretation and reinforcing of regulations by supranational organisations such as the International Air Transport Association (IATA) and others, the regulation of humans and their bodies is an altogether more complex, politically sensitive and oft-contested process.

Acknowledgements

We extend our thanks to the three anonymous reviewers for their helpful comments on earlier drafts of this paper.

References

Adey, P. (2008). Architectural geographies of the airport balcony: mobility, sensation and the theatre of flight. *Geografiska Annaler B, 90*(1), 29–47.
Adey, P., Budd, L. C. S., & Hubbard, P. J. (2007). Flying lessons: exploring the social and cultural geographies of global air travel. *Progress in Human Geography, 31*(6), 773–791.
Aginam, O. (2003). The nineteenth century colonial fingerprints on public health diplomacy: a postcolonial view. *Electronic Law Journal*. www.warwick.ac.uk/fac/soc/law/elj/ldg/2003_1/aginam/aginam.rtf. Accessed 22.07.08.
Ali, S. H., & Keil, R. (2006). Global cities and the spread of infectious disease: the case of severe acute respiratory syndrome (SARS) in Toronto, Canada. *Urban Studies, 43*, 491–509.
Ali, H., & Keil, R. (Eds.). (2008). *Networked disease: Emerging infections in the global city*. Blackwell: Oxford.
American Journal of Public Health. (1930). The airplane and yellow fever. (Editorial section). *American Journal of Public Health Nations Health, 20*(11), 1221–1222.
American Journal of Public Health. (February 1952). The new international sanitary regulations. *American Journal of Public Health, 42*, 194–196.
Amoore, L. (2006). Biometric borders: governing mobilities in the war on terror. *Political Geography, 25*, 336–351.
Anderson, W. (1996). Immunities of empire: race, disease, and the new tropical medicine 1900–1920. *Bulletin of the History of Medicine, 70*(1), 94–118.
Ashraf, H. (1999). International health regulations: putting public health on the centre stage. *The Lancet, 354*, 2062.
Avila, M., Said, N., & Ojcius, D. M. (2008). The book reopened on infectious disease. *Microbes and Infection, 10*, 1–6.
Barrett, R. H. (November 1947). Health regulations for air travel. *British Medical Journal, 8*, 741–743.
Barrett, R. H. (1949). Health regulations for air travel (III). *British Medical Journal August, 6*, 329.
Bashford, A. (2004). *Imperial hygiene: A critical history of colonialism, nationalism and public heath*. Basingstoke and New York: Palgrave Macmillan.
Bashford, A. (2006a). 'The age of universal contagion': history, disease and globalization. In A. Bashford (Ed.), *Medicine at the border: Disease, globalization and security, 1850 to the present* (pp. 1–17). Basingstoke and New York: Palgrave Macmillan.
Bashford, A. (2006b). Global biopolitics and the history of world health. *History of the Human Sciences, 19*(1), 67–88.
Bell, H. (1997). *Frontiers of medicine in the Anglo-Egyptian Sudan, 1899–1940*. Oxford: Oxford University Press.
Bowen, J. (2002). Network change, deregulation, and access in the global airline industry. *Economic Geography, 74*(4), 425–440.
Bowen, J. T., & Laroe, C. (2006). Airline networks and the international diffusion of severe acute respiratory syndrome (SARS). *The Geographical Journal, 172*(2), 130–144.
Braun, B. (2007). Biopolitics and the molecularization of life. *Cultural Geographies, 14*, 16–28.
British Medical Journal. (January 1949). International sanitary conventions (Editorial). *British Medical Journal, 1*, 22–23.
Brockington, F. (1958). *World health*. Harmondsworth: Penguin.
Brown, T. M., Cueto, M., & Fee, E. (2006). The World Health Organization and the transition from 'international' to 'global' health. In A. Bashford (Ed.), *Medicine at the border: Disease, globalization and security, 1850 to the present* (pp. 76–94). Basingstoke and New York: Palgrave Macmillan.
Budd, L. C. S. (2008). Pests on a plane. Airports and the fight against infectious disease. *Airports of the World, 18*, 48–53.
Canadian Medical Association Journal. (September 1933). Air traffic and infectious disease. (Editorial comments). *Canadian Medical Association Journal, 29*, 307.
Cheng, B. (1962). *The law of international air transport*. London: Stevens and Sons.
Cliff, A., & Haggett, P. (1995). Disease implications of global change. In R. J. Johnston, P. J. Taylor, & M. J. Watts (Eds.), *Geographies of global change remapping the world in the late twentieth century* (pp. 206–223). Oxford: Blackwell.
Cobham, A. J. (1926a). *My flight to the cape and back*. London: A&C Black.
Cobham, A. J. (1926b). *Australia and back*. London: A&C Black.
Cobham, A. J. (1978). *A time to fly*. London: Shepheard-Walwyn.
Colizza, V., Barrat, A., Barthelemy, M., & Vespignani, A. (2006). The role of the airline transportation network in the prediction and predictability of global epidemics. *Proceedings of the National Academy of Sciences, 103*, 2015–2020.
Cresswell, T. (2006). *On the move: Mobility in the modern western world*. London: Routledge.
Davey, E. L. (1948). Immunization procedures recommended for foreign travel. *Canadian Medical Association Journal, 58*, 77–79.
Davies, R. E. G. (1964). *A history of the world's airlines*. London: Oxford University Press.
Davies, S. (2008). Securitizing infectious disease. *International Affairs, 84*, 295–313.
Dorolle, P. (1968 December 18). Old plagues in the jet age. International aspects of present and future control of communicable disease. *British Medical Journal, 4*, 789–792.
Farley, J. (1991). *Bilharzia: A history of imperial tropical medicine*. Cambridge: University Press.
Fidler, D. P. (2001). The globalization of public health: the first 100 years of international health diplomacy. *Bulletin of the World Health Organization, 79*(9), 842–849.
Fidler, D.P. (2004a). Germs, norms, and power: global health's political revolution. *Law, Social Justice and Development Journal* (An electronic law journal).
Fidler, D. P. (2004b). Caught between paradise and power: public health, pathogenic threats, and the axis of illness. *McGeorge Law Review, 35*(1), 45–104.
Fidler, D. P. (2004c). *SARS, governance, and the globalization of disease*. Houndmills: Palgrave Macmillan.
Fidler, D. P. (2007). Architecture amidst anarchy: global health's quest for governance. *Global Health Governance, 1*(1).
Flight. (1920a). Report on a lecture by Professor Maxwell Lefroy. *Flight, 454*.
Flight. (1920b). Aircraft and insects 1920. *Flight, 643*.
Flight. (1920c). Airisms from the four winds. *Flight, 1067*.
Flight (1920 November 18). Quarantine for aeroplanes. Flight.
Flight. (1920e). Airisms from the four wind. *Flight, 1281*.
Flight (1930 September 5). International congress on sanitary aviation. Flight.
Flight. (1935 July 25). Oran to Khartoum some incidents during the Duchess of Bedford's recent African flight. *Flight, 110*.
Flight. (1938a). Massacre at Battersea. *Flight, 378*.
Flight (1938 March 31). Commercial aviation. A week at Croydon. *Flight*: 327–328.
Flight (1947 January 23). Spread of disease by air travel an International Organization Suggested. *Flight*: 95–96.
Flight. (1951 May 11). Speaking of bugs. *Flight, 571*.
Foucault, M. (1977). *Discipline and punish: The Birth of the prison*. London: Allen Lane.
Garrett, L. (1995). *The coming plague: Newly emerging diseases in a world out of balance*. New York: Penguin.
García, G. D., Estrella, E., & Navarro, J. (1999). *The pan American sanitary code toward a hemispheric health policy*. Washington, DC: Pan American Health Organization.
Gear, H. S. (1948 June 5). Problems of international travel. *British Medical Journal, 1948*, 1092–1094.
Gordon, A. (2008). *Naked airport a cultural history of the world's most revolutionary structure* (2nd Ed.). Chicago: University of Chicago Press.

Gostin, L. O. (2004 June 2). International infectious disease law revision of the World Health Organization's International Health Regulations. *Journal of the American Medical Association, 291*(21), 2623–2627.
Gould, P. (1999). *Becoming a geographer*. Syracause, NY: Syracause University Press.
Handover, D. H. (1936). A new empire link West African colonies linked with empire's air system. *African Affairs, 35*, 413–417.
Harrison, M. (2006). Disease, diplomacy and international commerce: the origins of international sanitary regulation in the nineteenth century. *Journal of Global History, 1*(2), 197–217.
Health Protection Agency (HPA). (2007). *Foreign travel-associated illness England, Wales, and Northern Ireland – 2007 report*. London: Health Protection Agency (HPA).
Hoare, S. (1927). *India by air*. London: Longman's Green and Co.
Howard-Jones, N. (1950 May 6). Origins of international health work. *British Medical Journal, 1950*, 1032–1037.
Huber, V. (2006). The unification of the globe by disease? The International Sanitary Conferences on Cholera, 1851–1894. *The Historical Journal, 49*(2), 453–476.
Imperial Airways. (1935). *Facts*. London: Imperial Airways.
Imperial Airways. (1939). *Information for passengers*. Croydon: Imperial Airways.
Imperial Airways Ltd. (1924). *Pilots handbook and general instructions no. 20*. (Reprinted 1974 London, Ducimus Books). Imperial Airways Ltd.
Ingram, A. (2005). The new geopolitics of disease: between global health and global security. *Geopolitics, 10*, 522–545.
International Civil Aviation Organisation (ICAO). (1944). *Convention on international civil aviation done at Chicago on the 7th day of December 1944*. Chicago: ICAO.
Janelle, D. G. (1969). Spatial reorganization: a model and concept. *Annals of the Association of American Geographers, 59*, 348–364.
Keil, R., & Ali, H. (2007). Governing the sick city: urban governance in the age of emerging infectious disease. *Antipode, 39*, 846–873.
King, N. B. (2002). Security, disease, commerce: ideologies of postcolonial global health. *Social Studies of Science, 32*, 763–789.
Kyle, J. (1948 December 25). Health regulations for air travel (II). *British Medical Journal, 2*, 1115.
Leibhold, A. M., Work, T. T., McCollough, D. G., & Cavey, J. F. (2006). Airline baggage as a pathway for alien insect species invading the United States. *American Entomologist, 52*, 48–54.
Lyons, M. (1992). *The colonial disease a social history of sleeping sickness in northern zaire, 1900–1940*. Cambridge: University Press.
Mackie, F. P., & Crabtree, H. S. (1938). The destruction of mosquitoes in aircraft. *The Lancet, 235*, 447–450.
Mangili, A., & Gendreau, M. A. (2005). Transmission of infectious diseases during commercial air travel. *The Lancet, 365*(12), 989–996.
Massey, A. (1933). *Epidemiology in relation to air travel*. London: H.K. Lewis and Co Ltd.
Megonnell, W. H., & Chapman, H. W. (April 1956). Sanitation of domestic airlines. *Public Health Reports, 71*(4), 360–368.
Nerlich, B., & Halliday, C. (2007). Avian flu: the creation of expectations in the interplay between science and the media. *Sociology of Heath and Illness, 29*(1), 46–65.
O'Connor, K. (2003). Global air travel. Towards concentration or dispersal? *Journal of Transport Geography, 6*(3), 171–186.
Pang, T., & Guindon, E. (2004). Globalisation and risks to health. *European Molecular Biology Organization Reports, 5*, S11–S16, Special Issue-Science and Society.
Pavia, A. T. (2007). Germs on a plane: aircraft, international travel, and the global spread of disease. *The Journal of Infectious Diseases, 195*, 621–622.
Salt, A. E. W. (1930). *Imperial air routes*. London: John Murray.
Sampson, A. (1984). *Empires of the sky the politics, contests and cartels of world airlines*. London: Hodder and Stoughton.
Sanitary Convention for Aerial Navigation (1933). International sanitary convention for aerial navigation Signed 12 April 1933 at *The Hague*.
Simonsen, D. G. (2005). Accelerating modernity: time-space compression in the wake of the aeroplane. *Journal of Transport History, 26*, 98–117.
Sparke, M. Unpacking economism and remapping the space of global health. In Williams, A. & Kay, A. (Eds), *Global health governance: Transformations, challenges and opportunities amidst globalization*. London: Palgrave, in press.
Stanley-Turner, H. M. (1947 November 22). Health regulations for air travel (correspondence). *British Medical Journal, 1947*, 838–839.
Stock, P. G. (1945). The International sanitary convention of 1944. *Proceedings of the Royal Society of Medicine (Section of Epidemiology and State Medicine), 38*, 309–316, (Sectional: 17–24).
Stuart, F. S., & Biard, H. C. (1954). *Modern air transport*. London: John Long Ltd.
Sykes, F. H. (1920). Imperial air routes. *The Geographical Journal, 55*(4), 241–262.
Tatem, A. J., & Hay, S. I. (2007). Climatic similarity and biological exchange in the worldwide airline transportation network. *Proceedings of the Royal Society B: Biological Sciences, 274*(1617), 1489–1496.
Tatem, A. J., Hay, S. I., & Rogers, D. J. (2006 April 18). Global traffic and disease vector dispersal. *PNAS, 103*(16), 6242–6247.
United Nations – Treaty Series 106. (1948). Sanitary convention for aerial navigation, 1944, modifying the International Sanitary Convention for Aerial Navigation of 12 April 1933. Opened for signature at Washington, on 15 December 1944.
Urry, J. (2000). *Sociology beyond societies. Mobilities for the twenty-first century*. London: Routledge.
Urry, J. (2007). *Mobilities*. Cambridge: Polity Press.
Weir, L., & Mykhalovskiy, E. (2006). The geopolitics of global public health surveillance in the twenty-first century. In A. Bashford (Ed.), *Medicine at the border: Disease, globalization and security, 1850 to the present* (pp. 240–263). Basingstoke and New York: Palgrave Macmillan.
Whittingham, H. E. (1938). Preventive medicine in relation to aviation. *Proceedings of the Royal Society of Medicine, 32*, 455–472.
Whittingham, H. E. (1953 March 7). Medical aspects of air travel 1 – environment and immunization requirements. *British Medical Journal, 1953*, 556–558.
WHO. (1946). *Constitution*. New York: World Health Organization.
Witlox, F., Vereecken, L., & Derudder, B. (2004). Mapping the global network economy on the basis on air passenger transport flows GaWC. *Research Bulletin, 157*. http://www.lboro.ac.uk/gawc/rb/rb157.html. Accessed 17.12.04.
Zylberman, P. (2006). Civilising the state: borders, weak states and international health in modern Europe. In A. Bashford (Ed.), *Medicine at the border: Disease, globalization and security, 1850 to the present* (pp. 21–40). Basingstoke and New York: Palgrave Macmillan.