Travel Medicine and Infectious Disease (2014) 12, 330–340

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevierhealth.com/journals/tmid

Prevention of infectious diseases during military deployments: A review of the French armed forces strategy

R. Michel [a,d,*], J.P. Demoncheaux [b], M.A. Créach [a], C. Rapp [c,d], F. Simon [d,e], R. Haus-Cheymol [f], R. Migliani [d,f]

[a] *Centre d'épidémiologie et de santé publique des armées, Marseille, France*
[b] *Centre médical des armées de Nîmes-Orange-Laudun, Antenne vétérinaire de Nîmes, France*
[c] *Hôpital d'instruction des armées Bégin, Saint Mandé, France*
[d] *Ecole du Val-de-Grace, Paris, France*
[e] *Hôpital d'instruction des armées Laveran, Marseille, France*
[f] *Direction centrale du Service de santé des armées, Vincennes, France*

Received 21 December 2013; received in revised form 24 June 2014; accepted 2 July 2014
Available online 16 July 2014

KEYWORDS
Infectious diseases;
Military;
Prevention

Summary Military personnel in operations have always paid a high toll to infections. In the 21st century some of these diseases still cause outbreaks with significant morbidity and impact on deployments. The new configuration of the French Armed Forces requires the permanent preparedness of deployable units. During deployments, soldiers are at least exposed to the infectious diseases that are observed in travellers, but with a potentially severe impact for the combatting strengths and a risk for cancelation or failure of the operational durability. The most common disabling infections during military deployments are faeco-oral transmitted diseases including diarrhoea. Preventing infectious diseases during deployments is of great concern and the French medical service has established a strategy based on different components; risk assessment and preparation, immunizations, protective measures and chemoprophylaxis, health education, health surveillance, outbreak investigations and medical tracking. In this review, the authors present the context of deployment of the French Armed Forces, the main health risks they are exposed to and develop the key points of the force health protection strategy, focused on infections related to military deployments.

* Corresponding author. Centre d'épidémiologie et de santé publique des armées, Marseille, France; Ecole du Val-de-Grace, Paris, France. Tel.: +33 6 28 90 44 16 (mobile), 33 4 91 63 79 40.
E-mail addresses: r.michel4@wanadoo.fr, rappchristophe5@gmail.com (R.Michel).

http://dx.doi.org/10.1016/j.tmaid.2014.07.001
1477-8939/

1. Introduction

Historically, military personnel in operations have always paid a high toll to infections, particularly during epidemics [1].While decimating the fighting strengths, much more than the enemy, epidemics have often decided the fate of battles. During World War I, from September 1914 to May 1915, over 65,000 cases of typhoid fever (including 11,000 deaths) were counted among the French troops, the epidemic was controlled by the administration of the typhoid vaccine developed by Hyacinthe Vincent, a French military doctor, undoubtedly influencing the outcome of the conflict [2]. Even in the 21st century some of these diseases still cause outbreaks with significant morbidity and impact on deployments [3] and infectious diseases (diarrhoea 6000/y, respiratory acute infection 500, dengue like fever 400, malaria 300/y) still account for the majority of illnesses encountered by military personnel in modern operations and warfare campaigns [4,5]. Since the end of the conscription in France, in 2002, the new configuration of the French Armed Forces requires the permanent preparedness of deployable units. In 2013, about 40,000 French soldiers have served outside metropolitan France for missions and operations of variable duration and in many different countries, in particular in Africa, Asia or Central and South America. For these troops, risk of infection persists despite the implementation of preparedness strategies, pre-deployment training and infectious disease control measures. These risks can affect individuals but can also have a large impact on the operational capacity of the deployed strengths, in case of outbreaks for example. In this review, the authors present the context of deployment of the French Armed Forces, the main health risks they are exposed to and develop the key points of the force health protection strategy, focused on infections related to military deployments.

2. Context of deployments

In recent years, the number of overseas operations has increased for the French Armed Forces, whether warfare campaigns (Mali 2013), peace keeping and security operations in the context of national or European decisions, North Atlantic Treaty Organization (NATO), like in Afghanistan or United Nations (UN). French soldiers also took part to humanitarian missions, in Indonesia in 2004 in the following days of the Tsunami, after the earthquakes in Pakistan (2005), Haiti (2010), Japan (2011) and Jordan (2012) for example.

French soldiers are present outside metropolitan France under very different types of missions. These missions can be classified into two main categories according to their purpose: i) military operations or humanitarian missions of variable duration (between 4 and 6 months) in countries where French troops are not present (*Opérations extérieures* — OPEX), ii) missions of prepositioned forces, either in the application of defense agreements with different countries (Gabon, Ivory Coast, Chad, Senegal, Central African Republic, Djibouti) or in French overseas territories and departments (French Caribbean, French Guiana, New Caledonia, French Polynesia, La Reunion, Mayotte). These missions of prepositioned forces can be divided into two categories according to their duration; short-term deployments (4—6 months) and long-term missions (2—3 years).

Countries of deployment for French soldiers are often characterized by the importance of communicable diseases due to multiple factors: low socio-economic status of countries, tropical climate, poor general health, large number of pests and vectors of infectious diseases, lack of health infrastructure [6]. Soldiers are exposed to infection by human contact with the population and the environment. They may be both victims and transmitters of these pathogens to the military community and their relatives when returning home [2]. Health risks are higher among soldiers deployed for short-term period, either in OPEX or short-term deployment (prepositioned forces or in overseas territories) [7].

3. Health risks related to deployments

Most of the threatening diseases for deployed French military personnel are communicable diseases. The experience shows that the risk of community-acquired infections is worldwide on the field and often higher than the risk of endemic/epidemic diseases in tropical areas. These infections can be classified, according to their route of transmission, in seven different types of infection: vector borne-, Airborne-, food or waterborne-, sexually transmitted-, contact with water-, animal-transmitted infections and, in addition, warfare infections [2] (Table 1). The major infectious diseases with high severity are Malaria, Meningococcal infections, Anthrax and infection of war wounds.

The most common disabling infections during military deployments are faeco-oral transmitted diseases including diarrhoea [8] with an overall incidence ranging from 5 to 30 episodes per 100 person-month [9,10]. The risk appears to be higher in the first days or weeks of deployment and is associated with poor hygienic conditions and contaminated food or water sources [11]. In addition, foodborne outbreaks with no diarrhoeal clinical pattern can occur as observed for an outbreak of typhoid fever in Ivory Coast or of poisoning with scombroid fish in Senegal due to high histamine concentration [12,13]. Although high, the incidence of diarrhoea reported to the French forces health surveillance, is likely underestimated and self-reporting seems more appropriate than medical-based surveillance to estimate true incidence of diarrhoea during deployment of military troops. A study showed that among soldiers self-reporting multiple episodes of diarrhoea during deployments, only 42% led to medical consultation, resulting in a threefold higher actual incidence compared to the apparent incidence estimated through the health surveillance. Mathematical models integrating self-reported data should better predict outbreaks during military deployments and define a more complete assessment of disease burden [14].

Vector borne diseases remain a real problem, malaria being the most threatening of them. For this reason, malaria prevention is one of the major concerns of the French Forces medical service. Despite research programs