

# Infectious threats during the Portuguese exploration of West Africa in the 15<sup>th</sup> and 16<sup>th</sup> centuries

Silvia Matta<sup>1</sup>, Mariana Sao Miguel Morgado<sup>2</sup>, Lorenzo Donghi<sup>3</sup>, Luca Braidotti<sup>4</sup>, Ylenia Gobbo<sup>5</sup>, Stefano Di Bella<sup>6</sup>, Omar Simonetti<sup>7</sup>

<sup>1</sup>Independent researcher, contractor in Emergency Room, ULSAM, Viana do Castelo, Portugal;

<sup>2</sup>Public Health and Hygiene Service, AUSL RE, Reggio Emilia, Italy;

<sup>3</sup>Infectious Diseases Unit, AUSL RE, Reggio Emilia, Italy;

<sup>4</sup>Department of Engineering and Architecture, University of Trieste, Trieste, Italy;

<sup>5</sup>Historical and Philosophical Disciplines, Department of Humanities, Trieste University, Trieste, Italy;

<sup>6</sup>Clinical Department of Medical, Surgical and Health Sciences, Trieste University, Trieste, Italy;

<sup>7</sup>Infectious Diseases Unit, University Hospital of Trieste, Trieste, Italy.

Article received 7 July 2025 and accepted 30 January 2026

## SUMMARY

The Portuguese exploration of sub-Saharan Africa in the 15th and 16th centuries marked a crucial point both for geographical discovery and for the development of early naval medicine. This article looks at the health challenges faced by explorers from the time of Henry the Navigator (1394-1460) onwards, focusing on the infectious diseases that emerged on first contact with West Africa. Italian explorers such as Alvise Cadamosto and Antoniotto Usodimare provided valuable accounts of early expeditions in which they emphasized the occurrence of febrile diseases in the swampy coastal regions. These encounters showed the double threat of infections on board and off the ship. The article also highlights the Portuguese response to the pathogenic barriers encountered. While medical care was initially neglected, the continuing

loss of labour prompted the empire to gradually deploy medical professionals on board and in the colonies. Over time, Portugal established hospitals and lazarettos and standardised medical training and licensing under King Manuel I. These early efforts to formalise medical care laid the foundations for colonial healthcare systems and early forms of public healthcare. Although these adaptations are still a long way from modern tropical medicine, they represent fundamental steps towards organised health care in the overseas territories and reflect the shift from pure exploration objectives to institutionalised support for the survival of imperial ventures.

*Keywords:* tropical diseases, naval medicine, malaria, hygiene, colonial medicine

## ■ BACKGROUND AND AIMS

The golden age of Portuguese exploration of the sub-Sahara experienced its heyday under Infante D. Henrique (1394-1460), who was known as “the Navigator” (Henry the Navigator). After the expeditions to Madeira (1420), the Azores (1431)

and Cape Bojador (1433), systematic exploration of the continental African coast began. In 1455 and 1456, two Italian explorers, Alvise Cadamosto (1432-1483) and Antoniotto Usodimare (1416-1461), sailed to the Gulf of Guinea on behalf of the Kingdom of Portugal. Usodimare fought natives on his first voyage to the Gambia River and brought slaves and valuable goods back to Portugal. Between 1455 and 1456, the explorer sailed back to the Gulf of Guinea and encountered Cadamosto on the African coasts. Cadamosto is known for having a good expertise in narration and the

*Corresponding author*

Omar Simonetti

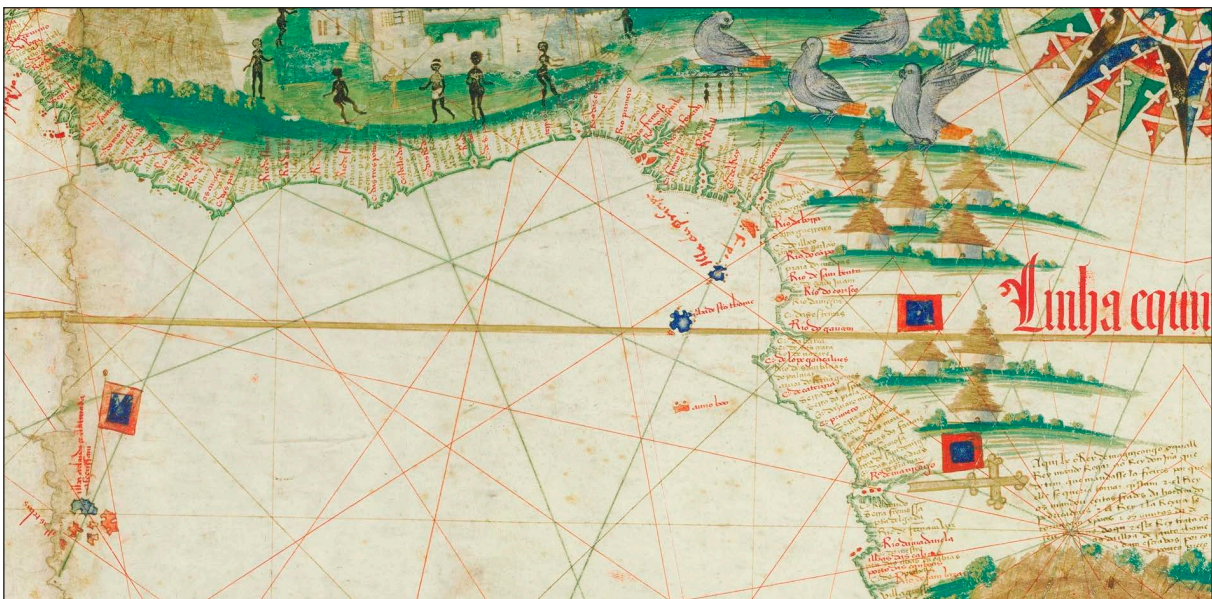
E-mail: omarsimonetti89@gmail.com

Italian records of his second voyage are a rich and valuable source of information, also for the description of diseases [1].

In the 15th century, technological progress in Portugal led to the creation of the caravel, a new type of ship that evolved from local fishing vessels and integrated both Northern European and Mediterranean shipbuilding traditions [2]. Portuguese shipbuilders adopted the frame-first construction technique, a naval building method developed in the Mediterranean since the first millennium AD, which involved attaching hull planks edge-to-edge to frames fixed directly to the keel. This enhanced the hull's structural integrity, allowing it to withstand greater forces from larger sails and additional masts [3–5]. They also introduced the central rudder - used in Northern Europe since the 12th century - in place of steering oars, which were common in Mediterranean ships until the 13th century [6]. Moreover, the Portuguese pioneered fully-rigged ships combining square and lateen sails. These innovations culminated in the caravel: a vessel with a central rudder and three masts fitted with either lateen or mixed sails. The caravel offered superior windward performance, high speed, excellent maneuverability, and required only a small crew [7]. As a result, it became a cut-

ting-edge maritime technology that enabled the Portuguese to explore long distances, including voyages across the Atlantic and along the African coast (see *Figure 1*).

The predictions were those of a flourishing age of geographical and scientific discoveries for the 15<sup>th</sup> and 16<sup>th</sup> centuries. As reported in 1589 in the “Diálogos” by Amador Arrais (1530-1600), the Portuguese maritime explorations: “[...] *revelaram aos sábios da terra muitos segredos [...]*” (“[...] will unveil many secrets to the experts worldwide [...]”) [8]. Nevertheless, the living conditions on board and the available supplies did not differ from those of earlier ships designed for shorter voyages. Therefore, the scarce water supply and fragile hygiene on board led to very unhealthy conditions during the early voyages of discovery in the 15th and 16th centuries [9]. Interestingly, infectious diseases acted as a bicompartimental threat to ship crews and explorers. As a matter of fact, the outboard diseases depended on the coastline reached and inspected (mainly tropical ones) while infections on board were not related to the destination of the voyage (mainly homeland diseases) [10, 11]. The outboard diseases faced by explorers in Sub-Saharan West Africa were so harmful that the region was later called “The White Man’s Grave” [12].



**Figure 1** - A detail of the Gulf of Guinea in Cantino planisphere (1502). Biblioteca Estense Universitaria, Modena, Italy. This file has been identified as being free of known restrictions under copyright law, including all related and neighboring rights. Image in the Public Domain. Source: Wikimedia Commons.

The aim of the present work is to briefly review Portuguese naval medicine in the 15<sup>th</sup> and 16<sup>th</sup> centuries with a focus on the first infectious diseases encountered in the exploration of the sub-Saharan since the expeditions promoted by Henry the Navigator. Scientific databases (e.g. PubMed) and historical records have been retrieved in English, Italian and Portuguese language.

### ■ PORTUGUESE NAVAL MEDICINE AND DISEASES IN THE 15<sup>th</sup> AND 16<sup>th</sup> CENTURIES

The first voyages with caravels took years and were anything but an easy journey. In addition to the risks of travelling by ship due to climatic adversities, the hygienic conditions, the social environment and diseases were a real threat. As previously reported, West Africa was later labelled the white man's grave, but the conditions on board the caravels were no better.

Malnutrition was widespread in caravels. Vitamin C deficiency, known as scurvy, was called in Portuguese "*mal de Luanda*" ("Luanda's illness") and represented one of the main health problems on caravels at that time (Luanda is the capital of Angola). The diary food consisted of 400 mg (mainly biscuits) and 1.4 litres of water. Animals were brought on board, but only the captain and the seriously ill crew were allowed to eat them. Hunting for rats was widespread and they were regularly boiled in salt water [9]. The scurvy description by João de Barros (1496-1570) is clear: "*per espaço de um mês que ali estiveram no corregimento dos navios adoeceu muita gente, de que morreu alguma. A maior parte foi de herisípolas e de lhe crescer tanto a carne das gengivas que quási não cabia na boca aos homens, e assi como crecia apodrecia e cortavam nela como em carne morta, cousa mui piadosa de ver; a qual doença vieram depois conhecer que procedia das carnes, pescado salgado, e biscoito corrompido de tanto tempo*" ("in the month following their stay on the caravels, many people fell ill and some died. Most of them because of cutaneous lesions - purpura? - and because gingival tissue was growing so much that they almost did not fit into people's mouths, [...] open like rotten meat, [...]; this disease, we have recently understood, came from meat, salty fish and biscuits that rotted over time") [13].

Gurgel and colleagues interestingly point out that morbidity and mortality depended on the final

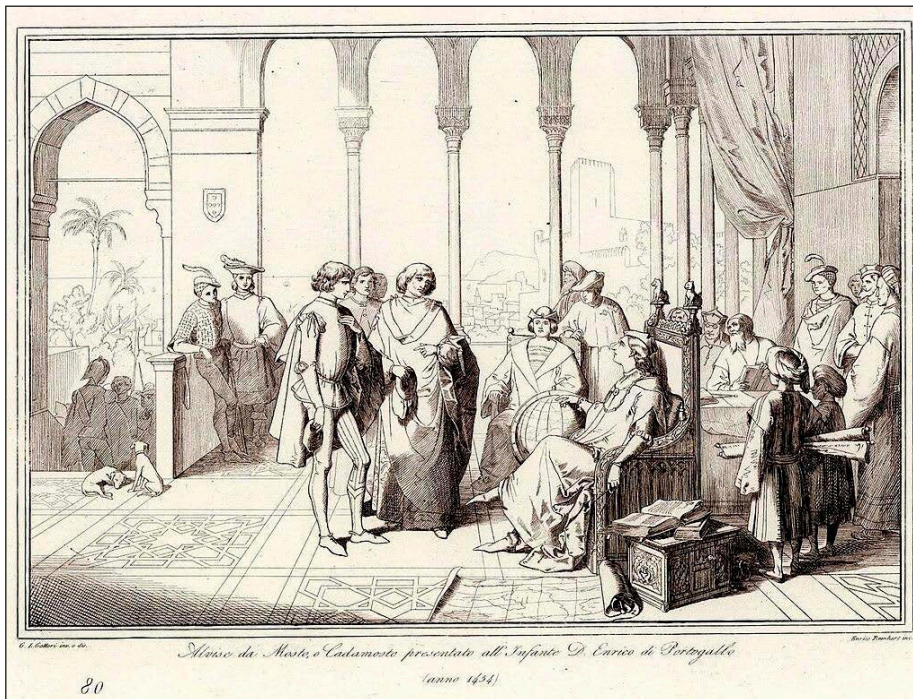
destination of the trip. The African coast was considered "*um inferno*" ("an hell") for Portuguese explorers. The monk Luis de Zouza (1555-1632) wrote in 1528: "*seiscento doentes! [...] 200 doentes em Zanzibar, 150 em Melinde, [...] em Moçambique se enterravam 400!*" ("six hundred sick! [...] 200 sick in Zanzibar -actual Tanzania-, 150 in Malindi -actual Kenia-, [...] in Mozambique 400 were buried!"). The causes of mortality on board were mainly fevers of unknown origin. Typhoid fever, smallpox, diphtheria, scarlet fever, rickettsiosis and tuberculosis were frequently described [14]. The so-called "*mal das calmarias*" ("illness of stillness), frequent in the Gulf of Guinea, worsened them [15].

Ulcers (including traumatic ones) in ship crews were also described, such as the one that Mestre Joao Faras, surgeon and physicist, contracted on his way to Brazil in 1500 [16]. As no detailed descriptions are available, it is impossible to draw conclusions about the full aetiology.

### ■ INFECTIOUS HYPOTHESIS ABOUT THE FAILURE OF ALVISE CADAMOSTO'S SECOND EXPEDITION

During Cadamosto's second expedition (see *Figure 2*) between 1455-1456, the Gambia River was navigated from the delta to more than 60 miles (approx. 95 kilometers). During the voyage, one place described as a swamp ("*polesine*" in Italian) was reached while a crew member died of fever. The ship was anchored at the final destination, Mansa, and recorded diary trades with natives. After 11 days, Cadamosto decided to sail back to the Gulf because "*molti de' nostri si cominciarono ammalare di febbre calda, acuta e continua*" ("many of us began to have a fever, with acute chills and constant"). Three vessels abandoned the Gambia River "*per la invalescenza de' nostri uomini*" ("because of the crew's illness").

The disease is closely associated with the swampy place reached by the same author, so that the disease was probably brought in on ships from the surrounding area. Malaria is the most likely onboard infectious aetiology for the disease described by Cadamosto. In fact, the mortality rate for typhoid and yellow fever may vary between 20 and 30% [16, 17]. As long as one death is reported by Cadamosto it is natural to consider a disease with a lower fatality rate such as malaria. As a matter of fact, severe complicated malaria has a



**Figure 2**  
Alvise da Mosto,  
or Cadamosto  
is presented to Henry  
of Portugal. 1863.  
Image in the Public  
Domain.  
Source: Wikimedia  
Commons.

mortality of 15-30%; while it is only 0,4% in uncomplicated acute cases [18]. In addition, the dispersal of *Anopheles* spp. mosquitoes varies and in the central part of The Gambia they can fly over 2 kilometers. Mosquitoes can also be transported over long distances by ship [19].

#### ■ DISEASES REPORTED DURING THE FOLLOWING PORTUGUESE EXPEDITIONS AND SETTLEMENTS

Difficulties and dangers for European explorers are also described later in some letters and documents of 1490. Indeed, after Congo's King's conversion to Christianity, Congo's queen asks to be baptized as she observes many missionaries become ill soon after arriving there. The death toll was so high that there was the risk not to have available missionaries. It is reported that: "A Rainha vendo que [...] Fr. João o principal dos Religiosos era falecido, e outros estavam doentes por logo os apalpar a terra, começou de se queixar a El Rey, pedindo-lhe que houvesse por bem ante de sua partida ella ser baptizada; [...] e temia falecerem os Ministros deste Sacramento [...]" ("When the Queen saw that [...] Father João, the main Religious, had died and others

were sick after touching the ground, she began to complain to the king and asked him to be baptised; [...] and feared that the ministers of this sacrament would die [...]" [20].

In 1510, the procurator of the island of Santiago (the largest island of the Green Cape) explained all the reasons why the king granted privileges to the inhabitants of the island, including many diseases that endangered life: "E mais, Senhor. A dita Ilha hé tão alongada destes Regnos, e tão maa de doenças, que necessita que lhes dê vossalteza o dito Priuilegio, e ainda outros, somente por abitarem na dita Ilha" ("Besides, sir. The said island is so far from these regions and so plagued with disease that it is necessary for you to give them the said privilege and still others, just because they live in the said island.") [21].

Even the climatic adversities of Guiné, particularly humid in certain regions, also made life in the country difficult. This is reported in a document from 1554: "Es tierra la más enferma que hay de todas las que nauiegan los portugueses" ("It is the sickest land of all that the Portuguese have travelled through") [22].

Joao Marinho Dos Santos, professor at the Faculty of Literature at the University of Coimbra, ex-

plains that the adaptation of the Portuguese to the newly discovered lands was generally not easy, as they faced various obstacles: from food shortages to inadequate hygiene measures and a lack of knowledge about local diseases [23].

### Portuguese response to the pathogenic barrier encountered

It is assumed that the Portuguese golden age of explorations gave an impetus to the progress of medical care and assistance's progress. During the first expeditions, the health of the sailors was not yet considered crucial. There was no medical staff on board, there was no organised plan to maintain the well-being of the travellers. Doctors were professionals who devoted themselves more to astronomy, maths and technical progress than to healthcare. Nevertheless, health conditions on board and on the mainland became an important issue as the Portuguese empire continued to expand [24]. Facing loss of workers and sailors due to illness, health care became an increasingly important issue. The caravels began to have a number of health care providers on board, such as: a doctor whose duties consisted of diagnosis, prescribing medication and direct care of infirms; a surgeon who was responsible for operations and the treatment of injuries; a barber-bloodletter who made "*sangrias*" and "*boticario*" whose work was to prepare medications (a pharmacist) [23]. Healthcare providers started to be sent to settle in colonies, even if it was difficult to recruit them. Remarkable is a letter in which the regent D. Pedro, the Duke of Coimbra, states that he forgives Mestre Lançarote (Henry's surgeon), who had committed adultery, if he accepts to live in Ceuta for 2 years [25].

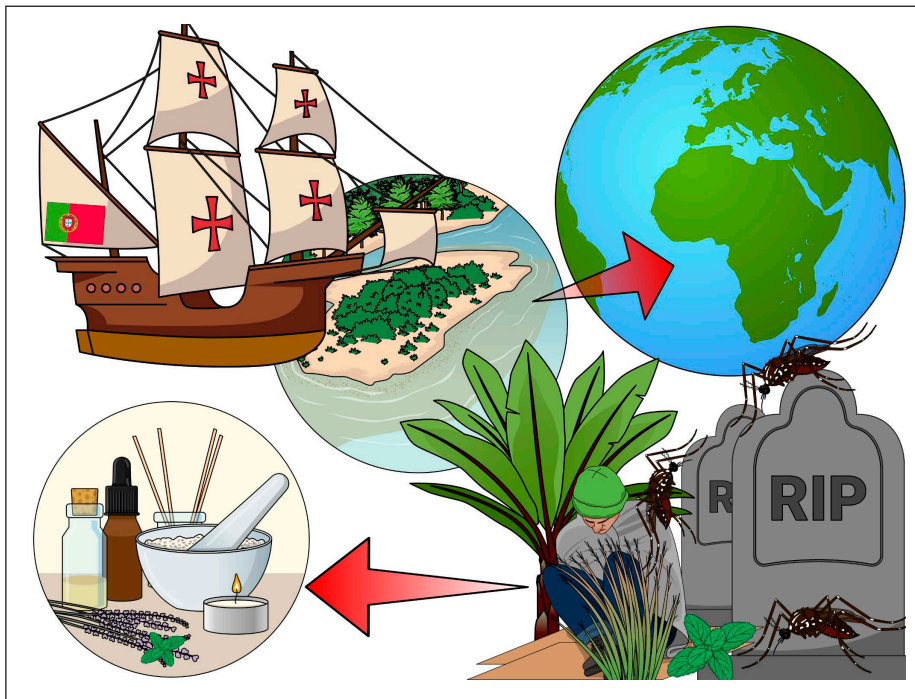
The Portuguese empire began to build nurseries and hospitals in the colonial territories. In São Jorge da Mina (now Ghana), a nursery was established in 1482, attached to the fortress, but was converted into a hospital just over a decade later, in 1495. Many hospitals were administered by Misericórdias, confraternities that were under the protection of the Crow but had autonomous power and provided social aid mainly as a form of religious charity [24]. During the reign of Manuel I (1495-1521), the training of physicians was standardized, with specific statutes, medical licences, university education until becoming professional figures with a proper salary [26]. In a letter from

the Bishop of Cabo Verde and the priests from the 17th century, they ask for an increase in their salary because of medical costs: "*E que do dito tempo a esta parte foraõ as cousas em tanta carestia que cõ o ordenado que té se naõ podem sustentar comodamente e uiuer cõ a linpeza que requiere o estado sacerdotal, por lhe custará huás casas de alug[u]er vinte mil reaes, e o que resta de seu ordenado guastará em fiziquo e botiqua, por o mais do tépo estará doentes*" ("From that moment on, resources were scarce, so we were not able to feed ourselves comfortably with the salary and live with the quality demanded by the clergy, because the rent for a house cost 20,000 reals and the rest of the salary was used to pay a doctor and a pharmacist, because most of the time we are sick") [27].

### CONCLUSIONS

The Portuguese began exploring the west coast of Africa in the 15th century, thanks in part to a new, ultra-modern maritime technology, called caravel. Various documents from these voyages of discovery show that the Portuguese encountered several difficulties in the African regions, including infectious diseases. The voyages of discovery focused on the coastal areas and we can assume that the diseases endemic in Africa were an obstacle to further expansion on the mainland. In fact, malaria is considered the main obstacle to the colonisation of Africa by the British Empire and other Europeans [28, 29].

We believe that the availability of vessels such as caravels made it possible to reach new areas after long voyages, without the sanitary and health conditions for the crew being adequately improved at first. Nevertheless, it is plausible to assume that the contact with new diseases prompted Portugal to improve medical care after the first exploration by caravels. These improvements were still a long way from the time when "shift from humoral and miasmatic perspectives to the new fields of parasitology and epidemiology" gave birth to tropical medicine in the 19th century [30]. However, the growing awareness of health risks between the 15<sup>th</sup> and 16<sup>th</sup> centuries leads the Portuguese empire to set up structures such as infirmaries and hospitals in the colonised regions and to standardise medical licences. These measures and the hybridisation of medical knowledge described by Havik could be the first step towards global health, albe-



**Figure 3**  
The link between the Portuguese exploration of West Africa and the need to organise healthcare in the overseas territories from the 15th century onwards. Created using the tool MindTheGraph under a regular subscription.

it from the perspective of the colonisers [28]. In summary, the exploration of the sub-Saharan since the time of Henry the Navigator and the experiences of Cadamosto are a great example of how infectious diseases have hindered the improvement of maritime medicine and health care in the European colonies since the late 15th century (summarised graphically in Figure 3).

#### Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

#### Conflict of interest

The authors declare no conflict of interest.

#### REFERENCES

- [1] Cà da Mosto A, Usodimare A, da Recco N. Le navigazioni atlantiche. Edizioni Alpes. 1928.
- [2] Schwarz GR. The history and development of caravels. Texas A&M University. 2009.
- [3] Pomey P, Kahanov Y, Rieth E. Transition from Shell to Skeleton in Ancient Mediterranean Ship-Construction: analysis, problems, and future research. *Intl J Nautical Archaeology*, 2012, 41: 235-314.
- [4] Smith RC. Vanguard of the Empire: Ships of Exploration in the Age of Columbus. Oxford University Press. 1993.
- [5] Bettini C. Come costruivano i velieri, alle origini dell'architettura navale moderna. Edizioni ETS. 2019.
- [6] Mott LV. The Development of the Rudder: A Technological Tale. Texas A & M Univ Pr. 1997.
- [7] Britannica Editors. Caravel. *Encyclopedia Britannica*, 18 Mar. 2024, <https://www.britannica.com/technology/caravel>. Accessed 13 April 2025.
- [8] Arrais A. Dialogos. Coimbra 1589 as cited in Rasteiro A. Os Médicos Portugueses e os Descobrimientos dos Séculos XV e XVI. *Revista Ordem dos Médico*. 1990; 11, 21-30.
- [9] Gurgel CBFM, Lewinsohn R. A medicina nas caravelas - Século XVI. *Cadernos de História da Ciência - Instituto Butantan*. 2010; 6 (2), 105-20.
- [10] Martini M, Riccardi N, Simonetti O, et al. The blinding disease. The history of trachoma in Italians between the 19th and 20th centuries: colonial or national blindness?. *Pathog Glob Health*. 2024; 118(6), 499-504.
- [11] Simonetti O, Armocida E, Rossi B, et al. A possible trachoma cluster unveiling the mist of Le Rôdeur: probes in favor and against an alternative cause of the crew blindness. *Pathog Glob Health* 2025, 119 (1-2), 22-28.
- [12] Curtin P D. 'The White Man's Grave': Image and Reality, 1780-1850. *Journal of British Studies*. 1961; 1 (1), 94-110.
- [13] De Barros J. Ásia: Dos Feitos que os Portugueses

- Fizeram no Descobrimento e a Conquista dos Mares e Terras do Oriente - Livro Quarto da Primeira Década, Capitulo III, em que se contém como a Índia foi descoberta per mandado del-Rei Dom Manuel, deste nome o primeiro de Portugal. Em Lisboa impressa per Iorge Rodriguez. 1628.
- [14] Gurgel C. Doenças e curas. O Brasil non Séculos XVI e XVII. Ed. Contexto. 2010.
- [15] Míceli P. O Ponto Onde Estamos, viagens e viajantes na história da expansão e da conquista (Portugal, século XV e XVI). Editora da Unicamp. 1997.
- [16] Kallas EG, D'Elia Zanella LGFAB, Moreira CHV, et al. Predictors of mortality in patients with yellow fever: an observational cohort study. *Lancet Infect Dis.* 2019; 19(7), 750-758.
- [17] Marchello CS, Birkhold M, Crump JA. "Complications and mortality of typhoid fever: A global systematic review and meta-analysis". *J Infect.* 2020; 81(6), 902-910.
- [18] Watson JA, White NJ, Dondorp AM. "Falciparum malaria mortality in sub-Saharan Africa in the pretreatment era". *Trends Parasitol.* 2022; 38(1), 11-14.
- [19] Takken W, Charlwood D, Lindsay SW. "The behaviour of adult *Anopheles gambiae*, sub-Saharan Africa's principal malaria vector, and its relevance to malaria control: a review". *Malar J.* 2024; 23(1), 161.
- [20] Brásio A. Monumenta Missionária Africana, África Ocidental (1471-1531); vol 1: Primeira missão enviada ao Congo (9-12-1490). Agência Geral do Ultramar. 1952.
- [21] Brásio A. Monumenta Missionária Africana, África Ocidental (1500-1569); Segunda Serie vol. 2: Privilégios aos moradores de Santiago (Maio - 1510). Agência Geral do Ultramar. 1963.
- [22] Brásio A. Monumenta Missionaria Africana, África Ocidental (1532-1569) vol. 2: Carta do Padre Diogo Mirão ao Padre Polango (17-9-1554). Agência Geral do Ultramar. 1953.
- [23] Dos Santos JM. Estudos sobre os descobrimentos e a expansão portuguesa. Coimbra University Press. 2021
- [24] Ferrinho P, Doria JL, Hartz Z. Primórdios dos serviços de medicina colonial em África: séculos XV – XIX. *Anais Do Instituto De Higiene E Medicina Tropical.* 2012; 11, 7-13.
- [25] De Castro A. Físicos, cirurgiões e boticários nas naus dos descobrimentos. *Arquipélago História.* 2000. 4 (2), 535-50.
- [26] Abreu L. Health care and the spread of medical knowledge in the Portuguese empire, particularly the Estado da Índia (sixteenth to eighteenth centuries). *Med Hist.* 2020; 64 (4), 449-466.
- [27] Brásio A. Monumenta Missionaria Africana, África Ocidental (1570-1600), série 2 vol. 3: Benefícios da Sé de Cabo Verde (24-2-1600). Agência Geral do Ultramar. 1964.
- [28] Bump JB, Aniebo I. Colonialism, malaria, and the decolonization of global health. *PLOS Glob Public Health.* 2022; 2 (9).
- [29] Curtin PD. The End of the "White Man's Grave"? Nineteenth-Century Mortality in West Africa. *J. Interdiscip. Hist.* 1990; 21(1), 63-88.
- [30] Havik PJ. Hybridising Medicine: Illness, Healing and the Dynamics of Reciprocal Exchange on the Upper Guinea Coast (West Africa). *Med. Hist.* 2016; 60(2), 181-205.