Tourism and the Health Effects of Infectious Diseases: Are There Potential Risks for Tourists?

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Abstract
According to statistics of the World Tourism Organization (WTO), international tourist arrivals for 2014 exceeded 1138 million. In the same year the majority of international tourist arrivals were for the purposes of leisure, recreation and holiday, about 55%. However travel is a potent force in the emergence of disease since the migration of humans has been the pathway for disseminating infectious diseases throughout recorded history and will continue to shape the emergence, frequency, and spread of infections in geographic areas and populations. The current volume, speed, and reach of travel are unprecedented. The consequences of travel extend beyond the traveler to the population visited and the ecosystem. International travel and tourism can pose various risks to health, depending on the characteristics of both the traveler and the travel. Travelers may encounter serious health risks that may arise in areas where accommodation is of poor quality, hygiene and sanitation are inadequate. The purpose of this paper is to highlight the details and impact of significant infectious diseases that can pose a risk to tourists and threaten public health. The paper also seeks to raise awareness of the issues outlined and thereby increase efforts to enhance travel safety.

Keywords: tourism, risks, infectious diseases, health

1. Introduction

Recovery from the global financial crisis and an emergence of new source markets has led to considerable growth in the global tourism industry from 2009 to 2014. The volume of travel has grown exponentially too. International tourist arrivals increased from 25.3 million in 1950 to 1138 million in 2014, an astounding 45-fold increase. In recent years, the World Tourism Organization has estimated growth in travel at approximately 6% per year, and anticipates...
similar growths in upcoming decades as seen in the tourism highlight United Nation World Tourism Organization (UNWTO) 2014 report. The demand in the international markets (5.4%) expanded at a slightly faster rate than domestic travel (4.9%). Strongest overall growth (domestic and international combined) was recorded by carriers in the Middle East (11.4%) followed by Asia-Pacific (7.1%), Latin America (6.3%) and Africa (5.2%). The slowest growth was in the developed markets of North America (2.3%) and Europe (3.8%). These areas of rapid growth include many developing countries in tropical/subtropical regions, places characterized by greater species richness, (Guernier et al. 2004). Other attributes of these areas, including poor infrastructure, lack of clean water and sanitation, and poor vector control, may increase the risk that travelers will be exposed to local infections. The shift of international tourist arrivals to less-developed regions predicts increased exposure for tourists to diseases endemic in those regions.

An expansion in the overall global tourism market has contributed significantly to the spread of infectious diseases. Like trade, international travel is vast, rapid, on the rise, and a significant risk factor for infectious disease emergence. Human travelers can easily carry person-to-person transmitted infections to any part of the world as has been seen recently with the Ebola virus. In looking ahead, it is unclear to what extent the current dramatic changes in the global economy will affect numbers of travelers or favored destinations. Political instability and disease outbreaks can also influence travel destinations, sometimes abruptly. Travelers play a critical role in the movement of microbes globally. In an increasingly interconnected world with a growing, increasingly urban population in low-latitude areas, new risks exist and disease-causing microbes and resistance genes can move even more rapidly than in past decades. In some instances, disease can be prevented by vaccination, but there are some infectious diseases, including some of the most important and most dangerous, for which no vaccines exist, e.g. the Ebola virus. General precautions can greatly reduce the risk of exposure to infectious agents and should always be taken for visits to any destination where there is a significant risk of exposure. These precautions should be taken regardless of whether any vaccinations or medication have been administered.

Global travel has evolved dramatically during the past two centuries, with ever escalating speed, distance, and volume. Because the geographic distribution of diseases is dynamic and influenced by ecologic, genetic, and human factors, travel allows humans to interact with microbes and introduce pathogens into new locations and populations. The increased numbers of travelers and their spatial mobility have reduced geographic barriers for microbes and heightened the potential for the spread of infectious diseases that can negatively affect the tourism industry. Between 1950 and 2013, world population grew from 2.5 to more than 6.9 billion. The population growth favored centers of commerce, usually urban or suburban areas, which brought more humans into close contact with larger groups of people. Concurrently, progress in transportation led to speedier movement of humans and goods as well as microbial organisms which cause the rapid spread of diseases.
2. Methodology

An extensive literature review was conducted using published reports from the World Tourism Organization, World Health Organization, World Bank, U.S Center for Disease Control & Prevention and Internet sources. This investigation was conducted utilizing the secondary data analysis research method. The research method consists of how the researcher collects, analyzes, and interprets the data in the study (Creswell, 2009). Secondary analysis is a systematic method with procedural and evaluative steps similar to the primary research method. Secondary data analysis offers methodological benefits and can contribute to tourism research through generating new knowledge. The overall goal of this method is the same as that of others, to contribute to scientific knowledge through offering an alternate perspective; it only differs in its reliance on existing data. Tourism researchers should take advantage of the high quality data that are available and consider the potential value in gaining knowledge and giving insight into a broad range of tourism issues through utilizing the secondary data analysis research method.

3. Literature Review

3.1 Risk Theory

Risk is a many-layered concept, one that has yet to have a single, widely accepted definition (Clarke and Short Jr, 1993; Fischhoff, et al, 2004; Tierney, 1999). Risk can take myriad forms and is influenced by facts, perceptions, experience, social groups, culture, and personal judgments (Boholm, 1998; Cole and Withey, 1981; Rogers, 1997; Sjoberg, 2000). In addition, sensational occurrences can dramatically affect risk perception, as evidenced by the 2001 September 11th terrorist attacks that led to an increased awareness in the tourism academic and non-academic literature (Kegley, 2003) of terrorism. Tourism is an integral part of the global economy; it generates spending internationally and creates jobs (Allen et al, 2002; Dwyer, 2002; Tarlow, 2005). Socially, tourism provides a venue exposing travelers to new cultures and ideas, thereby promoting a more global community (Goeldner & Ritchie, 2003; Tarlow, 2002). In addition, visitors are highly mobile and may change their choice of destination if they perceive an increase in risk at a destination. Tourism studies have consistently found five critical tourism risk factors: (1) War and political instability (Gartner & Shen, 1992; Ioannides & Apostolopoulos, 1999; Mansfeld, 1996; Seddighi et al., 2000); (2) Health concerns (Miller & Ritchie, 2003; McKercher & Chon, 2004; Cooper, 2005); (3) Crime (Brunt, Mawby & Hambly, 2000; Dimanche & Leptic, 1999; Pizam, 1999); (4) Terrorism (Sönmez, 1998; Aziz, 1995; Sönmez & Graefe, 1998a, 1998b; Sönmez, Apostolopoulos & Tarlow, 1999); and (5) Natural disaster (Faulkner, 2001; Armstrong & Ritchie, 2007; Faulkner & Vikолов, 2001; Mazzocchi & Montini, 2001; Chandler, 2004; Higgins, 2005).

Given the economic importance of the tourism industry, the effects of a crisis can potentially be devastating and can have long-term impacts on a destination and the nation’s economy (Blake & Sinclair, 2003; Faulkner, 2001; Heath, 1998; Santana, 2004). Research on risk perceptions and
travel intentions has been found to exhibit an inverse relationship, in that when perceptions of risk are high, intentions to travel are lower. Many studies have examined mediating variables between risk perceptions and intentions to travel. These variables include past travel experience (Lepp & Gibson, 2008); nationality/culture (Reisinger & Mavondo, 2005); psychographics (Priest, 1990; Roehl & Fesenmaier, 1992); and knowledge seeking (Hennig-Thurau & Walsh, 2004). A recent study by Reisinger and Mavondo (2005) found that travel safety was positively associated with intentions to travel and travel safety was negatively associated with travel anxiety. Travel anxiety was impacted mostly by personality, but motivation also played a role in people’s level of anxiety (Reisinger & Mavondo, 2005). Scholars have found that risk perceptions significantly influence the intention to travel. Sönmez and Graefe (1998b) found that perceptions of risk are pivotal to the travel-related decision-making process. For instance, when potential travelers perceive a destination as risky, these travelers may modify their intentions to travel to that destination.

Risk perceptions associated with international travel may vary depending on the geographic region (Sönmez & Graefe, 1996). Furthermore, risk perceptions seem to have a great effect on avoidance of geographic regions and destinations (Sönmez & Graefe, 1998b). Thus, if the potential tourist perceives that the risk of encountering the Ebola virus at a destination is high, then the individual may seek other destinations for their vacation. Therefore, riskier destinations may be omitted from the destination choice set (Crompton, 1992; Sönmez & Graefe 1998a, 1998b). When traveling internationally, tourists often experience a great degree of anxiety (Korstanje, 2011). Risk perceptions, whether real or perceived, can potentially become the dominant factors in travel related decisions, particularly in the international context (Sönmez & Graefe, 1998a; Sönmez, 1998). The influence of risk perceptions related to international travel has been found to be related to several factors: (1) type of risk, (2) culture/nationality, (3) proximity to origin, and (4) international media coverage.

3.2 Implication of Travel Pattern on Disease Outbreaks

Travel pattern influences disease outbreaks. Frequent travelers accelerate international spread if they are infected early and the outbreak does not otherwise expand rapidly, (Hollingsworth, 2007). The travel routes, aviation network, number of flights departing from and arriving at airport, number of passengers carried, and size of aircraft are important considerations in estimating the spread of modern epidemics (Hufnagel et al., 2004). For some types of infections, simulations illustrate that travel restrictions, particularly isolation of largest cities, will be a necessary component in epidemic control strategies, (Hufnagel et al., 2004). The present pattern of air travel could expedite the spread of an influenza pandemic compared with past pandemics. In 1968 to 1969, 160 million persons traveled internationally on commercial flights, (Rvachev & Longini, 1985), this number increased to 2.9 billion in 2012 (International Civil Aviation Organization, 2012). The Hong Kong influenza strain of 1968 to 1969 spread globally through the network of cities by air travel: first to northern latitudes, then southern latitudes. (Rvachev & Longini,
Modeling of the epidemic with air transportation data in 2000 for 52 cities showed that influenza would spread concurrently to cities in both hemispheres, resulting in minimal seasonal swing and little time for public health intervention, (Grais et al., 2003). Disease would reach nearby cities first, but also distant cities with high air travel volumes; a pandemic initiating in Hong Kong can now spread speedily to northern hemisphere cities 111 days earlier than in 1968, (Grais et al., 2003). Understanding the local ecology and linkages through travel can provide projection of disease spread.

### 3.3 Interactions of Travelers, Microbes, and Locations
Travelers have dynamic interactions with microbes and places. Travelers can carry these microbes and their genetic material, and can play many roles with respect to microbes. Travelers can be victims, sentinels, couriers, processors, and transmitters of microbial pathogens, (Wilson, 2003). Conversely, arrival of travelers can affect host population through contact with diverse groups of people and microbes throughout their trip and sharing environments sequentially. Travel should be considered a loop and not just an origin and destination, (Wilson, 2003). Travel can be associated with behavior that leads to transmission of pathogens through blood and body fluid exposure. Travelers may engage in sexual activities, pursue extreme sports, and hike in the mountains or jungle or other injury-prone activities that they would not risk at home. A survey assessing possible exposures to hepatitis B among more than 9000 European travelers found that most had potential risk (60.8%–75.8%), including holiday romance (12.5% of all travelers), with 6.6%–11.2% at high risk (Zuckerman & Steffen, 2000). A Canadian study found that 15% of travelers had potential exposure to blood and body fluid through vehicles such as new sexual partner (9%); sharing instruments, such as razor or toothbrush (5%); receiving injection for medical treatment (3.2%); having acupuncture or other percutaneous nontraditional treatment (1%); tattooing or body piercing (0.5%); and abrasive injury (0.5%), (Correia et al. 2001). Other investigators found that 5.6% of tourists departing from Cuzco engaged in sexual activity with a new partner during their stay, (Cabada, 2003). Although most reported having sex with other travelers (54.3%), some had sex with local partners (40.7%) or commercial sex workers (2.15%), (Cabada, 2003). Sexually transmitted infections (including hepatitis B, HIV, and HTLV-1) acquired during travel can further spread during the journey and after travelers return home.

### 4. Specific Infectious Diseases Involving Potential Health Risks for Travelers

#### 4.1 Severe Acute Respiratory Syndrome (SARS)
The outbreak of SARS in 2003 exemplifies the impact of spatial mobility and the dynamic role of travelers. In 2002, a previously unrecognized coronavirus caused an outbreak of respiratory infections in the Guangdong Province of China. The virus apparently jumped species from civet cats to humans, although subsequent research suggests that the reservoir host is the fruit bat, (Li et al., 2005). The outbreak became visible to the world community when an infected physician
from Guangdong, who stayed for a day in Hotel Metropole in Hong Kong, was the source of infection for multiple hotel guests, who then disseminated the virus in many other countries upon their return home. By May 2002, more than 8000 SARS infections had been reported by the World Health Organization, (WHO, 2002). By July 2002, 29 countries and territories across five continents reported outbreaks and attributed 774 fatalities to SARS (WHO, 2002). Transmission of SARS on aircraft occurred at rates of 0% to 18.3%, and occurred as far as seven rows from the source passenger, (Olsen et al., 2003).

One particular SARS case showed the potential for rapid international dispersion of a pathogen that is spread from person to person, (Breugelmans et al., 2004). A businessman flew from Hong Kong to Frankfurt, Germany, on March 30, 2003. He traveled on seven flights throughout Europe during a 5-day period, including stops in Barcelona, London, Munich, and Hong Kong. He was hospitalized in Hong Kong on April 8 for suspected SARS, subsequently confirmed on April 10, (Breugelmans et al., 2004). Responding to SARS outbreak, the Center for Disease Control (CDC) issued travel advisories to avoid travel to the SARS-affected countries, thus negatively affecting tourism. Most countries in Asia instituted strict quarantine measures and restricted travel to reduce cross-border spread and as inter-country spread. The CDC temporarily suspended international adoption from China because of concern for dissemination. SARS and the associated travel advisories led to significant decline in international tourist arrivals in 2003; the World Tourism Organization (WTO) reported that arrivals to some affected countries in Asia plummeted to less than 50% of their usual levels, (WTO, 2004). Although the region rebounded quickly, SARS was responsible for a 9% overall loss in travel volume for Asia in 2003 and had substantial economic impact, (WTO, 2004).

4.2 Chikungunya
Chikungunya virus, an alpha virus first isolated in Africa in 1952, is a mosquito-transmitted virus that was recently carried by travelers to geographically disparate regions on different continents. Recent outbreaks of chikungunya virus infection originated in Kenya in 2004, and major outbreaks followed in the Indian Ocean Island countries like Reunion, Mauritius, Comoros, Seychelles and Madagascar in 2005 to 2006 (Charrel et al., 2007). Outbreaks ensued in India and Indonesia, and the virus was carried by travelers to Europe, (Panning et al., 2007; Beltrame et al., 2007; Parola et al., 2006; Simon et al., 2007; Hochedez et al., 2006); the United States, (Lanciotti et al., 2007; CDC, 2007); Australia, (Bruce et al., 2007) and Hong Kong, (Lee et al., 2006). A viremic traveler from India visiting the Ravenna province of Italy became the index case of an outbreak that infected 205 local residents, which was transmitted through local Aedes albopictus, a mosquito species introduced into Italy by ship in 1990, (Rezza et al., 2007). The overall results are the same, negatively affecting travel and tourism.
4.3 Dengue
Dengue virus, a flavivirus, is endemic in Southeast Asia, South Asia, the Pacific, Caribbean, and Central and South America, and its history illustrates the intricate interactions of travel, movement of goods, and translocation of infectious disease, (Gubler, 2002). Most cases of dengue virus infection diagnosed in the United States have been imported in travelers, although limited local transmission in Texas has also occurred recently. Less well-known is the fact that a competent vector, Aalbopictus, or Asian tiger mosquito, was introduced into the United States in 1980s by ships that carried used tires. Since then, the mosquito has established itself in many states, and could potentiate autochthonous dengue outbreaks. In 2001 Hawaii experienced dengue outbreaks, the likely source being viremic travelers returning from French Polynesia. Dengue had been present in Hawaii until the 1940s (after World War II), when autochthonous transmission ceased. However, Aalbopictus became established in Hawaii, and in 2001 was the primary vector in a local outbreak involving more than 100 cases, (Effler et al., 2005).

4.4 Influenza: Seasonal and Pandemic
Influenza remains an ongoing global challenge, given the large pool of influenza viruses in avian and other species and the capacity of the virus to recombine, re-assort, and mutate. Spread through aerosol or direct contact, the aircraft provides an ideal enclosed space for transmission of the influenza virus. In one well-characterized outbreak, a passenger who had influenza on an airplane with a nonfunctioning ventilation system for 3 hours probably transmitted the infection to 72% of 54 passengers onboard, (Moser et al., 1979). Movement of troops during World War I contributed to the spread of influenza in 1918 to 1919. Nowadays the expanded range and speed of travel can rapidly disseminate a pandemic strain of influenza. Influenza has caused multiple outbreaks on cruise ships. A large outbreak of influenza cases during the summer of 1998 in Alaska and the Yukon Territory-Canada affected primarily tourists and workers in the tourism industry, (Uyeki et al., 2003). Outbreaks also occurred on two cruise ships, affecting passengers between New York, Montreal, Tahiti and Hawaii, (CDC, 97-98).

A major outbreak on a cruise ship can affect thousands of individuals and passengers can carry infection from one destination to the next. In a study of Swiss travelers that included a questionnaire and paired serologic testing before and after travel (N =1450), 2.8% of travelers tested positive for influenza and 1.2% had more than a fourfold increase in antibody titers. Investigators estimated the incidence for influenza-associated events to be 1.0 per 100 person-months abroad, (Mutsch et al., 2005). These results indicate that influenza has become the most common vaccine-preventable disease in Swiss travelers to the tropics, and highlight the risk for spread through travel. An analysis of the CDC’s influenza and pneumonia mortality data from 1996 to 2005 found that international air travel influences the timing of influenza introduction, and that domestic airline travel volume in November correlates with the rate of spread in the United States, (Brownstein et al., 2006). A study of the hemagglutinin of 13,000 human influenza A(H3N2) viruses during 2002 through 2007 indicated that most new strains emerge in East and Southeast Asia, (Russell et al., 2008). The new strains circulate continuously in this
region and cause epidemics, leading to epidemics in temperate regions. The new strains initially spread to Oceania, North America, and Europe, later reaching South America, (Russell et al., 2008). It is widely accepted that the new influenza strains most likely reach other parts of the world through travelers.

4.5 Animal and Vector Movement and Travel

Human and livestock populations continue to grow rapidly, increasing the number of hosts potentially susceptible to novel infections. Mass transportation of people, products, livestock, and vectors of disease brings each of these closer to one another, and more quickly (Kimball et al. 2005; Wilson 2003). Over half of all human infections are zoonotic (nonhuman animal) in origin (Cleaveland et al. 2001; Woolhouse and Gaunt 2007), and the majority of all emerging pathogens in humans are zoonotic in origin (Jones et al. 2008; Tayloret al. 2001). Population, ecological, and behavioral changes that increase contact with wildlife exacerbate emergence of these pathogens (Daszak et al. 2000). Human encroachment into previously undisturbed areas increases remote area accessibility and introduces more vectors and reservoirs of infection to new hosts. Encroachment, extensification of agricultural land, and urban sprawl all alter population densities and distributions of wildlife, which change disease dynamics (Patz et al. 2004). Bush-meat is an important source of protein and income for millions of people, and the illegal bush-meat trade has been facilitated by the use of modern weapons and communication, logging operations that provide access to forests and transportation of products, lack of economic alternatives, and minimal capacity to enforce laws (Karesh and Noble 2009). Bush-meat hunting, preparation, and consumption are linked with several pandemics and epidemics, most notably human immunodeficiency virus (HIV), Ebola, and severe acute respiratory syndrome (SARS). Travelers have been affected by these and have helped with the spread to countries internationally.

4.6 Ebola Virus

In contrast to HIV, the Ebola virus is an RNA filovirus that has wiped out several nonhuman primate populations over the past 20 years (Bermejo et al. 2006; Leroy et al. 2004; Walsh et al. 2003). The virus appears to be restricted to the rainforests of central and western Africa and Southeast Asia (Monath 1999; Peterson et al. 2004). Marburg, a related virus, appears to be restricted to dry, open areas of central and eastern Africa, and the distributions of Ebola and Marburg likely reflect natural host distribution (ibid.). Nearly all cases of Ebola in humans can be traced back to the handling or consumption of infected wildlife carcasses, particularly that of apes (Leroy et al. 2004; Pourrut et al. 2005). Although not definitively known at this time, several fruit bat species are suspected to be the natural reservoir host for Ebola (subtype Zaire) and possibly other subtypes (Biek et al. 2006; Leroy et al. 2005). An outbreak of Ebola virus disease in West Africa, with onset in early February 2014, has evolved in Guinea, Liberia,
Nigeria and Sierra Leone. This is the first such outbreak in the area. The first cases were reported from the forested region of south-eastern Guinea. As of 7 April 2014, the Ministry of Health in Guinea reported 151 clinically compatible cases of Ebola, 54 of which were laboratory-confirmed. Ninety-five of these patients died, and the death toll is expected to go much higher in the months to come. Liberia has reported 21 cases clinically compatible with Ebola, including 10 deaths. In Mali, the Ministry of Health has reported six suspected cases as of 7 April 2014, two of which have tested negative for Ebola virus infection. Samples from the four remaining suspected cases have been sent to CDC and the Institute Pasteur in Dakar for testing. According to the UN and WHO, the first reported case in the Ebola outbreak that has ravaged west Africa dates back to December 2013, in Guéckédou, a forested area of Guinea near the border with Liberia and Sierra Leone and travelers took it across the border. By the end of June 759 people had been infected and 467 people had died from the disease, making this the worst ever Ebola outbreak. As of July 5th 2015, 27,609 cases and 11,261 deaths had been reported worldwide, the vast majority of them in these same three countries; Guinea 2499 deaths, Sierra Leone 3940 deaths and Liberia 4807 deaths. Travelers carried the Ebola virus to North America but less than 5 persons have died.

For tourists, visitors or residents in affected areas, the risk of infection is considered very low if some elementary precautions are followed, e.g. avoiding contact with symptomatic patients and/or their bodily fluids or with corpses and/or bodily fluids from deceased patients. In addition, generic precautions for travelling in West African countries also apply for preventing infection with Ebola virus, e.g. avoiding close contacts with alive or dead wild animals and consumption of ‘bushmeat’, washing and peeling fruits and vegetables before consumption, and following hand-washing routines. Those who are providing medical care in the outbreak area are advised to wear protective clothing, including masks, gloves, gowns, and eye protection and practice proper infection prevention and control measures. The risk related to seeking medical care in affected countries depends on the implementation of precautionary measures in those settings. The outbreak of the Ebola virus in West Africa is hitting many African economies where they hurt most: the tourism industry, as jittery travelers reconsider trips to places as far away as Kenya and South Africa. Fear of the virus is having some effects on would-be tourists to the continent and underlines the exaggerated risks some associate with travel to Africa, Paris (2015). Travelers are putting trips on hold to countries unaffected by Ebola, such as South Africa and Kenya. Africa’s tourism industry is feeling the effects of concerns about Ebola, the virus generates so much fear in people that it's almost impossible to reassure them with logic that the virus is not affecting the entire continent of Africa. Yet, in the mind of many visitors, all of Africa is a single country. Fear of the virus is rattling would-be tourists to the continent and is underlining the risks some associate with travel to Africa. The Ebola epidemic will continue to cripple the economies of Guinea, Liberia, and Sierra Leone even as transmission rates in the three countries show significant signs of slowing, according to a World Bank Group analysis on the economic impact of Ebola in Africa. The Bank Group estimates that these three countries will lose at least US$1.6 billion in forgone economic growth in 2015 as a result of the epidemic.
5. Conclusion

The impact of air travel on the spread of infectious diseases has led to considerable concern but limited study ((Mangili & Gendreau, 2005; Leder & Newman, 2005). More than 1 billion people travel by air each year. There are several important ways in which air travel can influence the global spread of emerging and established infectious disease. Infections may be spread on the aircraft through close contact and large droplets (Mangili & Gendreau, 2005); airborne spread through small-particle aerosols, as in the case of severe acute respiratory syndrome (SARS) (Olsen et al., 2003); or even through contaminated food, (Eberhart-Phillips et al., 1996; Widdowson et al., 2005). Aircraft can transport infected disease vectors, such as rats or malaria-infected mosquitoes, as nonpaying passengers. Perhaps the greatest concern for global health, however, is the ability of a person with a contagious illness to travel to virtually any part of the world within 24 hours as has been seen with the Ebola virus. The importance of air travel for the spread of seasonal influenza was recently demonstrated by empirical data showing that the spread of influenza was delayed by the decrease in air travel after the attacks of 11 September 2001, (Brownstein et al., 2006). With the current heightened awareness of Ebola, it is timely to reconsider the strategies to prevent more casualties.

Travelers should be considered an integral part of the global surveillance network for emerging infections. Research and the knowledge gained can be used to alert the global community to the presence or susceptibility patterns of pathogens in different regions; inform strategies that can be used to control infections in developing countries; and prepare travelers to those areas and guide the care of those returning. One major lesson from the Ebola outbreak was for the world to respond much more quickly than before to epidemics. The containment and preparedness efforts dramatically limited the potential impact of Ebola on the African economy, compared to earlier worst-case scenarios. This demonstrates why all countries, developing and developed, should make investing in pandemic preparedness a top priority. It points to the need for a global pandemic emergency financing facility that will enable the world to respond much more quickly and effectively to any future deadly outbreaks, and avoid the tragic and unnecessary human and economic costs that have resulted from the Ebola epidemic.
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