Tropical infections as occupational diseases – labor inspectorate physicians' aspects of a complex problem

Paul J. Jansing[1 A-F, A], Audry Morrison[2,3, D-G], Travis W. Heggie[4,D-G], Thomas Küpper[*3,5, A,C-F]

[1] *Institute of Occupational and Social Medicine, Heinrich Heine-University, Düsseldorf, Germany*
[2] *Royal Free London NHS Foundation Trust Royal Free London, UK*
[3] *Medical Commission of the Union Internationale des Associations d'Alpinisme (UIAA), Switzerland*
[4] *School of Human Movement, Sport and Leisure Studies; Bowling Green State University, Bowling Green, Ohio, USA*
[5] *Institute of Occupational and Social Medicine, RWTH Aachen University, Aachen, Germany*

A – the preparation of the research project
B – the assembly of data for the research undertaken
C – the conducting of statistical analysis
D – interpretation of results
E – manuscript preparation
F – literature review

Article history:
Received: 15.05.2021
Accepted: 30.06.2021
Published: 20.07.2021

DOI:
10.5604/01.3001.0015.0505

Abstract

Background: Occupational physicians work directly with individual employees regarding diseases that has been caused or exacerbated by workplace factors. However, employees are increasingly required to travel for their work, including to tropical countries where they risk exposure to diseases they would not normally encounter at home (i.e., malaria). Such disease/s may also take days to months to incubate before becoming symptomatic, even after their return home, thus delaying and complicating the diagnosis. Proving this was an occupational disease with respective sick leave entitlement or compensation can be challenging. There is a lack of data concerning occupational diseases caused by tropical infections.
Material and methods: Employee case records for the period 2003-2008 from the State Institute for Occupational Health and Safety of North-Rhine Westphalia in Germany were analysed and assessed within Germany's regulatory framework. These records included Germany's largest industrial zone.
Results: From 2003-2008the suspected cases of "tropical diseases and typhus", categorized as occupational disease "Bk 3104" in Germany, have decreased significantly. A high percentage of the suspected cases was accepted as occupational disease, but persistent or permanent sequelae which conferred an entitlement to compensation were rare.
Conclusion: There is scope to improve diagnosis and acceptance of tropical diseases as occupational diseases. The most important diseases reported were malaria, amoebiasis, and dengue fever. Comprehensive pre-travel advice and post-travel follow-ups by physicians trained in travel and occupational health medicine should be mandatory. Data indicate that there is a lack of knowledge on how to prevent infectious disease abroad.

Keywords: tropical diseases, occupational diseases, travel medicine, malaria, diagnosis, prevention, surveillance, compensation

Introduction

Occupational physicians play an important role when preparing employees to work abroad. It is widely recognized that whether conducting business meetings or performing manual labour, employees travelling to tropical countries risk exposure to

*Address for correspondence:
Prof. Thomas Küpper, MD, PhD
Institute for Occupational & Social Medicine
RWTH Aachen Technical University
D-52074 Aachen / Germany
Email: tkuepper@ukaachen.de

ISSN 2544-9117 Health Promotion & Physical Activity, 2021, 15 (2), 21–28

diseases they would not normally encounter at home (i.e., malaria, dengue). Depending on the disease's incubation period, symptoms may manifest while the employees are abroad or after they return home. There are cases where the diagnosis was not verified according to European standards or the diagnosis was suspected and treated more or less effectively based on the assumption. Some regions do not differentiate between diseases which show similar symptoms (survey in [1]) In either case, once diagnosed it can still be challenging for both employee and physician to prove the case is an occupational disease with compensation rights because of details which are mandatory by the governmental regulations may be missing or at least not complete and validated. This lack of clarity can lead on to legal situations. In some cases, the delay of diagnosis may also cause harm to family members or colleagues, at least when human-to-human infections are possible (e.g., hepatitis A, typhoid fever).

Therefore, an additional aim of physicians working in occupational and travel medicine is to provide medical advice and prevention strategies to employees departing to global regions with increased health risk [2-8]. Information concerning particular health risks, diseases, and prevention strategies can be lacking. In fact, valid data about the number, region and duration of job-related trips in foreign countries and countries considered to have increased health risks is scarce. According to the German Federal Institute of Statistics, overseas travel by German citizens averaged 85 million per year during 2005-2010. During the same time occupational travel by Germans increased from 28 million trips in 2005 to 65 million in 2010. In addition, the number of job-related trips to foreign countries increased from 9 million to 14 million trips (Fig.1). Of the occupational travel from 2007-2010, approximately 1 million trips were made to Asia, 300,000 trips were to Africa, and 250,000 trips were made to Central and South America (www.destatis.de; 2005-2011) (Fig.2).

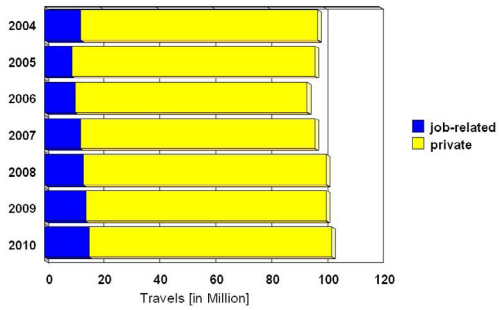

Figure 1. Private and job-related travels of the German population during the study period from 2004 to 2010 (www.destatis.de; 2005-2011)

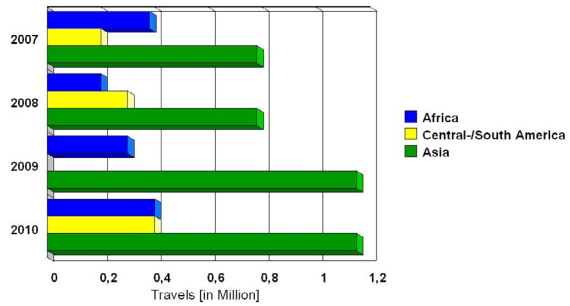

Figure 2. Job-related travelling of German employees in regions with increased risk for tropical diseases during the study period from 2007 to 2010 according to the data of the German Federal Institute of Statistics (www.destatis.de; 2008-2011). There are no data available for Central and South America 2009

In order to increase our understanding of the occupational disease hazards facing German workers abroad, this study examines six years of health records of the State Institute for Occupational Health and Safety for North Rhine-Westphalia, Germany's largest industrial region attracting a wide variety of international companies. The period was chosen to ensure that all cases had a final decision whether there is any compensation right or not, a procedure which may last several years. We also describe the complexity of the individual diagnosis of tropical diseases as occupational disease by three characteristic cases.

Material and methods

The employee case records which were reported to the State Institute for Occupational Health and Safety of North-Rhine Westphalia between 2003-2008 were analyzed using descriptive statistics. Only those cases which were accepted as an occupational disease by the government were included. Variables examined were subject's age and gender, employer, location and duration of deployment, medical diagnosis (diagnosis made at the location of deployment if available, and the final diagnosis as confirmed in Germany), all medical records and / or expert advice e.g., for court cases. The case files were comprehensive enabling the authorities a complete overview when assessing whether the case was an occupationally acquired disease or not. To ensure that all cases had a final decision by the authorities or by justice – the latter often takes years – we excluded those younger than 2012.

Results

During the study period the State Institute for Occupational health and Safety of North-Rhine Westphalia (LIA.NRW)

evaluated 71 cases. The mean age of the patients was 47 years (24-65 years). The gender proportion was 2:1 male vs. female (47 vs. 24). About 10% had more than one infectious disease suspicious for being an occupational disease.

Malaria was the dominating disease reported in 53.5% of all cases (38/71; Fig. 3). Plasmodium falciparum (Malaria tropica, ICD10: B50) was the most important diagnosis (15/71, 23.9%). Two cases were diagnosed as Malaria tertiana (Pl. vivax, ICD-10: B51). The remaining 21/38 cases (29.6%) were infections with more than one Plasmodium species or an unidentified Plasmodium genus. However, all of these cases were confirmed as Plasmodium (ICD10: B53). 11/71 (15.5%) cases were amoebiasis (confirmed as A. histolytica) and 8/71 (11.3%) were dengue fever. Other infections or parasites were rare (e.g., ancylostoma, bilharzia) (Fig. 3).

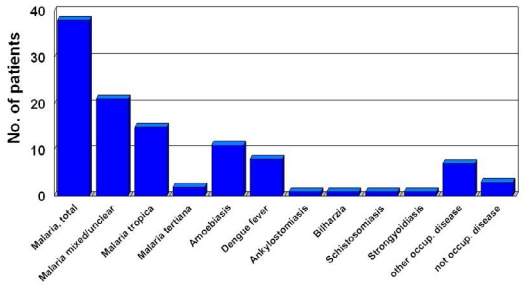

Figure 3. Spectrum of the diagnoses of the collective investigated (N = 71)

In 61 of the 71 cases (85.9%) investigated an occupational disease was confirmed, while the accumulated statistics for Germany as a whole shows a quota of about 70%. When assessing whether the severity of the disease warranted compensation, this was rarely awarded. In our collective it was 1/71 (1.4%).

Although the data included all medical contacts and checks before and after the employee's travel, in 4/71 (5.6%) cases there was no medical check-up or pre-travel advice provided by occupational medicine or travel medicine. Unfortunately, there are no data anymore for Germany as a whole about preventive check-ups by occupational medicine since the laws have been changed in 2008. Since then, the Government does not collect data about the incidence of the several occupational diseases anymore. Before 2008 such data provided a quite good overview about preventive strategies, pre-existing diseases of employees travelling to foreign countries etc.

Several records included at least some information about pre-travel training and the realisation of preventive procedures at the destination. Although a detailed and systematic analysis of such information was impossible, data indicated that there was a lack of knowledge (especially concerning exposure prophylaxis of malaria) and a deficiency to perform prevention at the destination.

Discussion

Regulatory framework in Germany

To establish a baseline identifying what criteria must be fulfilled to accept a disease as occupational disease by the authorities, the relevant German regulations are first explained to enable comparison of our results with those in other countries where the regulations may differ.

In Germany a medical check is mandatory according to chapter 4 no. 2 of the addendum of the regulation of occupational prevention (Verordnung zur arbeitsmedizinschen Vorsorge, ArbMedVV) before an employee may work "in tropical, subtropical or other regions with special climatic stress or increased risk for infectious diseases" [9]. Additional recommendations ("G35") have been published detailing how such a medical check may be performed [10].

The regulatory framework of occupational diseases in Germany have been defined by the social laws (Sozialgesetzbuch VII, § 9) [9] and the ensuing by-law concerning occupational diseases ("BKV") [11]. Here occupational diseases are defined as diseases which are listed in appendix 1 of this BKV (so-called "listed diseases"), e.g., No. 3104 is "tropical diseases and typhoid fever". The working group of the responsible ministry has also published an information sheet which gives facts about the prevalence, hazard source, aetiology, pathology, diseases and diagnoses, differential diagnoses, references and a short review about the most important tropical diseases [12]. The short reviews are intended to assist physicians who deal with such diseases, although the list is an ongoing project. Diseases which are not listed in appendix 1 may be accepted as occupational disease if they fulfil the general criteria of No. 3104. An overview about No. 3104 in Germany is given in Fig. 4.

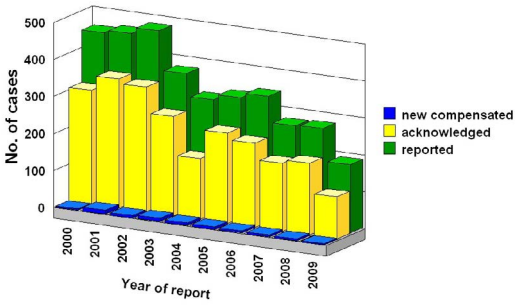

Figure 4. Occupational diseases of No. 3104 in Germany: notified, acknowledged, and new compensated cases for the period from 2000 to 2009 (www.dguv.de; 2002, 2011)

Diseases which occur during job-related sojourns in "critical" countries or regions are normally accepted as an occupational disease when the stay exposes the person to an increased risk of infection which typically occurs in the respective country or region. Normally the regulations strictly differentiate between occupational and non-occupational (private) risk of disease. But here this differentiation has been set aside because it is the employer who determines the location where the employee will reside for their work, which also includes the private time of this person [13]. In consequence, it is not relevant whether the employee has been infected at work or during their private time while being abroad for any occupational reason. This does not include high risk activities typically occurring during leisure time e.g., HIV infection of business people (non-medical personnel).

Some ubiquitary infectious diseases which show an increased risk due to low hygienic conditions (e.g., hepatitis A/E, typhoid fever, or zoonotic diseases) may also be accepted as occupational diseases No. 3101 or No. 3102 if the conditions for these regulations are fulfilled. For example, hepatitis B should be accepted as No. 3101 if the employee's job exposes them to an increased risk for infection, as for physicians or nurses. It will not be accepted if the infection resulted from the personal risky behaviour of the employee. There is an assumption implicit in these regulations that the employee has received adequate pre-travel advice on preventative measures for such diseases, which is not always the case. There are comparable procedures and regulations in the other countries of Central Europe (e.g. [14]). Some countries have published a long list of diseases which may be accepted as occupation-related, e.g., Switzerland. Here amoebiasis, yellow fever, hepatitis A and E, malaria, ankylostomiasis, cholera, clonorchiasis, filariasis, haemorrhagic fever, leishmaniasis, lepra, onchozerciasis, salmonelloses, shigelloses, schistosomiasis, strongyloidiasis, trachom, and trypanosomiasis are included [15]. In contrast to the Swiss regulations those of the European Commission which were intended to standardise the procedures in the European countries include only some diseases (Nos. 401 to 407) and are not appropriate to cover the spectrum of relevant diseases [16]. In this list which includes a total of 108 diseases only the numbers mentioned above are relevant for the topic discussed here. While malaria or yellow fever may be included in no. 401 ("Infectious or parasitic diseases transmitted to man by animals or remains of animals") and hepatitis (no. 404), tuberculosis (no. 405), or amoebiasis (no. 406) have their own numbers it is unclear which category may be appropriate for typhoid fever, probably no. 407 although the phrasing of this category ("Other infectious diseases caused by work in disease prevention, health care, domiciliary assistance and other comparable activities for which a risk of infection has been proven") would exclude maintenance workers who get typhoid fever by contaminated food or water at work.

Accidents which are specific to tropical countries (e.g., snake bites), or those caused by extreme climates (e.g., frostbite) are not considered occupational diseases. However, in these situations the employee may eligible for compensation as an occupational accident. But again, there are major differences: Switzerland in contrast to other European countries does not accept frostbite as occupational accident, although all factors of an accident are fulfilled, as there are unexpected event, caused by external factors etc.

Travel activities of German business travellers and expatriates

Valid data about the number, region and duration of job-related travel to foreign countries, and especially those with increased health risks, are scarce. Some data published are simply based on extrapolations and estimations. Therefore, the following data should be interpreted carefully.

According to the Federal Institute of Statistics the total number of visits to foreign countries by Germans remained quite constant at about 85 million per year over the period from 2005 to 2010 (Destatis 2005, 2010; www.destatis.de; Fig. 1). Job-related travel with at least one overnight stay in total (in Germany and abroad) more than doubled within this same period (2005: 28 million, 2010: 65 million). Job-related travel to foreign countries also increased over this period, but to a lesser degree from about 9 million to 14 million (Fig. 1).

Differentiated by regions there are reliable data for 2007 to 2010 only. Of those travellers who went to non-European countries, a mean of about 1 million went to Asia, 300,000 to Africa, and 250,000 to Central and South America (Fig. 2). The duration of these job-related travels was not recorded in these statistics.

The German statistics of occupational diseases from 2000 to 2009 include about 3,500 cases with suspicion for No. 3104 ("tropical diseases and typhoid fever") (www.dguv.de; 2002, 2011; Fig .4). Over this same period the number of cases reported showed a decreasing tendency: less than half the cases reported in 2000 were reported in 2009 (Fig. 4).

While the total number of travels of the German general population is relatively constant there is an astonishing increase of multiday job-related travels, a tendency which seems to be at odds with the general economic conditions. Especially during the last global economic crisis there were significantly more job-related travels. However, such travels to foreign countries

increased less in comparison to the domestic ones. Although the total number of foreign travels has increased, the number cases accepted as occupational disease classified as No. 3104 "tropical diseases and typhoid fever" has decreased significantly since the beginning of the new millennium. Data indicate a decreasing incidence of about 3.6 reports per 10,000 travels to foreign countries in 2005, compared to 1.4 per 10,000 in 2009. It seems implausible to explain this tendency simply by assuming there was better preventative measures by occupational or travel medicine only. Lacking valid data it was estimated that only 30-50% of all employees who undertook job-related travel received qualified pre-travel advice. An important risk factor that may have influenced this downward incidence trend is the local hygiene (e.g. [17, 18, 2]). There may have been improvements in hygiene at many locations where occupation-related travelling takes place.

The duration of the stay abroad may be another important factor influencing this downward trend. The longer a traveller stays in a high risk region, the higher is the risk of infection [3]. With more frequent job-related travelling of a shorter duration, the total risk may have been reduced for the group of internationally travelling employees. The German statistics do not provide data on the number of days abroad.

Another factor that may have resulted in a bias in the travel statistics is an improved medical infrastructure abroad, especially in regions of commercial interest. The case files for this study often showed the efficient expertise of local physicians in diagnosing and curing tropical diseases in the host country. Perhaps other employees in a similar situation who were effectively cured abroad would not bother to report the incident on their return home on the off chance it was relevant to a future occupational health claim. However, data about this bias are missing. To improve the situation every employee should be asked during pre-travel advice to report any disease he or she suffered from abroad because often it is initially unclear whether it is an occupational one or not.

Last but not least there is another factor which causes significant dynamics in the collective of corporate travellers: While elderly travellers, some of them with significant pre-existing diseases are more and more common, the international activities of young people (voluntary social year) have established a new group of business travellers rarely found in the past. While elderly people may be at specific risk by pre-existing diseases the latter show a risk profile by personal behaviour which differs significantly from those of other travellers [4-6], This indicates the need for differentiated pre-travel advice for young and elderly employees.

Another factor may also be that the statistics do not capture work-related travel by self-employed people. In some countries the regulatory body is only concerned with those employees working for companies big enough to have occupation health assessments. In UK, many are on zero-hour contracts as self-employed with no rights to anything.

The detailed analysis of the patient's reports clearly showed that with an effective diagnosis and adequate therapy, severe long-lasting effects or chronic consequences were avoided. This is also indicated by the very low percentage of those who received compensation. Such compensations will be paid according to German law if the health damage reduces the ability to work by an estimated 20% or more. The epidemiological data of the Robert Koch Institute and the results of others also support this conclusion [7, 8]. The detailed analysis also shows that most incidences are of minor severity. Diagnosis and treatment is often in an out-patient setting and the low number of compensated cases indicates that significant permanent impairment is rare [8].

As mentioned above the law has been chaged in 2008 and since then collecting data about the number of preventive check-ups by occupational medicine in Germany does not exist anymore. Therefore one must be very careful when estimations may be done with our data. In 4/71 cases (5.6%) there was no medical check-up at all or any pre-travel prevention advice. This includes all those cases where the post-travel check-up abroad was the only medical contact the employee received. Because it would be not realistic to assume that all of the remaining 94.4% have got an adequate pre-travel advice (the reports do not include detailed data to prove this) this also suggests that there are significant and relevant deficiencies in pre-travel advice. This is especially so when considering data about foreign travel of a short duration. Here it is often reported that there was no pre-travel check-up [8, 19]. In consequence it must be assumed that there is no adequate vaccination before the employee has departed. It is unclear whether even bare minimum medical advice was provided before or at the destination. However, this is not a substitute for a professional preventive check-up by occupational or travel medicine. It should be noted that the collective of people travelling for occupational reasons is not yet well investigated and therefore the existing pre-travel guidelines focus the needs of non-occupational travels [20].

Our study's spectrum of diseases and pathogenic germs roughly corresponds with the data published by the Robert Koch Institute [7]. To get an idea of the diseases which are imported by job-related journeys compared to all tropical diseases in Germany data from the authorities for occupational medicine and safety were correlated with the epidemiological data published by the Robert Koch Institute. Of course, these data sets are different and cannot be compared directly. However, a rough estimation shows a proportion of about 10% of tropical

infections being related to occupational travel to high-risk regions. These documents also support the experience that when such diseases are reported there is a significant delay which often decreases the chance to prove the correlation between the disease and the occupation-related travel or even to prove the diagnosis according to European standards. Although not included in the actual study it should be mentioned that international business travellers, social workers, military personnel and other people travelling for any professional reason also suffer from non-infectious problems which may cause long-lasting problems which are difficult to treat [4, 6]. Especially psychological disorders are an important factor which often causes the victim to stop the travel and the related business activity [4, 6, 21, 22].

In many cases the medical data of the patients included in the actual study was very good, and when the disease was first clinically diagnosed at the travel destination it was supported by laboratory data in most cases. Such timely and accurate diagnoses and data are of high relevance for both the governmental procedures when assessing if it is an occupational disease, and for legal pursuits. A detailed analysis of the records showed that the diagnoses made at destination was done much faster than comparable cases which were diagnosed after return home. This may indicate that the local physicians with their experience about regional diseases had an advantage over the German colleagues.

The recognition, diagnosis, and evaluation of infections which occur after the patient has returned home is much more difficult. Here many diseases were at first misinterpreted as simple flu, even if there was no or late amelioration of the symptoms after treatment. When symptoms persist or reoccur, a correlation to the stay abroad was done late or, unfortunately, even never. Serological tests may indicate late stages of a disease by specific antibodies, but it is rare that the diagnosis of an acute infection is effective and viable (e.g., high IgM titers or typical shifts of titers). Therefore, it may be difficult to correlate the disease with the job-related travel abroad. Sometimes zoonotic diseases which also occur in Germany were falsely diagnosed as a tropical disease. On the other hand, private sojourns shortly before or after job-related travels may cause problems when an occupational disease must be differentiated from another one. Two examples from our collective may illustrate this:

Case 1: A young woman fell ill by a febrile infection during a job-related journey to Central America. Diagnosis of Malaria tertiana with identified Plasmodium vivax in her blood and treatment was made in a local hospital. During the governmental procedure there was no problem to accept this case as occupational disease because all the preconditions like job-related exposure and confirmed diagnosis were fulfilled, and no private travel could be linked with the disease.

Case 2: A woman aged about 40 was living in a high-risk area for dengue fever before returning to Germany. She later returned to the former country for occupational reasons. About two weeks after her return to Germany this second time, she developed a highly febrile disease which seemed clinically to be a severe flu, although it lasted longer than normal. Some months later a check-up by occupational medicine was performed to prepare her for another international trip that was job-related. Now for the first- and only-time dengue IgG was checked and found positive. Because no early serological tests had been done (specific IgM and shift of titer) to prove the acute infection from her original stay in high-risk area for dengue fever, a valid correlation to the second trip was impossible as she had lived there previously for a long time. From a medical assessment perspective, this employee may not have received any compensation because of the failure to diagnose the disease early on. It is important to take detailed notes regarding any previous infection/s always, as in this particular case a later infection by a different genotype of dengue virus may cause severe complications, which may be life threatening (e.g., hemorrhagic fever). If the first dengue fever would have been accepted as occupational disease, the severe complications of a second infection would have also been accepted as an occupationally related issue. Even if this second infection occurred during a private sojourn, it must be assumed that these severe complications after the second trip would not have occurred without the predisposing risk by the occupational disease in the first instance.

Case 3: Case 3 was not part of this study, but was the first recorded case of Ebola Virus Disease (EVD) detected on U.K. soil, and the first case of a severe relapse of EVD in the CNS in the UK. The possibility of the latter was not previously documented nor anticipated, but it carried with it the potential for onward transmission, a serious public health concern. This widely publicised case summarises the issues raised in this paper, including the adverse medical and legal consequences that can arise with respect to the patient's health, and that of her medical colleagues.

Background: The 2014 West African breakout of EVD was the largest and deadliest recorded in history [23]. The mean time from onset of disease to death was 9.6 days, the mean time from onset to end of infectiousness for the survivors was 9.6 days, and the fatality ratio was 55%. There were no licensed treatments available for EVD [23].

Nurse 1 volunteered during the epidemic in Sierra Leone in 2014. She was well informed and prepared for the risks of direct EVD patient contact. She and fellow colleague Nurse 2 returned to the UK from Sierra Leone via separate flights. Nurse

1 displayed no symptoms of EVD throughout the journey, but is believed to have become febrile on the flight to Heathrow Airport, London. As part of the new EVD screening at the airport, Nurse 2 recorded Nurse 1's temperature twice at 38.2°C and 38.3°C, but wrote down 37.2°C for Nurse 1's temperature, and suggested 'they sort this out later'. This was above the 37.5°C threshold Public Health England (PHE) set as a potential warning sign for Ebola at the airport that would require further screening for EVD at the airport.

The next day Nurse 1 was unwell with fever and myalgia. She was admitted to a hospital isolation unit in Glasgow where it was confirmed she had EVD. She was then transferred to specialist high-level isolation unit in a London hospital where her clinical condition deteriorated rapidly. On day 28 after diagnosis, Nurse 1 was discharged as she had lower plasma Ebola virus RNA than the limit of assay detection, but she still had significant fatigue and an ongoing hypercoaguable state with thrombocytosis that was treated with heparin and aspirin.

Over the next 4 months her symptoms improved without specific treatment, and she returned to work as a community nurse. Two months later she developed severe arthralgic symptoms controlled by non-steroidal anti-inflammatory drugs, but continued to work. The symptoms improved over 2 months. Nine months after discharge, she developed severe headache, photophobia, fever and vomiting. There were no ocular symptoms, and she had not travelled outside Europe since her discharge. Ebola virus RNA was detected at a high level in CSF, and at a much lower level in plasma. Ebola virus relapse causing meningitis was diagnosed, and she was evacuated back to the specialist high-level isolation hospital in London. The severity of her clinical illness involved supportive therapy and an experimental antiviral drug. She was discharged 52 days later. In the months that followed, her health was poorly and she developed problems with thyroid, hair loss, headaches and arthralgia. At various stages she also required use of a wheelchair, crutches and sticks to walk.

All these cases clearly show the complex interaction of any party involved in the business when an occupational disease might be assumed. However, also external factors might interfere with the process as illustrated by case 4.

Case 4: A medical student of our university went to Ghana to work in a local clinic. After some weeks she phoned us to get advice how to treat her malaria. About six weeks later she phoned again, complaining that she had malaria again. Another 9 weeks later the third call came in, again for malaria. Three times malaria tropica in less than six months made us distrustful and we asked her to send specimen slides which were used to make the diagnosis. To our surprise the slides did not show a single parasite, but thousands small granules. It turned out that the lab in Ghana did not filter the staining solution after the staining powder was dissolved and the lab technician misinterpreted the dark blue grains as parasites although most of them were obviously completely independent from the erythrocytes. In consequence the student was erroneously treated three times against malaria and probably suffered from a simple flue.

Conclusions

A constant and qualified activity of occupational and travel medicine is necessary to provide medical prevention and advice for employees departing to regions with increased health risk [8, 21, 24-28]. There is a significant number of cases where this is not provided, although obligatory by law in Germany. This leads onto to a lack of general advice, management of travel-related emergencies, vaccinations, or drug prophylaxis. However, the amount of this deficiency is unknown.

There are a relevant number of unreported cases where a contracted tropical disease was unreported though technically an occupational disease. This situation can arise when the employee does not report when the respective disease was effectively diagnosed and treated at the foreign travel destination, or when an unclear infection occurred which (clinically) heals spontaneously. An obligatory medical check-up of this returning traveller might be an important secondary prevention and it should be recommended to get titers and other data which might be relevant for future treatment, and required evidential proof of an occupational disease if compensation is pursued later.

In unclear situations there is a readily accessible and reliable source of tropical disease information at www.istm.org/geosentinel/main.html. This international Geo Sentinel Network assists the practitioner with information concerning the differential diagnosis of imported diseases. In any unclear situation, earliest contact with a specialized tropical medicine centre is very important [29].

Any disease which is suspected of being job-related, independent of whether it has been treated sufficiently abroad or diagnosed later at home, should be reported to the authorities according to the German regulations concerning occupational health and safety, or according to the respective regulations of the country were the employee's company or his home is located.

References

[1] Saretzki C, Dobler G, Iroc E, Mayc Y. Chikungunya seroprevalence in two South Pacific Island States – the Cook Islands and Vanuatu. Annual Meeting of the German Society of Travel Medicine, Coburg, September 18-19, 2020 [in print].

[2] DuPont HL, Ericsson CD, Farthing MJ, et al., Expert review of the evidence base for prevention of travelers' diarrhea. *J Travel Med*. 2009;16(3):1491-60. doi: 10.1111/j.1708-8305.2008.00299.x.

[3] Toovey S, Moerman F, van Gompel A. Special infectious disease risks of expatriates and long-term travelers in tropical countries. Part II: Infections other than malaria. *J Travel Med*. 2007;14(1):50-60. doi: 10.1111/j.1708-8305.2006.00092.x.

[4] Neppach K. *Nicht-infektiöse Risiken junger Freiwilliger bei internationalen Sozialprojekten von Non-Governmental Organizations* [Non-infectious risks of young volunteers of international social projects of NGOs]. [master's thesis] Aachen: RWTH Aachen University. Institute of Occupational and Social Medicine; 2013.

[5] Küpper T, Neppach K, Martin J, Heggie T, Rieke B. Non-infectious health risks of young adults serving in international volunteer services. *Health Promot Phys Act*. 2020; 13(4): 29-39.

[6] Martin J, Rieke B, Neppach K, Hillebrandt D, Küpper T. Risks to young volunteers in international social projects. *Ann Occup Hyg*. 2012;56(2):242-252. doi: 10.1093/annhyg/mer104.

[7] Schoneberg I, Frank C, Stark K. Reiseassoziierte Infektionserkrankungen 2010 [Travel-related infectious diseases 2010]. *Epidem Bull.* 2011;41:371-378.

[8] Chen LH, Leder K, Barbre KA, et al. Business travel-associated illness: A GeoSentinel analysis. *J Travel Med*. 2018;25(1). doi: 10.1093/jtm/tax097.

[9] Siebtes Buch Sozialgesetzbuch – Gesetzliche Unfallversicherung (Artikel 1 des Gesetzes vom 7.8.1996, BGBl I: 1254), zuletzt geändert durch § 62 Abs. 19 des Gesetzes vom 17. Juni 2008. BGBl I, 2010: 1010.

[10] DGUV, *Grundsätze für arbeitsmedizinische Vorsorgeuntersuchungen, Grundsatz G35 "Arbeitsaufenthalt unter besonderen klimatischen und gesundheitlichen Belastungen"*. 6th ed. Stuttgart: Gentner Verlag; 2014.

[11] Berufskrankheitenverordnung vom 31. Oktober 1997, BGBl I: 2623, zuletzt geändert durch Artikel 1 der Verordnung vom 10.7.2017. BGBl I, 2017:2299.

[12] Merkblatt zur Bk Nr. 3104: Tropenkrankheiten, Fleckfieber. BArbBl, 2005;7:48-62.

[13] Becker P. Neues Prüfschema für Arbeitsunfälle und Berufskrankheiten [New checking procedure for occupational accidents and diseases]. *Med Sach*. 2010;106:145-152.

[14] Maruna H, Westphal G. Tropenkrankheiten als Berufskrankheiten [Tropical diseases as occupational diseases]. Mitt Österr Ges Tropenmed Parasitol, 1985;7:197-205.

[15] (anonymous) (2018) Anhang 1 UVV.

[16] EC, *Information notices on occupational diseases: A guide to diagnosis*. Luxembourg: Office for Official Publications of the European Communities; 2009. doi: 10.2767/38249.

[17] Boulware DR. Influence of hygiene on gastrointestinal illness among wilderness backpackers. *J Travel Med*. 2004;11(1):27-33. doi: 10.2310/7060.2004.13621.

[18] Schlaich CC, Oldenburg M, Lamshöft MM. Estimating the risk of communicable diseases aboard cargo ships. *J Travel Med*. 2009;16(6):402-406. doi: 10.1111/j.1708-8305.2009.00343.x.

[19] Khan NM, Jentes ES, Brown C, et al. Pre-travel medical preparation of business and occupational travelers: An analysis of the Global TravEpiNet Consortium, 2009 to 2012. *J Occup Environ Med*. 2016;58(1):76-82. doi: 10.1097/JOM.0000000000000602.

[20] Pierre CM, Lim PL, Hame DH. Expatriates: Special considerations in pretravel preparation. *Curr Infect Dis Rep*. 2013;15(4):299-306. doi: 10.1007/s11908-013-0342-4.

[21] Liese B, Mundt K, Dell L, Nagry L, Demure B. Medical insurance claims associated with international business travel. *Occup Environm Med*. 1997;54:499-503. doi: 10.1136/oem.54.7.499.

[22] Patel D, Easmon C, Seed P, Dow C, Snashall D. Morbidity in expatriates – a prospective cohort study. *Occup Med (Lond)*. 2006;56(5):345-352. doi: 10.1093/occmed/kql026.

[23] Gomes MF, Pastore YPA, Rossi L, et al. Assessing the international spreading risk associated with the 2014 West African ebola outbreak. *PLoS Curr*. 2014;6. doi: 10.1371/currents.outbreaks.cd818f63d40e24aef769dda7df9e0da5.

[24] Kupper T. Occupational medicine. In: Rieke B, Küpper T, Muth CM, eds. *Moderne Reisemedizin* [Modern Travel Medicine] Stuttgart: Gentner Verlag; 2013.

[25] Lopez-Velez R, Bayas, JM. Spanish travelers to high-risk areas in the tropics: Airport survey of travel health knowledge, attitudes, and practices in vaccination and malaria prevention. *J Travel Med*. 2007;14(5):297-305. doi: 10.1111/j.1708-8305.2007.00142.x.

[26] Florchinger B. Beruflicher Auslandsaufenthalt mit Familien. *Ergomed*. 2011;35:23.

[27] Ricken U. Arbeitsaufenthalt im Ausland unter besonderen klimatischen und gesundheitlichen Belastungen. *Prakt Arbmed*. 2010;18:245.

[28] Steffen R, Amitirigala I, Mutsch M. Health risks among travelers – need for regular updates. *J Travel Med*. 2008;15(3):145-146. doi: 10.1111/j.1708-8305.2008.00198.x.

[29] Cramer JP, Burchard GD, von Sonnenburg F. Reiseassoziierte Erkrankungen frühzeitig erkennen [Early diagnosis of travel-related diseases]. *Dtsch Ärztebl*. 2011;108:2594-2597.