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Contents

[Petersen, J., Simons, H., Patel, D., (2018) Amplification of Perceived Risk among Users of a National Travel Health Website during the 2013-2016 West African Ebola Virus Outbreak. *American Journal of Infection Control* (2018): http://dx.doi.org/10.1016/j.ajic.2017.11.012 1](#_Toc504483935)

[Petersen, J., Simons, H., Patel, D., Freedman, J. (2017) Early detection of perceived risk among users of a UK travel health website compared with internet search activity and media coverage during the 2015–2016 Zika virus outbreak: an observational study. *BMJ Open* 7: e015831 5](#_Toc504483936)

[Petersen, J., Simons, H., Patel, D. (2017) Access to yellow fever travel vaccination centres in England, Wales, and Northern Ireland: A geographical study. *Travel Health and Infectious Diseases* 18: 24e29 11](#_Toc504483937)

[Petersen, J., Simons, H., Patel, D. (2016) TravelHealthPro – a new online resource for the travel health sector *Journal of British Global and Travel Health Association* 18 22](#_Toc504483938)

# Petersen, J., Simons, H., Patel, D., (2018) Amplification of Perceived Risk among Users of a National Travel Health Website during the 2013-2016 West African Ebola Virus Outbreak. *American Journal of Infection Control* (2018): http://dx.doi.org/10.1016/j.ajic.2017.11.012

**Title**

Amplification of Perceived Risk among Users of a National Travel Health Website during the 2013-2016 West African Ebola Virus Outbreak

**Abstract**

Timely outbreak information was paramount to public health bodies issuing travel advisories during the 2013-2016 West Africa Ebola virus (EBV) outbreak.

This paper explores the potential for a syndromic system/Shewhart control chart based on the online interaction with a national travel health website in comparison to searches on the Google UK search engine.

The study showed an amplification of perceived risk among users of a national travel health website months before the World Health Organization declared the outbreak a Public Health Emergency of International Concern (PHEIC) and the initial surge in public interest on Google UK in August 2014.

**Keywords**

Infections, Epidemiology, Surveillance, Prevention, Health services

**Highlights**

* Timely information was key to the travel health sector during the EBV outbreak
* Data on information seeking behaviours carry potential for surveillance
* Traffic to a travel health website showed early/sustained interest in the outbreak
* This suggests a potential for a syndromic surveillance system

**Introduction**

The 2013-2016 West African Ebola virus (EBV) disease outbreak was unprecedented in terms of the sheer numbers of cases and deaths, the countries affected, the spread between neighbouring countries and further afield through air traffic, the time scale to contain the disease and the intensity of human-human transmission in urban environments where only smaller and more confined outbreaks in rural environments had been observed previously (1).

Authoritative, accurate, and timely information about the spread of EBV was key to the work of public health bodies issuing travel advisories during the outbreak. This was important, to reduce international spread, avoid harm in travellers, to provide optimal support for travel health services, and to disseminate appropriate public health messages while media attention was high (2).

Data on online behaviours carry rich potentials for surveillance in the field of infodemiology, i.e. the science of distribution and determinants of online information with the aim of informing public health and public policy (3–6).

The aim of this paper is to explore the potential value of a syndromic surveillance system for early identification of incidents, allowing timely preparation of public and travel health messages to prevent under capacity when there is a sudden surge in demand.

**Methods**

The National Travel Health Network and Centre (NaTHNaC) is a government body supporting travel health services in England, Wales, and Northern Ireland. The main information channel is its website, TravelHealthPro.org.uk (7).

In total, NaTHNaC issued 28 EBV-related travel advisories between 24 March 2014 and 9 January 2015.

Weekly counts of unique pageviews (‘views’ from here on) of EBV-related pages versus all pages were extracted from Google Analytics March 2013 through December 2014. The relative search volumes for “Ebola” were obtained from Google Trends UK (https://[www.google.co.uk/trends; country](https://www.google.co.uk/trends;%20country): UK) as a measure of interest from the public.

A Shewhart control chart was created for the proportion of EBV-related views relative to total views (8). The same time period in the previous year was used as a baseline (mean +/- 3 standard deviations). Both numerators and denominators were logarithmically transformed.

**Results**

The time trend of EBV-related searches showed an earlier interest on the professional website compared to Google UK (Figure 1). The Shewhart chart showed all weeks from 30 March to 31 December 2014 as “out-of-control” relative to the baseline (Figure 2).

**Figure 1** Ebola virus-related searches on a professional travel health website, www.TravelHealthPro.uk, and searches on Google UK, 23 March to 31 December 2014. Vertical line: week of WHO PHEIC on 8 August 2014.

**Figure 2** Shewhart control chart of weekly Ebola-related page views relative to total views with end of March to end of December 2013 as baseline. Out-of-control data points were defined as being three standard deviations above the baseline mean. Vertical line: week of WHO PHEIC on 8 August 2014.

**Discussion**

Online information seeking activity has been shown to wax and wane as new information on threats becomes available and satisfy gaps in knowledge. The mechanism behind the initial bursts of information seeking has been termed the social amplification of risk (SAR) (2). Several studies have explored the SAR mechanism for early detection of disease outbreaks using online information sources including search engines (9–13), social media networks such as Twitter (10,11,14,15), the online encyclopaedia, Wikipedia (16), media newsrooms and news aggregators (2,9,17,18), professional networks such as Program for Monitoring Emerging Diseases (ProMED) (19), and traffic to professional travel health websites (20). Particular diseases of interest have been swine / seasonal flu (2,17,18), Ebola virus disease (9,10,13,15,19), dengue (12), and most recently, Zika virus (11,14,20).

The time trend of EBV-related searches on Google UK was characterised by three distinct spikes (Figure 1). The first spike in late July/early August 2014 coincided with the WHO PHEIC. The second and largest spike coincided with news on 30 September 2014 of the first US EBV case in a Liberian resident, who travelled to Texas and infected two healthcare workers before being diagnosed (1). The third spike at the end of December 2014 coincided with the EBV diagnosis of a British aid worker on 29 December 2014. In comparison, the activity on the professional website also showed an early interest at the end of March and in the lead up to the PHEIC four months later (Figure 1). Compared to the baseline of the Shewhart chart, this represented a clear and significant change. This study thus demonstrates a potential for early detection of, not the outbreak itself, but the interest among users of a national travel health website.

A syndromic surveillance system as outlined in this study could have benefits in terms of alerting public health organisations about outbreaks early. As with any surveillance system it would by design have to qualify on a number of auditable criteria such as acceptability, cost-effectiveness, data quality, flexibility, positive predictive value, representativeness, security, sensitivity, simplicity, stability, standards use, and timeliness (21,22). The crux of the system would be its predictive value and specificity, which can easily be evaluated against the timing of reports from WHO and other leading public health agencies as well as surges in interest in social media and on internet search engines as provisionally demonstrated in this study. Another clear strength of such a system would be that the data are naturally occurring and the costs of setting and running it would be minimal. There are known limitations to systems based on online activity, e.g. not all searches are performed by humans with genuine concerns about diseases and it has not been possible to rule out whether some searches could have been carried out by robots designed to boost traffic to other websites for commercial gains (23). The fact that the NaTHNaC website, TravelHealthPro.org.uk, is specialised and has a relatively small following (7), however, make this less likely to be an issue.

**Conclusions**

The study showed an amplification of perceived risk among users of a national travel health website months before the PHEIC and the initial surge in public interest on Google UK in August. This suggests a potential for tools predicting periods of high demand on travel health services by detecting changes in online information seeking behaviours. Such tools may facilitate early identification of incidents, allowing the timely preparation of appropriate public and travel health messages to prevent under capacity when there is a sudden surge in demand.

**Author contributions**

JP, HS, and DP were closely involved with the design, conduct, analysis, presentation, and interpretation of the study findings.

**Sources of funding**

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**Competing interests**

None of the authors have any competing interests in the manuscript.

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**Title**

Early detection of perceived risk among users of a UK travel health website compared with internet search activity and media coverage during the 2015-2016 Zika virus outbreak – an observational study

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**Word count**

2,316 words

**Abstract**

*Objectives* The Zika virus (ZIKV) outbreak in the Americas in 2015-2016 posed a novel global threat due to the association with congenital malformations and its rapid spread. Timely information about the spread of the disease was paramount to public health bodies issuing travel advisories. This paper looks at the online interaction with a national travel health website during the outbreak and compares this to trends in internet searches and news media output.

*Methods* Time trends were created for weekly views of ZIKV-related pages on a UK travel health website, relative search volumes for “Zika” on Google UK, ZIKV-related items aggregated by Google UK News, and rank of ZIKV travel advisories among all other pages between 15 November 2015 and 20 August 2016.

*Results* Time trends in traffic to the travel health website corresponded with Google searches, but less so with media items due to intense coverage of the Rio Olympics. Travel advisories for pregnant women were issued from 7 December 2015 and began to increase in popularity (rank) from early January 2016; weeks before a surge in interest as measured by Google searches/news items at the end of January 2016.

*Conclusions* The study showed an amplification of perceived risk among users of a national travel health website weeks before the initial surge in public interest. This suggests a potential value for tools to detect changes in online information seeking behaviours for predicting periods of high demand where the routine capability of travel health services could be exceeded.

**Keywords**

HEALTH SERVICES ADMINISTRATION & MANAGEMENT, INFECTIOUS DISEASES, PREVENTIVE MEDICINE, TROPICAL MEDICINE, EPIDEMIOLOGY

**Strengths and limitations of this study**

* *Infodemiological applications have to date primarily used online search engines or social media networks. This study is to our knowledge the first to use data on the online interactions with a professional online resource.*
* *The study used a large and broad range of online news sources, which assisted in making the results generalisable.*
* *Formal validation of many Google tools is still pending on the disclosure of the underlying methodologies.*
* *Any system based on online information seeking behaviours is open to new biases such as the activity of robots designed to boost traffic to other websites for commercial gains.*

**OBJECTIVES**

The rapidly evolving Zika virus (ZIKV) outbreak associated with a cluster of congenital malformations in Brazil in 2015 led the World Health Organization (WHO) to declare the outbreak a public health emergency of international concern on 1 February 2016 [1].

Authoritative, accurate, and timely information about the spread of ZIKV was paramount to the work of public health bodies issuing travel advisories, especially to pregnant women, as the outbreak unfolded and spread across the Americas. This was important, firstly, to prevent harm in travellers at higher risk of complications from ZIKV, specifically pregnant women [2], secondly, to support travel health services at a time of high demand, and thirdly, to disseminate appropriate public health messages while media attention was high [3].

Repositories of data on online behaviours carry rich potentials for surveillance and have been termed infodemiology, i.e. the science of distribution and determinants of online information with the aim of informing public health and public policy [4–7]. Google Flu Trends represents an early example of an infodemiological system that has been used for both early detection and estimation of outbreak magnitude [8]. There have since been several applications in infectious disease surveillance (dengue, Ebola virus, swine flu, Zika virus), both in endemic and non-endemic settings, and exploiting a variety of data sources such as online search engines [9–14], social media networks [12,13,15,16], online encyclopaedias [17], media newsrooms and news aggregators [3,11,14,18,19], and mediated surveillance networks [20]. Some of the lessons from these early works have been that information seeking behaviours wax and wane as new information becomes available and satisfies gaps in knowledge, e.g. [11–13]. In some situation, especially in endemic settings, there may be an equilibrium between information seeking and case numbers, which is useful for predicting the pressure on frontline services or in countries with limited surveillance capability, e.g. [7,8,10,14,15]. In this study, we look at information seeking behaviours among users of a UK national travel health website during the 2015-2016 ZIKV outbreak and compare this to time trends in concurrent internet searches and output from news media rooms. The motivation being that travel health services are staffed by healthcare professionals who routinely deal with traveller risk scenarios weeks and months ahead of departure. The paper in that way looks at the potential value of a professional network as a sentinel surveillance system for predicting periods of high demand on travel health services [8] over commonly used sources such as internet search engines and news media.

**METHODS**

The National Travel Health Network and Centre (NaTHNaC) is a government commissioned clinical advisory service supporting travel health services in England, Wales, and Northern Ireland in consultation with Public Health England’s Travel and Migrant Health unit. Its main information channel is a website, travelhealthpro.org.uk. Emerging threats such as ZIKV are covered in frequently updated news items and outbreak surveillance notices. Established threats are covered in factsheets with advice to travellers and health professionals. In the case of the ZIKV outbreak, the news items with travel advisories for pregnant women issued from 7 December 2015 onwards quickly became highly accessed. Various other news items on ZIKV and a factsheet (ZIKV risk assessment) were also available, but were much less visited. Data on the weekly number of unique pageviews (defined as number of sessions in which the page was viewed at least once and from hereon referred to as ‘views’) for each page were extracted using Google Analytics and the rank according to the weekly number of views was calculated. The access to the travelhealthpro.org.uk website was compared to Google searches (a measure of interest from the public) and news items aggregated by Google UK News (a measure of media output). The relative search volumes for “Zika” were obtained from Google Trends UK (https://[www.google.co.uk/trends; country](http://www.google.co.uk/trends;%20country): UK) and ZIKV-related news items on Google UK News (term: “zika”; <https://news.google.co.uk/>; country: UK, date of extraction: 1 September 2016). The media news items were included if the headline and excerpt were ZIKV-related and each item was categorised by topic (General concerns/Rio de Janeiro Olympics 2016/Vector control/Vaccine development/Business news/First imported cases to a country/Sexual transmission news/Refund/cancellation practices of tourism industry/First deaths for a country/First Congenital Zika Syndrome cases for a country or region/First local transmission in a country/Other). It was not uncommon for news items to include information on multiple aspects of the outbreak, i.e. virus, disease, geographical spread, adverse outcomes, possible control measures, burden on society, etc. These items were grouped together under ‘general concerns’. The study period began on 15 November 2015, the week WHO first published news about a microcephaly cluster in northeast Brazil on 20 November 2015 [21] and ended on 20 August 2016, coinciding with the final week of the Rio Olympics 2016. Data for the entire period was extracted at weekly intervals (Sunday-Saturday weeks). Data analyses were carried out in Stata 14 [22].

**RESULTS**

The analysis of ZIKV-related items from the Google UK news aggregator yielded a total of 1,750 items (Table 1). The majority of items were categorised under general concerns (43.8%) or the Rio Olympics 2016 (37.9%). Other popular topics, although on a smaller scale, concerned control measures such as vector control (5.1%) and vaccine development (3%).

*Table 1 Google UK news items by category.*

|  |  |  |
| --- | --- | --- |
| **Topics** | **Frequency** | **Percent** |
| General concerns | 766 | 43.8 |
| Rio Olympics 2016 | 663 | 37.9 |
| Vector control | 89 | 5.1 |
| Vaccine development | 53 | 3.0 |
| Business news | 42 | 2.4 |
| First imported cases to a country | 36 | 2.1 |
| Sexual transmission news | 23 | 1.3 |
| Refund/cancellation practices of tourism industry | 19 | 1.1 |
| First deaths for a country | 19 | 1.1 |
| First Congenital Zika Syndrome cases for a country or region | 18 | 1.0 |
| First local transmission in a country | 13 | 0.7 |
| Other | 9 | 0.5 |
| Total | 1,750 | 100.0 |

The time series of the news items by category revealed that items about the Rio Olympics overtook all other topics from the beginning of June 2016 and culminating at the beginning of August, the week of the opening ceremony (Figure 1).

The time series of ZIKV-related browsing activities were characterised by an initial surge, at the end of January to the beginning of February 2016, punctuated by smaller spikes on travelhealthpro.org.uk and on Google searches in April and May, and again at the end of July (Figure 2). The opening week of the Rio Olympics at the beginning of August was associated with the highest number of news items of the study period. The rank of the first travel advisory to pregnant women published on 7 December 2015 quickly declined in popularity (rank) only to rise again in popularity from the beginning of January 2016 (Figure 3). The third travel advisory, published on 26 January 2016, remained among the ten most popular pages on the website throughout the study period. The three pregnancy travel advisories had reached a total of 149,496 views by 20 August 2016. For comparison, the most popular item covering the developments of the Ebola virus outbreak in West Africa only reached 20,000 views between July and December 2014 (unpublished information, NaTHNaC, 1 September 2016).

**DISCUSSION**

Traditionally, public health bodies have been informed about changes in the burden of diseases mainly through indicator-based surveillance systems such as yearly incidence or prevalence rates of pre-defined diseases. In recent decades, however, increasing attention has been directed towards the development and use of complementary event-based surveillance systems tuned at detecting new and emerging threats of the month, week, day, or even hour [23,24]. Online information seeking behaviours (information demand), user generated content and online media stories (information supply) have opened new and almost immediate opportunities for surveillance of emerging threats. This scientific discipline has been termed infodemiology or infoveillance [5,6]. An early example of an infodemiological system was the Google Flu Trends, which could predict demand on healthcare systems based on mass searches for flu symptoms and remedies on the Google search engine [8]. Part of the early detection relies on the fact that many individuals will try to self-diagnose and self-treat before seeking help from the healthcare services. Several studies have since explored the potential of various online data sources for early detection including online search engines [9–14], social media networks such as Twitter [12,13,15,16], the online encyclopaedia, Wikipedia [17], media newsrooms and news aggregators [3,11,18,19], and mediated surveillance networks such as Program for Monitoring Emerging Diseases (ProMED) [20]. Particular diseases of interest have been swine/seasonal flu [3,18,19], Ebola virus disease [9,11,13,16,20], dengue [10,14], and most recently, ZIKV [12,15].

Google Flu Trends has since been replaced by more sophisticated systems exploiting multiple data sources and calibrating the models to take regional variation into account, e.g. internet connectivity, demographic factors, and healthcare seeking behaviours [25,26]. Infodemiological systems, including early versions of Google Flu Trends, have been subject to criticism on a number of other points too. First, some have been critical of the fact that many of the Google tools and underlying algorithms have not been published and have thus remained methodologically ‘black boxes’ [27]. Second, and more fundamentally, less is known about internet and data-driven methodologies than traditional methods. New biases have to be defined and addressed, e.g. that internet searches for a part are made by robots and not humans with genuine concerns about diseases [27]. Third, the issues around the fear and curiosity driven initial bursts of information seeking can mask *de facto* risk especially for new threats. An interesting example of this was the disproportional interest in the few Ebola cases in USA compared to the situation in West Africa during the 2014 Ebola epidemic [13]. This and other studies have similarly found a very high initial interest in the ZIKV outbreak; especially as the first cases were imported to the USA and Europe [12,15]. This phenomenon has been termed the social amplification of risk mechanism and known to be modified by volume, content, and tone of coverage. Further attention can be triggered by key events such as first imported case, first death, or in the case of ZIKV, first pregnant case or first case of Congenital Zika Syndrome [3]. In the present study, secondary spikes in online behaviours were observed in April, May, and at the end of July in both the professional network and in Google searches. The spike in April coincided with reports about scientific consensus for a causal link between ZIKV infection and microcephaly and Guillian-Barré syndrome [28]. The spike at the end of July coincided with the first local cases of mosquito-borne ZIKV infection in Florida, USA. In the case of ZIKV and the UK media, the majority of ZIKV-related items from June to August were associated with an even bigger news generator, i.e. the Rio Olympics with extensive coverage of e.g. top athletes dropping out due to the ZIKV outbreak. The epidemiological ‘signal value’ of media stories has in this case been weaker than for the online trends of Google searches or the information seeking behaviour on a travel health website. Chan et al. similarly found that dengue-related Google searches were better correlated with case numbers in endemic countries, where outbreaks are newsworthy yet not media sensations [10]. Fourth, many syndromic surveillance systems set up in the 2000s have been discontinued due to high false positive rates, which have led some observers to ask for systems incorporating higher quality sensors to inform early responders more effectively [24]. Finally, some have advocated for surveillance systems based on voluntary panels of members of the public that should offer timeliness and a tentative compromise between the safety and limitations of traditional study designs and the promises and perils of crowd-based systems [29].

Sections of the public planning to travel to potentially high risk disease areas may seek advice, vaccinations and other protection from travel health services; either voluntarily or due to mandatory requirements imposed by governments and the World Health Organization [30]. Due to vaccination schedules consultations may have to be arranged weeks or months before departure. Potentially vulnerable travellers such as pregnant women, young children, those with immunocompromise or other comorbidities are particularly likely to seek professional travel health advice [31]. The online interaction with a national travel health information service could for that reason act as a sentinel system for early detection of an emerging outbreak – at least at the point where it starts to be considered a risk to travellers. The advantage of such a system would be to direct attention to emerging issues at an early stage before a surge in public/media interest threaten to overwhelm the routine capability of frontline services.

There are undeniably many examples of where the media, as a whole, delivers important health messages in ways that are not misleading or merely seeking to cause sensation [32]. The present study however can show that trends in media reports on an infectious disease is not always related to risk as no exported cases of ZIKV were reported in connection with the Rio Olympics [33].

A possible limitation of a system based on online information seeking behaviours could be robots designed to boost traffic to other websites for commercial gains [27]. We have not been able to exclude this possibility, but the fact that the audience is relatively small and specialised makes this less likely than had it been big and broad in terms of interests.

The study used a large and broad range of news sources aggregated by Google News, which assists in making the results generalisable. The various Google tools have virtue in being widely used and the data easily accessible. Formal validation of many of the tools is however still pending on the disclosure of the underlying methodologies [27].

**CONCLUSIONS**

The study showed an amplification of perceived risk among users of a national travel health website weeks before the initial surge in public interest at the end of January 2016. This suggests a potential value for tools to detect changes in online information seeking behaviours for predicting periods of high demand where the routine capability of travel health services could be exceeded.

**Contributorship statement**

JP, HS, DP, and JF were closely involved with the design, conduct, analysis, presentation, and interpretation of the study findings.

**Competing interests**

None.

**Funding**

None.

**Data sharing statement**

Unpublished website usage data captured by Google Analytics, which can be made available upon request to the corresponding author.

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**FIGURE LEGENDS**

**Figure 1** Zika virus-related Google UK News items by whether the Rio Olympics was mentioned or not.

**Figure 2** Professional browsing activity (travelhealthpro.org.uk), public searching activity (Google UK Trends), and number of Google UK News. Weekly data.

**Figure 3** Rank among all pages on national travel health website, travelhealthpro.org.uk, for ZIKV travel advisories for pregnant women issued on 7 Dec 2015, 19 January and 26 January 2016, respectively (weekly data). Vertical line: WHO Public Health Emergency of International Concern on 1 February 2016.

# Petersen, J., Simons, H., Patel, D. (2017) Access to yellow fever travel vaccination centres in England, Wales, and Northern Ireland: A geographical study. *Travel Health and Infectious Diseases* 18: 24e29

**Title**

Accessibility to yellow fever travel vaccination centres in England, Wales, and Northern Ireland: A geographical study

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**Abstract** (200/200 words)

*Background* More than 700,000 trips were made by residents in England, Wales, and Northern Ireland (EWNI) in 2015 to tropical countries endemic for yellow fever, a potentially deadly, yet vaccine-preventable disease transmitted by mosquitoes. The aim of this study was to map the geographical accessibility of yellow fever vaccination centres (YFVC) in EWNI.

*Methods* The location of 3,208 YFVC were geocoded and the average geodetic distance to nearest YFVC was calculated for each population unit. Data on trips abroad and centres were obtained regionally for EWNI and nationally for the World Top20 countries in terms of travel.

*Results* The mean distance to nearest YFVC was 2.4km and only 1% of the population had to travel more than 16.1km to their nearest centre. The number of vaccines administered regionally in EWNI was found correlated with the number of trips to yellow fever countries. The number of centres per 100,000 trips was 6.1 in EWNI, which was below United States (12.1) and above the rest of Top20 countries.

*Conclusions* The service availability was in line with demand regionally. With the exception of remote, rural areas, yellow fever vaccination services were widely available with only short distances to cover for the travelling public.

**Key words** (max 6)

GEOGRAPHICAL ACCESSIBILITY, PREVENTIVE MEDICINE, VACCINATIONS, YELLOW FEVER

**1. Introduction**

The populations of England, Wales, and Northern Ireland made more than 60 million trips abroad in 2015 [1]. More than 700,000 of these trips were made to countries endemic for yellow fever, a potentially deadly, tropical disease transmitted by mosquitoes. The disease is preventable by vaccination and this study was undertaken to elucidate the geographical accessibility of yellow fever vaccination centres.

Yellow fever control has been on the international public health agenda since 1851 and has remained a disease under tight international surveillance and control measures ever since together with diseases such as cholera, and pneumonic plague [2]. Due to its reservoir in monkey and other non-human primate populations in the rain forests of Africa and South America (the forest cycle is maintained with tree-living mosquitoes as vectors), yellow fever may never be eradicated [3]. The main control measure for yellow fever is therefore vaccination in combination with vector control in high risk areas as well as measures available to countries at risk of importing or exporting the disease such as vaccination certificate requirements, border vaccination, and emergency quarantine restrictions to reduce the international spread of the disease [2,4,5].

Occasionally, there are large outbreaks in urban areas (urban cycle), where the transmission depends on the *Aedes aegypti* mosquito, which has spread in cities across the tropics in recent decades. A yellow fever outbreak in Angola and Democratic of Republic of Congo (DRC) in 2015-2016 with more than 7,000 suspected cases (965 confirmed cases and 137 confirmed deaths) was a stark reminder of the emerging threat of urban yellow fever outbreaks [6,7]. Increased international travel, urbanisation, and the fact that many tropical countries have large unvaccinated populations make the prospects of new urban yellow fever outbreaks a particular concern. At least 42 cases of international spread were recorded in connection with the Angola-DRC outbreak to countries with vector presence and largely unvaccinated populations including China and Kenya [8].

Despite vector control efforts and vaccination campaigns, large, cyclical sylvatic outbreaks continue to affect some countries [9]. In early 2017, a sylvatic outbreak in Brazil spread into states where transmission is rarely or not previously reported. As of 31 May 2017, a total of 792 confirmed cases with 274 confirmed deaths had been reported [10]. A mass vaccination programmes was set up to stop the spread into cities. A move that has been seen against the back cloth of recent large urban outbreaks of similar mosquito-borne diseases in Brazil, i.e. chikungunya, dengue, and Zika virus [9].

The National Travel Health Network and Centre (NaTHNaC) has overseen the registration, training, clinical standards, and audit of yellow fever vaccination centres in England, Wales, and Northern Ireland in compliance with the International Health Regulations for yellow fever since 2005 [11] and this is the first study to evaluate the geographical accessibility [12] of the yellow fever vaccination services. The aims of the study were thus to map and ascertain the geographical accessibility of yellow fever vaccination centres, match the number of trips to countries with yellow fever risk to the number of vaccinations given per region, identify any underserved populations and evaluate any need to regulate service provision, and gather data to support contingency planning in the event of a vaccine shortage.

**2. Methods**

Administrative data on the postcode location of yellow fever vaccination centres were extracted from the Yellow Fever Vaccination Programme database (NaTHNaC, 27 October 2016). Occupational Health departments (N=218) were excluded as these by definition were not open to the general public. A total of 3,222 centres were registered. General practitioner (GP) practices were the most frequent type of centre (N=2,381). Of the 3,222 centres, 3,208 or 99.6% could be geo-located to Census 2011 lower layer super output area (super output area for Northern Ireland; this is the nearest equivalent unit and it will be referred to as lower layer super output area hereinafter) and UK Region using the Office for National Statistics (ONS) Postcode Directory, August 2016 [13]. The lower layer super output area unit is the finest geographical unit for census data release in the UK that has been optimised to be homogenous with regards to population size and socio-economic characteristics. The latest mid-year population estimates (2015) were obtained at lower layer super output area level from ONS [14] and the Northern Ireland Statistics and Research Agency (NISRA) [15]. The analyses were conducted at lower layer super output area (N=35,643), which had a mean (SD) population of 1,676 (379). The average geodetic distance (crow-fly distance) from each population unit was calculated to each centre location using the Stata module, GEODIST [16] to determine the distance to the nearest centre at lower layer super output area level. The centres were assigned to distance categories according to the following population percentiles: 75th, 90th, 95th, and 99th. Data on the average number of vaccinations per centre across regions were obtained from annual surveys of the centres in 2013-2015 (NaTHNaC, unpublished data). Boundary data for Census output areas, UK Regions and countries were obtained from the UK Data Service/ Edinburgh University Data Library [17], which contains National Statistics data (© Crown copyright and database right, 2016), NRS data (© Crown copyright and database right, 2016, Source: NISRA Website, [www.nisra.gov.uk](http://www.nisra.gov.uk); accessed 17 November 2016), and OS data (© Crown copyright and database right, 2016). Boundary data for the Isle of Man, Republic of Ireland, and Scotland were obtained from Natural Earth ([www.naturalearthdata.com](http://www.naturalearthdata.com); accessed 17 November 2016) . Maps were created using Quantum GIS 2.12 [18]. Data on trips abroad by UK region of residence undertaken in 2015 were obtained from ONS Social Surveys (Crown copyright; December 2016). Data on trips abroad by countries where the traveller spent most time and UK Region of residence were obtained from Office for National Statistics [1]. Data on countries with risk of yellow fever transmission were obtained from the World Health Organization [19]. Data on the number of registered yellow fever vaccination centres in other countries were obtained from ministries of health websites, literature, and personal communication with health professionals (see references at Table 4). The numbers of trips abroad (departures) by country in 2013 (N=100) were obtained from the World Bank data repository [20]. Data analyses were carried out in Stata 14 [21].

**3. Results**

The population weighted mean distance to nearest centre varied from 0.6km in London to 7.1km in Northern Ireland. The national mean distance was 2.4km and the maximum distance 30.9km. Only 1% of the general population had more than 16.1km to their nearest centre (99th percentile) (Table 1, Figure 1, Figure 2).

A total of 713,548 trips to countries with yellow fever transmission risk were made by residents in England, Wales, and Northern Ireland in 2015 (Table 2). Nigeria (20.7%), Brazil (14.8%), and Kenya (13.8%) alone accounted for half of all trips and the ten most commonly visited countries combined accounted for 84.3% of all trips (Table 2).

The number of centres by UK Region varied from 51 in Northern Ireland to 858 in London. The number of centres per population varied from 2.8 per 100,000 population in Northern Ireland to 9.9 per 100,000 population in London. Nationally, there were 5.4 centres per 100,000 population (Table 3).

The size of the centres in terms of the yearly number of vaccines administered was calculated from data submitted in annual surveys in 2013-2015. The average number nationally was 40 vaccines per centre. The London average was the highest at 59 vaccines per centre followed by Northern Ireland (45), South East (40), North West (38), North East (38), East of England (34), South West (34), Yorkshire and The Humber (29), West Midlands (28), Wales (27) and East Midlands (25).

There was a linear relationship between the estimated number of yellow fever vaccines administered and the number of trips to countries with yellow fever risk by UK Region, which indicate that there is balance between supply and demand at the regional level (Figure 3).

The number of centres per 100,000 international trips abroad was 6.1 in England, Wales, and Northern Ireland, which was below that of United States (12.1) and above the rest of World Top20 countries in terms of trips abroad (Table 4).

Table 1 Distance to nearest yellow fever vaccination centre for the general population by UK Region (km).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Min** | **Median** | **Mean** | **p75** | **p99** | **Max** |
| North East | 0.0 | 2.1 | 3.2 | 3.8 | 20.2 | 28.3 |
| North West | 0.0 | 1.6 | 2.0 | 2.7 | 8.7 | 25.0 |
| Yorkshire & The Humber | 0.0 | 1.7 | 2.4 | 3.3 | 10.6 | 26.4 |
| East Midlands | 0.0 | 1.7 | 2.7 | 3.5 | 15.9 | 21.9 |
| West Midlands | 0.0 | 1.5 | 2.1 | 2.5 | 11.5 | 17.3 |
| East of England | 0.0 | 1.5 | 2.8 | 3.6 | 14.6 | 20.9 |
| London | 0.0 | 0.5 | 0.6 | 0.8 | 2.2 | 4.0 |
| South East | 0.0 | 1.2 | 1.9 | 2.4 | 9.6 | 18.7 |
| South West | 0.0 | 1.5 | 2.7 | 3.7 | 14.3 | 23.7 |
| Northern Ireland | 0.0 | 3.9 | 7.1 | 11.9 | 26.4 | 30.9 |
| Wales | 0.0 | 3.2 | 4.9 | 7.5 | 22.0 | 29.3 |
| Total | 0.0 | 1.3 | 2.4 | 2.9 | 16.1 | 30.9 |

Note: The national 56th percentile was 1.6km. The headers, p75 and p99, denote the 75th and 99th percentile, respectively.

Table 2 Top10 Trips abroad to countries with yellow fever risk made by residents in England, Wales, and Northern Ireland. Source: International Passenger Survey 2015.

|  |  |  |  |
| --- | --- | --- | --- |
| **Destination** | **Freq.** | **Percent** | **Cumulative Percent** |
| Nigeria | 147,856 | 20.7 | 20.7 |
| Brazil | 105,331 | 14.8 | 35.5 |
| Kenya | 98,392 | 13.8 | 49.3 |
| Ghana | 66,558 | 9.3 | 58.6 |
| Gambia | 42,329 | 5.9 | 64.5 |
| Trinidad & Tobago | 37,589 | 5.3 | 69.8 |
| Uganda | 31,814 | 4.5 | 74.3 |
| Argentina | 31,188 | 4.4 | 78.6 |
| Colombia | 22,764 | 3.2 | 81.8 |
| Peru | 17,785 | 2.5 | 84.3 |
| Other | 111,942 | 15.7 | 100.0 |
| Total | 713,548 | 100.0 | - |

Table 3 Trips abroad by Region of residence in England, Wales, and Northern Ireland in 2015 compared to the number of yellow fever vaccination (YFV) centres. YF Trips: trips to countries with yellow fever risk. Trips data source: International Passenger Survey 2015.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Region** | **Trips Abroad** | **YF Trips** | **YFV Centres** | **Mean Distance to YFV Centre (km)** | **Centres per 100,000 Pop** | **Trips per 100,000 Pop** | **YF Trips per 100,000 Pop** |
| London | 14,596,697 | 350,422 | 858 | 0.6 | 9.9 | 168,287 | 4,040 |
| South East | 10,338,088 | 114,840 | 572 | 1.9 | 6.4 | 115,536 | 1,283 |
| West Midlands | 4,806,320 | 51,938 | 239 | 2.1 | 4.2 | 83,574 | 903 |
| East of England | 5,777,899 | 50,538 | 324 | 2.8 | 5.3 | 95,087 | 832 |
| North West | 6,568,124 | 39,169 | 251 | 2.0 | 3.5 | 91,557 | 546 |
| South West | 4,629,680 | 35,501 | 299 | 2.7 | 5.5 | 84,619 | 649 |
| East Midlands | 3,774,532 | 25,869 | 211 | 2.7 | 4.5 | 80,703 | 553 |
| Yorkshire & The Humber | 4,752,930 | 23,817 | 208 | 2.4 | 3.9 | 88,171 | 442 |
| North East | 1,844,388 | 16,185 | 85 | 3.2 | 3.2 | 70,273 | 617 |
| Wales | 2,183,671 | 5,267 | 110 | 4.9 | 3.5 | 70,462 | 170 |
| Northern Ireland | 803,150 | 0 | 51 | 7.1 | 2.8 | 43,376 | - |
| Total | 60,075,479 | 713,546 | 3,208 | 2.4 | 5.4 | 100,567 | 1,194 |

Table 4 Yellow fever vaccination centres per international trips abroad by country.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Rank (trips abroad)** | **Country** | **Trips abroad (millions)** | **Yellow fever vaccination centres (YFVC)** | **YFVC per 100,000 trips abroad** |
| 4 | United States [22] | 61.9 | 7,493 | 12.1 |
| 6 | England, Wales, N. Ireland | 53.0 | 3,208 | 6.1 |
| 13 | Netherlands [23] | 18.1 | 968 | 5.3 |
| 8 | Canada [24] | 33.0 | 1,050 | 3.2 |
| 2 | Germany [25] | 87.5 | 2,072 | 2.4 |
| 12 | Saudi Arabia [26] | 19.2 | 435 | 2.3 |
| 9 | Italy [27] | 27.8 | 330 | 1.2 |
| 20 | Switzerland [28] | 12.4 | 108 | 0.9 |
| 10 | France [29] | 26.2 | 162 | 0.6 |
| 7 | Poland [30] | 52.6 | 119 | 0.2 |
| 15 | India [31] | 16.6 | 34 | 0.2 |
| 16 | Hungary [32] | 16.0 | 30 | 0.2 |
| 1 | China [33] | 98.2 | 168 | 0.2 |
| 19 | Korea, Rep. [34] | 14.8 | 23 | 0.2 |
| 14 | Japan [35] | 17.5 | 22 | 0.1 |
| 5 | Russian Federation [36] | 54.1 | 44 | 0.1 |
| 18 | Mexico [37] | 15.9 | 6 | <0.1 |
| 3 | Hong Kong SAR, China [38] | 84.4 | 2 | <0.1 |
| 11 | Ukraine\* | 23.8 | . | . |
| 17 | Sweden\*\* | 15.9 | . | . |

\*) No data were obtained from Ukraine. \*\*) The vaccine is in principle available from any vaccination centre including family doctors, hospitals and private travel clinics in Sweden.

**4. Discussion**

This is the first study to look at the geographical accessibility of yellow fever vaccination centres in England, Wales, and Northern Ireland. For comparison, recent studies of geographical accessibility to GP practices and pharmacies found that 84.8% of the general population in England and Wales lived within 1.6km of a GP practice [39]; for pharmacies it was 89.2% [40]. In the present study, only 56% of the population lived within 1.6km of a yellow fever vaccination centre. For comparison, the number of active GP practices in England and Wales in August 2016 was 11,456 [41] and the number of pharmacies, 13,104 [42], whereas only 3,208 yellow fever vaccination centres were registered in England and Wales in October 2016. Only 1% of the population lived more than 16.1km away from a yellow fever vaccination centre. So, while the geographical accessibility of yellow fever vaccination centres is poorer than for general medical services, it does not seem unreasonable taking into account that long-haul trips to countries with yellow fever risk are likely to be planned and are, typically, private undertakings [43].

There was a linear relationship between the estimated number of yellow fever vaccines administered and the number of trips to countries with yellow fever risk by UK Region, which indicate that there is balance between supply and demand and hence an even service availability at the regional level. No under-served regions were – in other words – identified.

The number of centres per 100,000 international trips abroad was 6.1 in England, Wales, and Northern Ireland, which was below that of United States (12.1) and above the rest of World Top20 countries in terms of trips abroad (Table 4). The reasons for the large variation internationally are likely to be different travel patterns/demand and differences in healthcare system.

Scotland has its own yellow fever vaccination programme, which in 2014 counted 241 centres [44]. This is equivalent to 5 centres per 100,000 population: similar to the average of 5.4 for England, Wales, and Northern Ireland (Table 3). In 2010-11, the Republic of Ireland had 655 designated centres [45], which is close to 14 centres per 100,000 population. The same paper identified several issues with training, vaccine storage, administration, and documentation and recommended the introduction of new programme modelled on those in the UK and the Netherlands.

The detailed data of the accessibility of yellow fever vaccination centres, will allow the regulator to make contingency plans for future vaccine shortages to ensure that vaccination services can be accessed across all regions. It will, as an example, be possible to run various scenarios to see the impact on regional accessibility if the number of active centres were to drop during a shortage. The US regulator notably agreed on a tiered distribution plan with public and private partners to tackle a shortage in 2017 and the experience from this will be followed closely [46].

There are a few limitations with using the International Passenger Survey (IPS) data to estimate the regional demand of yellow fever vaccinations. First, the IPS does not record all trips on cruise ships (not at all if embarkation was in the UK) and the trip may simply be recorded as ‘cruising’ as a generic, multi-country destination. In 2015, UK residents undertook an estimated 1.78 million cruise trips (7.7% of global figures) [47]. More detailed UK data were not available to estimate the number of trips that would have required yellow fever vaccination either due to exposure risk or itinerary-based vaccination certificate requirements. Data on the cruise tourism industry as a whole in 2011, however, suggest that only a small fraction of cruise trips is likely to require yellow fever vaccination [48]. The Caribbean and the Mediterranean account for more than 70% of bed-days. Within the Caribbean most itineraries cover the ports in United States, Bahamas, Eastern and Western Caribbean and South American ports are much less visited. Most cruises only take seven days and use hub ports such as Miami, Fort Lauderdale, or San Juan, Puerto Rico, in the northern half of the Caribbean. South America accounts for 5.4% of the global number of bed-days and the majority of visits are to certain coastal regions outside the yellow fever risk areas. Future studies of actual itineraries (including inland trips and excursions) may be able to more realistically highlight any discrepancies between risk and protection, e.g. in South America and Eastern Panama [49]. Second, the data for yellow fever risk are provided by WHO at the country-level, whereas in practice it will, for countries only partly endemic, depend on a risk assessment of the individual traveller including regions to be visited within a country (which may change during large outbreaks), duration, and planned activities. Examples of countries that are only partly endemic are Brazil, Peru, and Kenya. Third, if a traveller plan to visit more than one country, the IPS record relate to the country where the traveller spend the most time. A travel itinerary where a yellow fever risk country is only a secondary destination would therefore not be counted. Fourth, the IPS only cover about 0.2% of all trips abroad [1] and rarely visited destinations may not be detected.

**5. Conclusion**

The geographical accessibility of yellow fever vaccination centres was good across all major population centres considering that that long-haul trips to countries with yellow fever risk are likely to be planned. Vaccines administered was found correlated with the number of trips to yellow fever countries at regional level in England, Wales, and Northern Ireland, which indicate an even service availability. A large variation was found between countries in the number of yellow fever vaccination centres per trips abroad. England, Wales, and Northern Ireland were together with United States and the Netherlands among the countries with the most yellow fever vaccination centres per trips abroad. The reasons for the large variation internationally are likely to be different travel patterns/demand and differences in healthcare system.

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**FIGURE LEGENDS**

Figure 1 Distance to nearest yellow fever vaccination centre for the general population by UK Region (km).

Figure 2 Distance (km) to nearest yellow fever vaccination centre in England, Wales, and Northern Ireland (lower layer super output area level).

Figure 3 Estimated number of yellow fever vaccinations and trips to countries with yellow fever risk by region of residence in England, Wales, and Northern Ireland. Labels: North East (NE), North West (NW), Yorkshire & The Humber (YH), East Midlands (EM), West Midlands (WM), East of England (EE), London (LO), South East (SE), South West (SW), Wales (WA), Northern Ireland (NI).

# Petersen, J., Simons, H., Patel, D. (2016) TravelHealthPro – a new online resource for the travel health sector *Journal of British Global and Travel Health Association* 18

**TravelHealthPro – a new online resource for the travel health sector**

**Introduction**

The National Travel Health Network and Centre (NaTHNaC) is a government commissioned clinical advisory service supporting travel health services in England, Wales, and Northern Ireland in consultation with Public Health England’s Travel and Migrant Health unit since 2002.

In September 2015, NaTHNaC launched a new website, TravelHealthPro.org.uk, with up-to-date information for the travel health sector. The new design was designed building on 13 years of experience running an online information service as well as input from a user survey and focus groups involving both health professionals and travellers in 2015 (REF Bramham et a. 2016).

With this paper, we would like to take stock of which parts of the content have been accessed the most and in which way throughout the inception year from September 2015 to August 2016. A major new threat emerged during this period, i.e. the Zika virus outbreak in the Americas, and this offers a possibility to study the type of information that comes to the fore during crises. Finally, we discuss the next steps in the development of a resource, we hope will continue to improve and grow in the coming years.

**Methods**

Data on the usage of the content on TravelHealthPro were obtained using Google Analytics from 6 September 2015 to 3 September 2016 (52 weeks). A small proportion of pages created for internal testing purposes were excluded (associated with 5,279 unique pageviews or 0.13% of all unique pageviews). The content was categorised according the structure of the URL for the different sections of the website. The majority of outbreaks, news, and factsheet items were matched on titles and the remaining items with ten or more unique pageviews were coded clerically. The remaining pages were associated with 5,291 unique pageviews or 0.1% of all unique pageviews and categorised as “Other”. The time spent on each page in days was calculated from the total number of views and average time spent on each page. International traffic to the website was analysed as all other countries than United Kingdom. A small proportion of sessions (2,275 or 0.16% of all sessions) had no known country origin and was dropped from the analysis. The relative increase in sessions over the year was

calculated from the linear predictions of sessions at week 1 and week 52, respectively.

**Results**

The website has a number of sections presented as tabs on the front page including Country Information and Latest News (Figure 1). The website was overall associated with 3.9 million unique pageviews in the first year (unique pageviews will be referred to as views hereinafter) (Table 1). The time spent on the web pages exceeded 19 person-years, i.e. equivalent to 19 persons browsing the website continuously for a year. The most popular sections were the information pages for individual countries (country items), which accounted for nearly a third of all views (31.3%), the portal to individual countries (21.8%), the front page (14.7%) followed by news items (8.2%) and factsheet items (7.2%). Of the various ways to search for information on the website, the filtering through forms (news and outbreaks), sub-sections (factsheets), or A-Z lists (country pages) were more popular than free search options within a section. The free search facility in the top bar was however the second most popular search method overall.

The traffic originating from outside the UK accounted for 9.4% of all sessions (Table 2). Overall, the number of sessions increased by 76% over the first year, whereas international sessions alone increased with 115%.

The number of views increased dramatically during the first quarter of 2016 in connection with Zika virus outbreak culminating the week of the World Health Organization (WHO) public health emergency of international concern (PHEIC) on 1 February 2016 (Figure 2). Interestingly, the usage of news items spiked in this period. At other periods and increasingly, the country pages attract the most views (Figure 3).

The most popular country pages were for Thailand (6.9% of country page views), India (6%), and Mexico (4.6%) (Table 3). The most popular news items were dominated by the Zika virus outbreak and risk to pregnant travellers, of which a single news item accounted for 40% of all views of news items. More than half of the total views of factsheets were attributable to insect and tick bite avoidance (37%) and food and water hygiene (17%).

**Discussion**

The new website is the product of years of development and in recent years also more formal consultation. The usage of the inception year of the new website have demonstrated that the country information pages is the ‘work horse’ of the website and they are attracting an increasing number of views – nationally and internationally. News items on the other hand playing a different role as demonstrated by the spike in the use of news items during the emergence of the Zika virus as novel global threat.

Interactive maps were one of the additions that were included on the website as a result of consultation. Notably, the new world overview map only attracted a fraction of views overall. We hope that further user testing will reveal whether this and other new areas of the website are ‘fit for purpose’ and whether we can do more make the many new features easier to find and use. It should be noted that outbreak notices can be read directly from the country information page, but their usage are only captured when searched and browsed in the outbreak surveillance section itself.

The next phase in the development of the TravelHealthPro website will be to carry out user testing and focus groups with the travel health sector to gain more specific feedback on the new design. Alongside consultation, we will continue to develop the range and depth of the information that are offered. One example of this is a new range of antimalarial recommendation maps for countries with sub-national variation. We are also researching new areas for our factsheets. In the past year, we have for instance produced factsheets for medical tourism and female genital mutilation.

**Conclusion**

Travel health practice depend on day-to-day updates on emerging threats as well as the latest recommendations on vaccination on other protection. This paper has shown that country information pages is the undisputed core of this information service. Further user testing will be required to establish whether essential content can be made even easier to find. We are also planning focus groups to identify areas for further development.

**References**

Table 1 Views and time spent on TravelHealthPro.org.uk web pages by content category, September 2015 - August 2016.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Content category** | **Unique pageviews** | **%** |  | **Time on page (days)** | **%** |
| FRONT PAGE | 575,868 | 14.7 |  | 329 | 5.2 |
| COUNTRY INFORMATION | 854,999 | 21.8 |  | 566 | 9.0 |
| Country - free search | 33,910 | 0.9 |  | 15 | 0.2 |
| Country item | 1,227,100 | 31.3 |  | 3,584 | 56.7 |
| LATEST NEWS | 38,915 | 1.0 |  | 28 | 0.4 |
| News - free search | 7,174 | 0.2 |  | 3 | <0.1 |
| News - form search | 142,612 | 3.6 |  | 100 | 1.6 |
| News - A-Z search | 24,676 | 0.6 |  | 13 | 0.2 |
| News item | 321,812 | 8.2 |  | 660 | 10.4 |
| OUTBREAK SURVEILLANCE | 30,937 | 0.8 |  | 31 | 0.5 |
| Outbreak - free search | 2,131 | 0.1 |  | 3 | <0.1 |
| Outbreak - form search | 22,114 | 0.6 |  | 24 | 0.4 |
| Outbreak - linked search | 2,207 | 0.1 |  | 3 | <0.1 |
| Outbreak item | 14,568 | 0.4 |  | 11 | 0.2 |
| DISEASES IN BRIEF | 20,994 | 0.5 |  | 9 | 0.1 |
| Disease item | 87,541 | 2.2 |  | 175 | 2.8 |
| FACTSHEETS A-Z | 49,423 | 1.3 |  | 26 | 0.4 |
| Factsheets – free search | 781 | <0.1 |  | <1 | <0.1 |
| Factsheet section - infectious diseases | 6,431 | 0.2 |  | 3 | <0.1 |
| Factsheet section - healthy travel | 3,029 | 0.1 |  | 2 | <0.1 |
| Factsheet section - special traveller | 1,884 | <0.1 |  | 1 | <0.1 |
| Factsheet section - clinical resources | 2,160 | 0.1 |  | 2 | <0.1 |
| Factsheet item | 281,362 | 7.2 |  | 601 | 9.5 |
| WORLD OVERVIEW MAP | 13,650 | 0.3 |  | 16 | 0.3 |
| World overview - form search | 5,566 | 0.1 |  | 6 | 0.1 |
| ABOUT/CONTACT US | 36,082 | 0.9 |  | 46 | 0.7 |
| Free Search | 54,832 | 1.4 |  | 26 | 0.4 |
| Tag cloud | 48,640 | 1.2 |  | 23 | 0.4 |
| Disclaimer/Terms of use | 179 | <0.1 |  | <1 | <0.1 |
| Other | 5,291 | 0.1 |  | 12 | 0.2 |
| Total | 3,916,868 | 100 |  | 6,318 | 100 |

Table 2 National and international sessions on TravelHealthPro.org.uk, September 2015 - August 2016.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Origin** | **Week 1-52** |  | **Week 1\*** |  | **Week 52\*** | **Change** |
|  |  |  | **xb** | **Ll** | **Ul** |  | **xb** | **ll** | **ul** | **%** |
| UK | 1,263,516 |  | 17,818 | 13,658 | 21,979 |  | 30,779 | 26,618 | 34,939 | 73 |
| International | 131,398 |  | 1,602 | 1,090 | 2,114 |  | 3,452 | 2,940 | 3,964 | 115 |
| Total | 1,394,914 |  | 19,420 | 14,773 | 24,067 |  | 34,231 | 29,583 | 38,878 | 76 |

\*) Figures for Week 1 and 52 are linear prediction over 52 weeks (point and 95% confidence intervals).

Table 3 Most popular country, news, and factsheet items on TravelHealthPro.org.uk, September 2015 – August 2016.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Rank** | **Page** | **Unique pageviews** | **%** | **Time on page (days)** | **%** |
|  |  |  |  |  |  |
|  | COUNTRY ITEMS |  |  |  |  |
| 1 | Thailand | 84,323 | 6.9 | 276 | 7.7 |
| 2 | India | 73,462 | 6 | 278 | 7.8 |
| 3 | Mexico | 55,877 | 4.6 | 178 | 5 |
| 4 | Vietnam | 41,847 | 3.4 | 120 | 3.3 |
| 5 | South Africa | 38,459 | 3.1 | 126 | 3.5 |
| 6 | Brazil | 33,677 | 2.7 | 92 | 2.6 |
| 7 | Dominican Republic | 32,928 | 2.7 | 114 | 3.2 |
| 8 | Indonesia | 29,597 | 2.4 | 106 | 2.9 |
| 9 | Sri Lanka | 28,551 | 2.3 | 94 | 2.6 |
| 10 | China | 27,258 | 2.2 | 81 | 2.3 |
|  | Other | 781,121 | 64 | 2,120 | 59 |
|  | Total | 1,227,100 | 100 | 3,585 | 100 |
|  |  |  |  |  |  |
|  | NEWS ITEMS |  |  |  |  |
| 1 | Zika virus update and advice for travellers including pregnant women | 130,152 | 40 | 376 | 57 |
| 2 | Zika virus update and advice for pregnant women | 16,026 | 5 | 40 | 6.1 |
| 3 | Revision of UK Zika virus pre-travel guidance | 9,387 | 2.9 | 11 | 1.7 |
| 4 | Definition for areas with active Zika virus transmission amended | 9,073 | 2.8 | 11 | 1.6 |
| 5 | Zika virus - Quick links | 8,901 | 2.8 | 5.6 | 0.85 |
| 6 | Changes to yellow fever certificates 11 July 2016 | 8,722 | 2.7 | 19 | 2.9 |
| 7 | Zika virus in the Americas - update and advice for pregnant women | 7,073 | 2.2 | 12 | 1.8 |
| 8 | WHO PHEIC due to Zika virus | 6,373 | 2 | 5.6 | 0.85 |
| 9 | Chikungunya virus - Caribbean and the Americas | 6,339 | 2 | 11 | 1.6 |
| 10 | Summer holidays reminder - prevention of Zika virus infection | 5,964 | 1.9 | 9.3 | 1.4 |
|  | Other | 113,802 | 35 | 160 | 24 |
|  | Total | 321,812 | 99 | 661 | 100 |
|  |  |  |  |  |  |
|  | FACTSHEET ITEMS |  |  |  |  |
| 1 | Insect and tick bite avoidance | 103,304 | 37 | 239 | 40 |
| 2 | Food and water hygiene | 47,164 | 17 | 75 | 12 |
| 3 | Dengue | 14,942 | 5.3 | 32 | 5.4 |
| 4 | Zika risk assessment | 10,921 | 3.9 | 30 | 4.9 |
| 5 | Malaria | 9,261 | 3.3 | 19 | 3.2 |
| 6 | Personal safety | 9,047 | 3.2 | 11 | 1.8 |
| 7 | Pregnancy | 7,447 | 2.6 | 17 | 2.8 |
| 8 | Yellow fever | 6,817 | 2.4 | 24 | 4 |
| 9 | Sun protection | 6,785 | 2.4 | 11 | 1.8 |
| 10 | Country page guide | 5,825 | 2.1 | 6.4 | 1.1 |
|  | Other | 59,849 | 21 | 137 | 23 |
|  | Total | 281,362 | 100 | 601 | 100 |

Figure 1 TravelHealthPro.org.uk website for the travel health sector.

Figure 2 Time trend of unique pageviews on TravelHealthPro.org.uk, September 2015 – August 2016. Vertical line: WHO Zika virus PHEIC on 1 February 2016.

Figure 3 Time trends of country, news, and factsheet items on TravelHealthPro.org.uk, September 2015 – August 2016. Vertical line: WHO Zika virus PHEIC on 1 February 2016.