

Epidemiological, Clinical and Prognostic Features of Tetanus in Dakar, Senegal

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The aim of this study was to describe the epidemiological, clinical and prognostic aspects of tetanus.

Methodology: This is a retrospective, descriptive, cross-sectional study based on the records of patients hospitalized for tetanus in the infectious diseases and tropical department of the University Hospital of Fann and collected from 1 January 2015 to 31 December 2022.

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Results: Over an 8-year period, 517 cases of tetanus were selected, with an average age of 30.9 ± 21.7 years. The median age was 24 years, with extremes of 2 and 90 years. The distribution of cases according to sex revealed a clear male predominance, with a sex ratio of 4.94. The profession was not specified for 47% of patients. The population most affected was represented by students (20.9%) and manual workers (18.8%). In terms of origin, 65.6% of the cases recorded came from suburban areas. The classic signs of tetanus were found: trismus (99.2%), dysphagia (84.5%) and tonic paroxysms (61.01%). The absence of a vaccination record was noted in 99.4% of cases. The main the portal of entry, for tetanus was integumentary in 397 cases (76.8%), with tetanus presenting mainly in the generalized form in 98.1% of cases. The incubation period was greater than or equal to 7 days in 63.06% of cases, and the invasion period was greater than or equal to 48 hours in 39.8% of cases. With regard to serotherapy, 89.2% of cases were treated intrathecally, and the main complications were cardiovascular (19.5%), infectious (14.1%) and respiratory (10.3%). 19.9% of cases were fatal.

Conclusion: Although tetanus has become an exception in developed countries, it continues to pose a real public health problem in countries with limited resources, despite the existence of a vaccine that is now accessible, effective and completely safe. In Senegal, despite the efforts of the Expanded Programme on Immunisation, the incidence of tetanus in hospitals remains high, hence the importance of booster vaccinations and raising public awareness, especially among young people and manual workers.

Keywords: Tetanus; epidemiology; prognostic; Dakar.

1. INTRODUCTION

Tetanus is an acute, non-immunising, non-contagious infection caused by a gram-positive, spore-forming, strictly anaerobic, telluric bacillus called *Clostridium tetani* or *Nicolaier's bacillus* (Lamy, 2021). It is an exceptional disease in developed countries, but continues to pose a public health problem in countries with limited resources (Bletterly & Doise, 2004; Cailliez et al., 1991). Indeed, the epidemiological situation around the world varies greatly depending on the level of development of individual countries. In October 2020, the World Health Organisation estimated that 14,745 cases of tetanus had been reported worldwide (World Health Organization, n.d.; World Health Organization, n.d.), with 82% of cases and 77% of deaths occurring in sub-Saharan Africa and South Asia (Behrens et al., 2019). Incidence varies from country to country, ranging from 10 to 50 cases per 100,000 inhabitants per year, and all ages are affected (World Health Organization, 2020). The high incidence of tetanus in this region can be explained, among other things, by the environment of hot, humid tropical soil, rich in organic matter and conducive to the germination of tetanus spores, inadequate wound care and low levels of public awareness (Woldeamanuel et al., 2016). In addition, the lack of adequate technical facilities and difficulties in accessing healthcare increase the risk of mortality (Woldeamanuel et

al., 2016). In Senegal, despite the Expanded Programme on Immunisation (EPI) set up by the Ministry of Health in 1981, tetanus remains a frequent cause of hospitalization. Seydi (Seydi et al., 2005) found a hospital prevalence of 11%. The case-fatality rate was 30% in the Tanon study in Abidjan (Tanon et al., 2017) and 21% at Fann hospital between 2009 and 2012 (Fortes Déguénonvo et al., 2015). In order to update data on tetanus, which remains a serious disease in our context, we initiated this study with the aim of describing the epidemiological, clinical and prognostic aspects of patients admitted for tetanus at the infectious and tropical diseases department of the University Hospital of Fann.

2. PATIENT AND METHODS

2.1 Study Design and Patient

This is a retrospective, descriptive study based on the records of patients hospitalised for tetanus at the at the infectious and tropical diseases department of the University Hospital of Fann and collected from 1 January 2015 to 31 December 2022. The patients included in this study were those hospitalized regardless of their sex and aged at least 1 year or more and for whom the diagnosis of tetanus was established, whether isolated or associated with another pathology.

2.2 Operational Definition of Variables

The diagnosis of tetanus was based on the following arguments:

- Epidemiological arguments: absence of vaccination or incomplete vaccination, presence or absence of an entry point
- Clinical arguments: trismus and/or contractures and/or dysphagia and/or tonic or tonic-clonic paroxysms.
- Incubation is defined as the time between cutaneous or mucosal invasion and the appearance of the first sign.
- Invasion is defined as the time between the first sign and the generalization of signs.

2.3 Data Collection

The list of records to be included was obtained from the Médical information cell database. Following this list, the records found were extracted from the archives and analyzed on site by filling in the standard form. The data were collected using a standard form comprising items divided into five parts:

- **Socio-demographic aspects:** year, age, sex, geographical origin, occupation,

education, marital status, previous tetanus vaccination,

- **Clinical aspects:** existence of comorbidity, route of entry, clinical form, duration of incubation and invasion, trismus, dysphagia, temperature, pulse, tonic and tonic-clonic paroxysms,
- **Prognostic aspects:** time and duration of hospitalisation, classification by Mollaret stage (Table 1), classification by Dakar score (Table 2).
- **Therapeutic and evolutionary aspects:** aetiological treatment (antibiotics, trimming of the portal of entry, anti-tetanus serotherapy), symptomatic treatment (sedatives, muscle relaxants, tracheotomy, etc.), evolution (cure or death, complications).

2.4 Statistical Analysis

Data was entered using Excel. The categorical variables were expressed as proportions, and the quantitative variables as mean and standard deviation (in the case of a normal distribution) or as median with extremes (in the case of a non-normal distribution).

Table 1. Classification by Mollaret stage (Mollaret et al., 1960)

Stage	Signs
Stage I	Trismus+/- contracture
Stage II	Stage I + dysphagia and /or tonic paroxysms
Stage III	Stage II + tonic-clonic paroxysm with two sub stages : <ul style="list-style-type: none"> • IIIA : tonic-clonic paroxysms occur after 72H. • IIIB : tonic-clonic before 72H.

Table 2. International classification by “Dakar score” (Vachon, 1975)

Prognostic elements	1 point	0 point
Incubation	< 7 days	≥7 days
invasion	< 2 days	≥2 days
Portal of entry	- umbilicale - Uterine - Intramuscular - Surgical - Open Fractures - Extensive burns	Other or not found
.paroxysm	Present	Absent
.temperature	> 38,4°C	≤ 38,4°C
.pulse	Adult>120/min New born >150/min	≤120/min ≤150/min

3. RESULTS

3.1 Sociodemographic Aspects

Over the 8-year period, 517 cases of tetanus were recorded out of 6,564 hospitalized patients, representing a hospital prevalence rate of 7.87%, with an average of 64 cases per year. The highest number of cases was observed in 2019 (84 cases, or 16.25%). The average age of patients was 30.90 ± 21.72 years, and the most representative age group was between 2 and 15 years (36.75%), followed by 16 to 45 years (35.58%). The distribution of tetanus cases by sex shows a clear male predominance of 430 cases (83.1%), giving a sex ratio M/F of 4.94 (Table 3). More than half of the patients came from suburban areas (65.6% of cases %). Occupation was not specified for 47% of our patients. The population most affected were school students (20.9%) and manual workers (18.8%). In addition, 99.4% had not been vaccinated or had a doubtful vaccination status because they did not have a vaccination record.

3.2 Clinical aspects

The average hospital stay was 4.31 ± 5.87 days. Of the 517 cases recorded, an entry site was found in 470 patients, i.e. 90.9% of cases, 84.46% of which were of integumentary origin, 8.7% surgical and 6.5% post-circumcision (Table 3). Most of the integumentary entry sites were recent wounds in 71.6% of cases, with the lower limbs predominating (57.6%), followed by the upper limbs (10.6%). The acute generalised form was the most representative, accounting for

98.1% of patients. The incubation period was more than or equal to 7 days in 63.06% of cases, with an average of 24.42 days. The duration of invasion was ≥ 2 days in 39.8% of cases, with an average of 2.8 ± 2.5 days (Fig. 1). The main signs of tetanus on admission were trismus (99.2%), dysphagia (84.5%) and tonic paroxysms (61.10%).

3.3 Prognostic, Therapeutic and Evolutionary Aspects

The patients were mainly classified as stage II according to the Mollaret classification, with 410 patients (79.3%). The median score was 2, with extremes of 0 and 6. 54.5% of patients had a score between 2 and 3. In addition to trimming of the entry portal. Antibiotic therapy consisted of metronidazole in 89.4% of cases, penicillin G in 0.2% and ampicillin in 1.9%. Tetanus serotherapy was administered intrathecally in 89.2% of cases. The other routes used were intramuscular (10.4%) and subcutaneous (0.4%). 59 patients [11.4%] had received a second dose of anti-tetanus serum. A tracheotomy had been performed in 12.4% of patients. A third of our patients (31.9%) had complications, the most common of which were cardiovascular (19.5%), infectious (14.1%) and respiratory (10.3%). Cardiac arrest was the most common cardiovascular complication, with 90 cases (89.1%). Respiratory complications were dominated by chest blockage (35.84%) and laryngeal spasm (28.30%). The average hospital stay was 11.91 ± 7.68 days, with extremes of 0 and 47 days. In our series, the case fatality rate was 19.9%.

Table 3. Socio-demographic, characteristics of tetanus among patients at the infectious and tropical diseases department, Fann hospital, Dakar, 2015-2022

Variables	Number of cases	Percentage (%)
Age group (years)		
2-15	190	36.75
16-45	184	35.58
46 - 60	88	17.02
>60	55	10.63
Sex		
Male	430	83.17
Female	87	16.82
Geographical origin		
Sub urban	340	65.6
Urban	120	23.4
Rural	44	8.5
Not specified	13	2.5

Table 4. Clinical and prognostic characteristics of tetanus among patients at the infectious and tropical diseases department, Fann hospital, Dakar, Senegal 2015-2022

Variables	Number of cases	Percentage (%)
Portal of entry = 470		
Integumentary	397	84.4
Surgical	41	8.7
Circumcision	31	6.5
Dental	14	2.9
Open bill	9	1.9
Uterine	6	1.2
Burn	2	0.4
Signs		
trismus	512	99.20
dysphagia	436	84.50
paroxysm	315	61.10
Mollaret stage		
Stage I	44	8.51
Stage II	410	79.30
Stage III	57	13.66
Not specified	6	1.16
Dakar score		
Score 0	31	5.99
Score 1	171	33.07
Score 2	206	39.84
Score 3	76	14.70
Score 4	18	3.48
Score 5	2	0.38
Score 6	1	0.19
Not specified	12	2.32

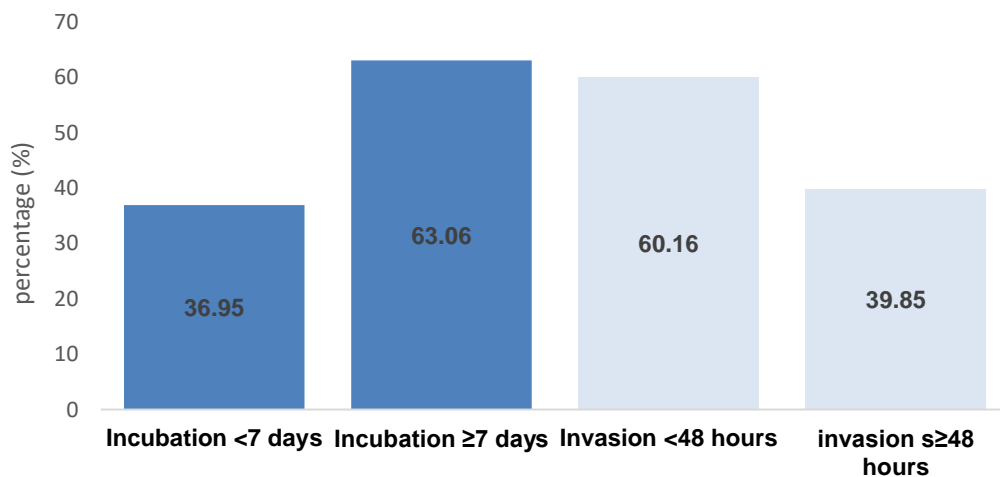


Fig. 1. Incubation and invasion period among patients admitted for tetanus at the infectious and tropical diseases department, Fann hospital, Dakar, 2015-2022

4. DISCUSSION

Tetanus remains a topical condition in our setting. The average age of patients was 30.9 ±

21.7 years, with a predominance of older children and young adults. These results are comparable with those of Attinsounon et al., (2012), who found an average age of 27.8 ± 22.1 years, and

with most African series (Tanon et al., 2017; Fortes Déguénonvo et al., 2015). The young age and male predominance of our study population could be explained by the absence of tetanus toxoid booster vaccination and increased exposure to injury, but also by traditional practices, as reported by Diallo in Côte d'Ivoire (Diallo et al., 2024). Bawe in Togo (Bawe et al., 2023) also noted a clear male predominance. This can also be explained by the fact that women who attend antenatal clinics receive tetanus vaccinations or booster shots. Occupation was not specified for 47% of our patients, although young people and manual workers accounted for the majority of cases. These results show the importance of trauma among manual workers and the lack of management of injuries in the event of exposure. Hence the importance of raising awareness among the general population, and particularly among manual workers.

In addition, the absence of vaccination or doubtful vaccination was noted in 99% of patients, thus corroborating the data of other authors (Bouh, 2023; Traoré et al., 2017). However, the methodology for verifying vaccination status based on the presentation or not of the vaccination record must be qualified. With the Expanded Programme on Immunisation (EPI), many patients probably received the primary vaccination during their 1st year of life, but did not receive the necessary booster shots to complete the vaccination. What's more, these boosters are not included in the EPI, so they are not free. This hampers access to booster doses.

With regard to the routes of entry, the integumentary routes were the most common, in line with the results in Senegal and elsewhere. Seydi et al., (2005) reported it in 73.92% of cases, in Nigeria Ogunrin et al., (2004) in 56% of cases, in Accra in Ghana Hesse IFA (Hesse et al., 2003) found an integumentary portal of entry in 56.9% of cases.

In our series, the generalized form (98.1%) was the rule, corroborating the results of Aba in Côte d'Ivoire Aba et al., (2011). The incubation period was ≥ 7 days in 63.1% of cases. In the literature, the incubation period varies according to the series: Diallo Mbaye et al., (2018) noted an average incubation period of 11 days [10-14 days] in his series on post-circumcision tetanus. Aba et al., (2011) in Abidjan found an average incubation period of 9.5 days in their study of healthcare-associated tetanus.

In terms of prognostic, 79.3% of patients were stage II according to the Mollaret classification, which is comparable to other studies. In Seydi's et al., series (2005), 80% of patients were stage II. In the Soumaré study (Soumaré et al., 2005), this rate was 73.3%. Attinsounou, on the other hand, reported a lower percentage (Attinsounou et al., 2014). The tetanus severity score obtained in the majority of cases in our study was moderate, with a score of between 2 and 3 in 54.5% of cases. These same results have been observed in other studies (Fortes Déguénonvo et al., 2015; Soumaré et al., 2005). 31.9% of patients developed complications. These were mainly cardiovascular, respiratory and infectious, in line with the data reported by some authors (Seydi et al., 2005; Tanon et al., 2017; Fortes Déguénonvo et al., 2015; Aba et al., 2011). The most frequent cardiovascular complication was cardiac arrest (89.1%). In the series by Diallo et al., (2024), infectious complications were found in 43.5% of patients and were mainly related to pulmonary and urinary tract infections.

In our series, the hospital mortality rate was 19.9%. This result is similar to those observed in the department by Ndour et al., (2002) and Seydi et al., (2005) who found an overall case fatality of 23.8% and 22% respectively. However, this lethality is lower than that described by other authors, Soumaré et al., (2005), Attinsounou et al., (2014), and Bawe et al., (2023) found a lethality of 26.7%, 26.9% and 27.4% respectively.

In other series, an even higher case-fatality rate has been reported, in India by Anuradha et al., (2006) (37.78%) and in Mali by Dao et al., (2009) (38.9%). Medical history, the occurrence of complications and pathologies associated with tetanus during hospitalisation are factors with a poor prognosis that require particular attention when managing cases of tetanus. This study was fraught with difficulties, but these did not prevent us from achieving our objectives: Lack of certain data in patients' hospital records - vital signs (pulse, temperature); date of onset of clinical signs; vaccination status difficult to obtain.

5. CONCLUSION

Tetanus remains a public health problem in countries with limited resources, and young people are more likely to be affected. Despite the existence of a vaccine that is accessible, effective and completely safe. In Senegal, despite the efforts made by the

Expanded Programme on Immunisation (EPI), the incidence of tetanus in hospitals remains high. It is important to raise public awareness of the importance, and even the necessity, of vaccinating against tetanus and getting booster shots, especially for at-risk professions such as manual workers. In addition, stock-outs should be avoided in all health facilities through good stock management. Education and communication campaigns on tetanus vaccination are also necessary.

CONSENT

It is not applicable.

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

DECLARATION

Confidentiality was ensured by the identification numbers used to ensure anonymity. Patients' names did not appear on the survey form. These patients will not be identified in scientific publications and/or in various presentations related to this study.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- Aba, T., Kra, O., Ehui, E., Tanon, K. A., Kacou, A. R., Ouatarra, B., et al. (2011). Clinical and developmental aspects of care-related tetanus in the reference service of the teaching hospital of Abidjan. *Bulletin of the Society of Pathology Exot*, 104(1), 38-41. <https://doi.org/10.1007/s13149-010-0092-6>
- Anuradha, S. (2006). Tetanus in adults—A continuing problem: An analysis of 217 patients over 3 years from Delhi, India, with special emphasis on predictors of mortality. *Medical Journal of Malaysia*, 61(1), 7–14.
- Attinsounon, C. A., Fortes Déguénonvo, L., Cissoko, Y., Diop, S. A., Manga, N. M., Dia, N. M., et al. (2014). Direct cost of hospital care and indicators of poor outcome of tetanus in Dakar (Senegal). *Médecine Afrique Noire*, 61, 411-416. https://www.santetropicale.com/sites_pays/resume_oa.asp?id_article=2622&revue=man&rep=senegal
- Attinsounon, C. A., Seydi, M., Cissoko, Y., Fortes-Déguénonvo, L., Diop-Nyafouna, S. A., Manga, N. M., et al. (2012). Tetanus of the child and adult in Senegal: Therapeutic itinerary, epidemiological aspects, clinical features, and outcome. *Rev. CAMES-Série A*, 13(1), 34-37. <https://d1wqtxts1xzle7.cloudfront.net>
- Bawe, L. D., Kotosso, A., Patassi, A. A., Abaltou, B., Naora, O. P., Moukaïla, A. R., et al. (2023). Tetanus, an infectious disease still topical in Lomé, Togo. *Médecine Tropicale et Santé Internationale*, 3(3). <https://doi.org/mtsi.v3i3.2023.273>
- Behrens, H., Ochmann, S., Dadonaite, B., & Roser, M. (2019). Tetanus. Tetanus is a bacterial infection that leads to painful muscle contractions and possibly death. Available at: <https://ourworldindata.org/tetanus>
- Blettery, B., & Doise, J. M. (2004). Tetanus: Prevention and diagnosis. *EMC - Médecine*, 1(2), 151-156.
- Bouh, I. A. (2023). Epidemiological, clinical, therapeutic, and evolutionary aspects of tetanus in patients hospitalized in the Department of Infectious and Tropical Diseases of the CHU du point G <https://www.bibliosante.ml/handle/123456789/12690>
- Cailliez, M., Aljabi, D., Lawrence, C., Layac, C., Porte, P., Fraisse, F., et al. (1991). Study of tetanus vaccination coverage in the injured: Interest of the Vaccti-test®. *Medicine Mal Infect*, 21(1), 27-31.
- Dao, S., Oumar, A., Maïga, A. I., Diarra, M., & Bougoudogo, F. (2009). Tetanus in a hospital setting in Bamako, Mali. *Médecine Tropicale et Corps Santé Colon*, 69, 485–487.

- Diallo, Z., Mourtada Wadartou, D., Diawara, S., Akpovo Mawusse, C. B., Yao Konan, Z., Mossou, M. C., et al. (2024). Infectious complications during tetanus at the Infectious and Tropical Diseases department in Abidjan, Ivory Coast. *Rev Malienne Infect Microbiol*, 190(1), 13-19.
- Fortes Déguénonvo, L., Leye, M. M. M., Dia, N. M., Ndiaye, R., Lakhe, N. A., Ka, D., et al. (2015). Complication of tetanus: Report of 402 cases at the Fann University Hospital Center of Dakar in Senegal. *Journal of Tropical Diseases*, 4(1). <https://doi.org/10.4182/2329-891X.1000182>
- Hesse, I. F. A., Mensah, A., Asante, D. K., Lartey, M., & Neequaye, A. (2003). Characteristics of adult tetanus in Accra. *West African Journal of Medicine*, 22(4), 291–294. <https://doi.org/10.4314/wajm.v22i4.28049>
- Lamy, A. (2021). Tests assessing tetanus vaccine immunity: Self-tests are in the pharmacy. *Pharmaceutical Sciences*. ffdumas-03329776.
- Mbaye, K., Lakhe, A., Sylla, K., Cissé, V., Massaly, A., Ka, D., et al. (2018). Post-circumcision tetanus: Epidemiological, clinical, prognostic, and evolutionary aspects of 16 cases collected at the Department of Infectious and Tropical Diseases in Fann Hospital (Dakar). *Bulletin of the Society of Pathology Exot*, 111, 275–277. <https://doi.org/10.3166/bspe-2019-0051>
- Mollaret, P., Bastin, R., Goulon, M., Rapin, M., Lissac, J., Pocidallo, J. J., et al. (1960). Le traitement du tétanos au centre de réanimation neuro-respiratoire de l'hôpital Claude Bernard (Les renseignements tirés de 210 observations). *Press Médicale*, 68, 217–220.
- Ndour, C. T., Soumaré, M., Diop, B. M., Touré, A. K., & Badiane, S. (2002). Twenty-one cases of post-abortum and post-partum tetanus in the Dakar teaching hospital. *Médecine et Maladies Infectieuses*, 32(8), 399–404.
- Ogunrin, O. A., & Unuigbo, E. I. (2004). Tetanus: An analysis of the prognosticating factors of cases admitted into the medical wards of a tertiary hospital in a developing African country between 1990 and 2000. *Nigerian Postgraduate Medical Journal*, 11(2), 97-102.
- Seydi, M., Soumaré, M., Gbangba-ngai, E., Mougué Ngadeu, J. F., Diop, B. M., N'diaye, B., et al. (2005). Current aspects of pediatric and adult tetanus in Dakar. *Medicine and Infectious Diseases*, 35, 28-32. <https://doi.org/10.1016/j.medmal.2004.11.003>
- Soumaré, M., Seydi, M., Ndour, C. T., Diack, K. C., Diop, B. M., & Kane, A. (2005). Cardiovascular events in the course of tetanus: A prospective study on 30 cases in the infectious diseases clinic, in the Fann teaching hospital, Dakar. *Médecine et Maladies Infectieuses*, 35(9), 450–454. <https://doi.org/10.1016/j.medmal.2005.09.005>
- Soumaré, M., Seydi, M., Ndour, C. T., Ndour, J. D., & Diop, B. M. (2005). Epidemiology, clinical features, and prognosis of juvenile tetanus in Dakar, Senegal. *Bulletin de la Société de Pathologie Exotique* (1990), 98(5), 371-373.
- Tanon, A. K., Doumbia, A., Coffie, P. A., Asséké, B., Ehui, E., Aoussi, F. A., et al. (2017). Current prognostic factors of tetanus in Abidjan: 2005-2014. *Journal of Microbiology and Infectious Diseases*, 7(3), 125-131. <https://doi.org/10.5799/jmid.367529>
- Traoré, A. M., Coulibaly, I., Dabo, G., Cissé, H., Diallo, K., Soukho-Kaya, A., et al. (2017). Tetanus associated with road accidents in the infectious diseases department of Point G University Hospital, Bamako, Mali. *Médecine et Santé Tropicales*, 27, 176–181. <https://doi.org/10.1684/mst.2017.0667>
- Vachon, F. (1975). IV congrès international sur le tétanos (Dakar 6-11 Avril 1975). *Médecine et Maladies Infectieuses*, 5, 310–311.
- Woldeamanuel, Y. W., Andemeskel, A. T., Kyei, K., Woldeamanuel, M. W., & Woldeamanuel, W. (2016). Case fatality of adult tetanus in Africa: Systematic review and meta-analysis. *Journal of Neurological Sciences*, 368, 292-299. <https://doi.org/10.1016/j.jns.2016.07.025>
- World Health Organization. (2020). Progress towards the elimination of maternal and neonatal tetanus worldwide, 2000–2018. *BEH*, 95, 173–183.

World Health Organization. (n.d.). Immunization coverage. <https://www.who.int/en/news-room/fact-sheets/detail/immunization-coverage>

World Health Organization. (n.d.). Key points on tetanus. <https://www.who.int/en/news-room/fact-sheets/detail/tetanus>

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