

Outbreak of beriberi in a prison in Côte d'Ivoire

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Abstract

Background. A beriberi outbreak occurred in the Maison d'Arrêt et de Correction d'Abidjan (MACA), a detention center in Abidjan, Côte d'Ivoire, between October 2002 and April 2003.

Objective. A retrospective investigation was conducted to document the outbreak in April 2003.

Methods. A descriptive analysis and a case-control study were performed. A probable case patient was defined as a person detained in the center between October 2002 and April 2003 with at least two of the following symptoms: bilateral leg edema, dyspnea, positive squat test, motor deficiencies, and paresthesia. A definite case patient was defined as a probable case patient who showed clinical improvement under thiamin treatment.

Results. Of 712 cases reported, 115 (16%) were probable and 597 (84%) were definite. The overall attack rate was 14.1%, and the case fatality rate was 1.0% (7/712). The highest attack rate was reported in the building housing prisoners with long-term sentences (16.9%). All patients were male, and the mean age was 28 years. During the period studied, the penal ration provided a fifth of the quantity of thiamin recommended by international standards. After adjustment for potential confounders, a history of cholera infection (adjusted odds ratio [OR_a], 12.9; 95% confidence interval [CI], 2.9 to 54.1) and incarceration in the building for severe penalties (OR_a 4.8; 95% CI, 1.3 to 18.5) were associated with the disease.

Conclusions. Beriberi has been underreported among prisoners. Further attention should be given to its risk factors, especially a history of acute diarrhea. Systematic

food supplementation with vitamins and micronutrients should be discussed when the penal ration does not provide the necessary nutrient intake recommended according to international standards.

Key words: Beriberi, Côte d'Ivoire, outbreak, prison

Introduction

Deficiency of thiamin (vitamin B₁) may cause beriberi, a disease that still occurs frequently in developing countries among populations with severely restricted diets or with a refined rice-based diet. Rarely, beriberi—commonly called “occidental beriberi”—is reported in industrialized countries among chronic alcoholics, intravenous drug users, patients depending on total parenteral nutrition, and the elderly [1-4]. More recently, cases of occidental beriberi have been reported in patients undergoing gastric bypass surgery or patients with a long-lasting hyperemesis gravidarum [5-7].

Outbreaks of beriberi have been reported in prisons and among refugees and internally displaced persons [8-11]. These populations are much more vulnerable to micronutrient deficiency diseases because their food intake depends mainly on outside sources. In such contexts, standard food supplies target 2,100 kcal/person/day, whereas micronutrient needs have received less attention. An outbreak of beriberi occurred in the Maison d'Arrêt et de Correction d'Abidjan (MACA), a detention center in Abidjan, Côte d'Ivoire, between October 2002 and April 2003. The medical nongovernmental organization, Médecins Sans Frontières, which had been present in the prison since 1996, provided assistance to control the outbreak. A retrospective investigation was carried out in order to describe the outbreak patterns and provide recommendations for patient treatment and disease control.

With an official capacity of 1,500 prisoners, the 30-year-old prison had an estimated population of

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5,500 inmates. Living conditions were precarious because of the high population density. The inmates were housed in six buildings: two (buildings A and B) for adult men, one (building C) for prisoners serving long-term sentences, one (the "assimilated" building) for high-profile prisoners, one (building W) for women, and one (building M) for minors aged 15 to 18 years. A penal ration was distributed once daily. Because of the insufficient budget allocated for the prison's food purchases, the rations were known to provide an insufficient daily caloric intake, estimated at less than 1,000 kcal/day.

Médecins Sans Frontières was involved in several components of the prison's health center: medical care in outpatient and inpatient departments, a supplementary feeding program, a tuberculosis program, and sanitation. A memorandum of understanding between Médecins Sans Frontières and the authorities acknowledged the rights of the detainees under national and international law. For this study, the authors obtained consent from the penitentiary administration and the director of the prison under the authority of MSF Paris Headquarters. Médecins Sans Frontières was allowed to develop these medical activities in accordance with these standards and to report to the authorities on important shortfalls on such issues [12]. The insufficient quantity of the daily caloric intake provided by the penal ration is a common problem in resource-limited countries, generated by budget constraints rather than a deliberate intention to violate detainees' human rights. Penitentiary authorities mitigate this shortfall by allowing relief agencies to perform nutritional activities and complementary distribution, and also by relying on the internal food market of the prison. However, these mechanisms do not ensure security of the nutritional status of a segment of the detainees who are affected by additional vulnerabilities or social exclusion.

The MACA is located in the Yopougon neighborhood of Abidjan, which is known to have regular difficulties in water supply. As a result of the prison's poor sanitation conditions, health hazards were frequently observed. A cholera outbreak occurred in the prison from September to November 2002, with a total of 443 cases and a case fatality rate of 5% (22/443). Between November and December 2002, an outbreak of *Shigella dysenteriae* type 1 was reported, with a total of 113 cases and a case fatality rate of 3% (3/113). Early in October 2002, bilateral leg edema was reported among several prisoners, which did not subside despite admission of the patients to the therapeutic feeding program. The affected prisoners also complained of sensitive disorders and leg weakness. Beriberi was suspected on the basis of these clinical indicators. Thiamin treatment was initiated and produced rapid clinical improvement. No laboratory tests were performed to confirm the diagnosis. In February 2003, in the face of an increased number of cases of beriberi, Médecins

Sans Frontières opened a specific clinic for the management and follow-up of beriberi. In April 2003, a retrospective investigation was conducted to document the outbreak.

Materials and methods

Epidemiological investigation

A retrospective investigation was carried out to analyze data collected from October 2002 to April 2003. Data were collected from hospital files, individual follow-up cards from the nutritional program, and medical files from the outpatient department. Socio-demographic characteristics, date of entry, location of detention in the prison, medical background, type of food intake, and clinical and therapeutic characteristics were described. The temporal distribution of cases was based on the date of diagnosis of beriberi, since the date of first clinical signs was not recorded during the epidemic.

Case definitions

Because the investigation was performed retrospectively, no laboratory tests were performed to confirm the clinical diagnosis. Therefore, a case of beriberi was defined on the basis of clinical signs, using the World Health Organization (WHO) case definition [13]. A probable case patient was defined as a person detained in the MACA between October 2002 and April 2003 with at least two of the following symptoms: bilateral leg edema, dyspnea with exertion or at rest, positive squat test, motor deficiencies (i.e., stepping gait or loss of balance), and paresthesia of the extremities. A definite case patient was defined as a patient meeting the criteria of a probable case with improvement of clinical signs under thiamin treatment. The combined form of beriberi was defined by the presence of at least one neurological symptom and one cardiac symptom.

Case patients were treated orally with 100 mg of thiamin daily during the first week, then 50 mg daily for the following 6 weeks. For severe cases with dyspnea at rest or for patients unable to walk unassisted, 100 mg of thiamin was administered intravenously for the first 2 to 3 days before switching to oral treatment.

A patient was classified as cured if, after a full course of thiamin treatment, there were no clinical signs of beriberi at the last recorded visit. A patient was classified as improved if there was persistence of at least one clinical sign at the last recorded visit. A patient was classified as not improved if there were no signs of clinical improvement at the last recorded visit. A patient was classified as relapsed if a second episode of beriberi was diagnosed after he was cured of the first episode.

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Case-control study

In a person with insufficient thiamin in the diet, the clinical signs of beriberi usually appear 2 to 3 months after the period of exposure [14]. Therefore, based on the date of the first case diagnosed, the at-risk period was defined as the period from August 1, 2002, to January 1, 2003.

A patient was included in the study if he was classified as a definite case patient, was alive, had entered prison before August 1, 2002, and was present in the prison during the entire period of the study. Patients were selected with a simple random sampling method. Relapsed patients were excluded. Controls had been admitted to the prison before August 1, 2002, were still alive at the time of the study, were without any clinical signs or history of beriberi, and had never been treated with thiamin. Controls were selected by a two-stage cluster sampling method [15, 16]: a random number of cells was selected among a total of 198 cells shared across the four prison buildings (A, B, C, and M) (first stage); controls were randomly selected within the cells (second stage). If we assume that 40% of the controls were exposed to insufficient thiamin intake, 30 cases and 90 controls needed to be included in the case-control study to guarantee a minimum detectable odds ratio of 3.5, with a 95% confidence interval and a power of 80%.

Informed oral consent was obtained in the presence of an eyewitness before subjects were included in the study. In order to respect the confidentiality of the interview, detainees were questioned without the presence of guards or supervisors. Data were collected with a standardized questionnaire. Potential risk factors were investigated related to sociodemographic characteristics, medical background, activities conducted in prison during the period (e.g., arts and crafts, haircutting), source of income (e.g., family, workshop activities), and food intake (penal ration and additional food supplies).

Evaluation of the nutritional value of the food intake

The daily penal ration was composed of rice and a sauce made of dried fish, eggplant, onions, and tomato purée. A supplementary daily penal ration was distributed to hospitalized tuberculosis patients and to patients discharged from the therapeutic feeding program for a period of 3 months following discharge. The nutritional value of the penal ration was calculated according to international references [17] and expressed as kcal/person/day.* Thiamin intake was calculated by adding up the thiamin value of each ingredient and was expressed in mg/person/day.

* Analysis of the diet plan, MACA, Abidjan RCI. Report by Médecins Sans Frontières—France, March 2002.

In the therapeutic feeding program, moderate malnutrition was defined by a body mass index (BMI) between 16 and 17 or a weight-for-height index between 70% and 79%, and severe malnutrition was defined by a BMI of less than 16 or a weight-for-height index of less than 70% with presence of edema.** One nutritional meal was provided daily to moderately malnourished detainees, and two meals were provided to those severely malnourished. The nutritional meal was made of precooked UNIMIX flour (80% maize, 20% bean sprouts) produced locally and enriched in vitamins and minerals.

Additional food sources available in the prison were vegetables from the garden, the tolerated prison market, and food provided by families. But because of the political crisis in the country, repeated security incidents were ongoing in the neighborhood and inside the prison. Access to the prison market and the garden had been restricted. Family visits were also suspended, and movements inside the prison of the detainees as well as the medical personnel had been maintained at the minimum since the end of 2002. In addition, food stocks for the market were reduced due to administrative restrictions and lack of external supplies.

Food basket evaluations (i.e., assessment of the general ration foods of the detainees) were regularly made inside the prison. However, no control of the penal ration or of its distribution was conducted on a daily basis. Médecins Sans Frontières had identified chronic deficiencies in the quantity and quality of the penal ration distributed. A report*** was written that recommended increasing the nutritional component of the penal ration and providing an adequate food ration. After the outbreak, this report was presented by the prison authorities to the Ministry of Justice who consequently increased the prison's food budget. But, this increase still remained insufficient.

Statistical analysis

The weekly attack rate was calculated and expressed in number of cases/100 detainees/week. Attack rates were calculated for each building and for the overall time period. Both the probable and the definite cases of beriberi were included for the calculation of all attack rates. For the descriptive study, characteristics were compared by a χ^2 test or Fisher's exact test for qualitative variables and student's *t*-test or the nonparametric Mann-Whitney test for quantitative variables. Differences were considered statistically significant if the two-sided *p* value was less than .05.

** Protocol treatment of malnutrition in adults, Detention Center of Abidjan, Côte d'Ivoire. Report by Médecins Sans Frontières—France, August 2002.

*** Food supply for the MACA Prison, Abidjan, Côte d'Ivoire. Report by Médecins Sans Frontières—France, April 2003.

For the case-control study, factors significantly associated with beriberi in the univariate analysis ($p < .25$) were included in a multivariate logistic regression model. The final model was obtained through a backward stepwise procedure to analyze important risk associations while adjusting for potential confounders. For each risk factor, an adjusted odds ratio (OR_a) and its 95% confidence interval (CI) estimated the association [18]. The Hosmer-Lemeshow χ^2 test was applied to evaluate the fit of the models [19]. Statistical analyses were performed with Epi Info, version 6.04d, and SPSS, version 10.0.

Results

Epidemiological investigation

A total of 712 cases were reported from October 13, 2002 (week 41), to April 4, 2003 (week 14). Of these, 115 (16%) were classified as probable and 597 (84%) as definite cases of beriberi. The overall attack rate was 14.1% for an estimated at-risk prison population of 5,038 detainees. The location in the prison was reported for 687 cases (96%). During the study period, building C had the highest attack rate (16.9%) (table 1).

From week 41 to week 47, 2002, an average of one new case per week was reported. Between week 48, 2002, and week 7, 2003, the number increased to six new cases per week. A peak of 259 cases was reported during week 8 of the year 2003, with active detection of beriberi cases in all six buildings on February 21, 2003. From March to April 2003, the number of cases reported continually decreased (fig. 1).

No cases were reported among women or highly ranked prisoners. The mean age of the 712 patients was 28 years (range, 15 to 73 years). The mean length of stay in the prison was 12.4 months (range, 7 days to 20 years). Of the 712 reported cases, 90 (13%) were cardiac beriberi, 29 (4%) were neurological beriberi, and 593 (83%) were the combined form. The most frequent clinical symptoms were paresthesia in 603 patients (85%) and leg edema in 534 patients (75%).

The first case was detected on October 13, 2002, and the first treatment with thiamin was initiated on the same day. Ninety-nine percent of patients ($N = 708$) benefited from the treatment. With regard to outcome of the cases, 46% ($N = 325$) were cured, 38% ($N = 272$) reported improvement at their last medical visit, 13% ($N = 90$) were lost to follow-up or released from prison, 3% ($N = 18$) did not improve, and 7 died, for a case fatality rate of 1%.

TABLE 1. Cases of beriberi in the Maison d'Arrêt et de Correction d'Abidjan (MACA), Côte d'Ivoire, October 2002–April 2003 ($N = 712$)

Building where cases occurred	Attack rate/100 detainees	No. of cases	No. of detainees	p^a
C	16.9	187	1,104	Reference
M	14.9	11	74	.6
A	13.4	297	2,223	.005
B	11.7	192	1,637	.0001
Not specified	—	25	—	—
All cases	14.1	712	5,038	—

a. χ^2 test.

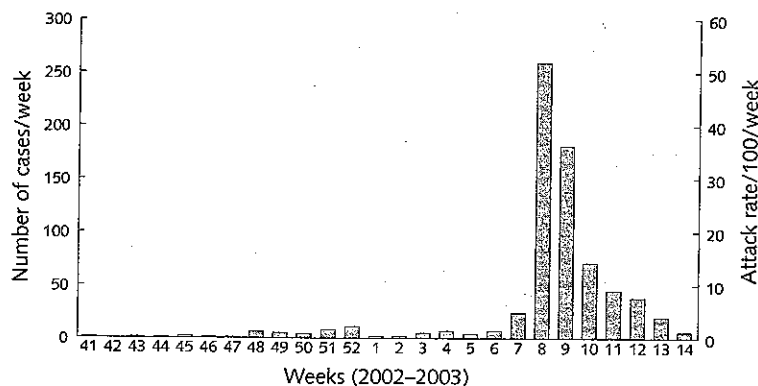


FIG. 1. Weekly attack rate per 100 detainees and weekly number of cases in the Maison d'Arrêt et de Correction d'Abidjan (MACA), Côte d'Ivoire, October 13, 2002–April 4, 2003 ($N = 712$)

Evaluation of the nutritional value of food intake

From August 2002 to April 2003, all beriberi patients had access to the daily penal ration. The ration provided a mean caloric intake of 945 kcal/detainee/day. The mean thiamin intake measured was 0.23 mg/detainee/day.

In the therapeutic feeding program, the mean number of beneficiaries was 221 inmates for the studied period. In addition to the penal ration, the moderately malnourished patients received one nutritional meal providing 1,336 kcal and 0.5 mg of thiamin per day, and the severely malnourished patients received two nutritional meals providing 2,672 kcal and 1 mg of thiamin per day.

Chronology of the control measures taken

After the sudden increase in the number of cases in February 2003, control measures were taken by the penitentiary authorities, involving an increase in the quantity of the penal ration and the modification of its mode of distribution. Before and during the epidemic, up to the end of February 2003, the penal ration was distributed by the inmates, who were responsible for collecting the rations at the prison kitchen. As a result, food was withdrawn from the penal ration and uneven portion sizes were distributed to the detainees. In March, the penal ration was brought in cooking pots to the entry of each building and was distributed directly to each detainee. These measures enabled the detainees to receive a more equitable quantity of food. Additionally, in March, Médecins Sans Frontières introduced QB MIX, a nutrient supplement enriched with vitamins and micronutrients that was designed to prevent nutritional deficiencies in emergency situations. This nutrient supplement was distributed in the penal ration rice twice a week. One dose of QB MIX provided 1.2 mg of thiamin and encompassed all the nutritional needs for vitamins and minerals. Other significant measures were taken to increase food access for the detainees: an increase in the number of family visits, access to the garden, acceptance of the activities related to the prison market, sensitization of the medical staff to early finding of beriberi cases, and an increase in the prison budget for food to an estimated US\$1/person/day.

Case-control study

We investigated risk factors that existed during the period from August 1, 2002, to January 1, 2003. No cases of beriberi were reported among women, who had access to additional food sources inside and outside the prison. No cases were reported among highly ranked prisoners (detained in the assimilated building) for similar reasons. Thus, the population investigated

for the case-control study was chosen from male residents of buildings A, B, C, and M. Thirty case patients and 88 controls were selected. There were no differences between case patients and controls in median age (27 vs. 26 years, $p = .2$) and length of stay in prison (14.4 vs. 14.9 months, $p = .9$).

In the univariate logistic regression, being located in building C at the onset of symptoms (OR, 4.7; 95% CI, 1.4 to 15.6), having a history of cholera during the risk period (OR, 9.0; 95% CI, 2.5 to 32.1), having no additional food sources (OR, 2.5; 95% CI, 1.1 to 5.9), having no family visits (OR, 3.1; 95% CI, 1.1 to 8.3), and having no source of income (OR, 2.8; 95% CI, 1.2 to 6.7) were significantly associated with the disease. A history of malaria or shigellosis, specific nationality or residency, and having been previously followed in the therapeutic feeding program were not associated with illness (table 2).

After adjustment for potential confounders, a history of cholera (OR_a, 12.9; 95% CI, 2.9 to 54.1) and residence in building C (OR_a, 4.8; 95% CI, 1.3 to 18.5) remained associated with illness (table 3).

Discussion

We report here a large outbreak of beriberi in a prison context, with more than 700 cases among an overall at-risk population of 5,000 detainees. The overall attack rate (14%) was close to the rates in previous outbreaks in prisons in West Africa (19%) and Taiwan (24%) [8, 10]. The case fatality rate observed in this study was relatively low (1%), probably because of the prompt initiation of thiamin treatment.

The combined form of beriberi was the most frequently diagnosed clinical form. These findings are similar to those described for other outbreaks in detention centers [8, 10, 20]. The absence of cases among women was probably related to the fact that they cooked their own meals inside the prison with various ingredients brought to them during visits or bought in their own prison market. Likewise, no cases of beriberi were detected among the highly ranked prisoners, who had better access to a variety of additional food sources.

Between August 2002 and April 2003, the nutritional intake in the detention center was significantly below international recommendations. The caloric content of one penal ration represented 45% of the daily 2,100 kcal and the thiamin content represented 18% of the daily 1.2 mg recommended by the World Food Programme and WHO [17]. For detainees with moderate malnutrition receiving UNIMIX flour in the feeding program, the total thiamin intake was below recommended standards [17]. Thus, the therapeutic feeding program did not prevent beriberi illness.

Our results showed different attack rates among the

TABLE 2. Univariate analysis of risk factors associated with beriberi in the Maison d'Arrêt et de Correction d'Abidjan (MACA), Côte d'Ivoire, April 2003

Variable	Cases (N = 30)	Controls (N = 88)	OR	95% CI
	no. (%)			
Nationality				
Ivorian	18 (60.0)	58 (65.9)	1.0	
Other	12 (40.0)	30 (34.1)	1.3	0.5-3.0
Residency				
Abidjan	25 (83.3)	81 (92.0)	1.0	
Other	5 (16.7)	7 (8.0)	2.3	0.7-7.9
Building				
B	5 (16.7)	29 (33.0)	1.0	
A	12 (40.0)	43 (48.9)	1.6	0.5-5.1
C	13 (43.3)	16 (18.2)	4.7	1.4-15.6
History of cholera	9 (30.0)	4 (4.5)	9.0	2.5-32.1
History of shigellosis	2 (6.9)	4 (4.5)	1.5	0.3-8.9
History of malaria	11 (40.7)	25 (28.7)	1.7	0.7-4.2
Previously followed in the nutritional program	5 (16.7)	5 (5.7)	3.3	0.8-12.4
No additional food sources ^a	15 (50.0)	25 (28.4)	2.5	1.1-5.9
No family visits	24 (80.0)	48 (56.5)	3.1	1.1-8.3
No prison chores	26 (86.7)	62 (70.5)	2.7	0.9-8.6
No source of income	15 (50.0)	23 (26.1)	2.8	1.2-6.7

OR, odds ratio; CI, confidence interval

a. Penal ration and nutritional feeding meal excluded.

TABLE 3. Multivariate analysis (final model) of risk factors for beriberi in the Maison d'Arrêt et de Correction d'Abidjan (MACA), Côte d'Ivoire, April 2003^a

Variable	OR _a (95% CI)
Building	
B	1.0
A	1.8 (0.5-6.5)
C	4.8 (1.3-18.5)
History of cholera	12.9 (2.9-54.1)
No prison chores	3.7 (0.9-14.7)
No source of income	2.6 (1.0-7.0)

OR_a, adjusted odds ratio; CI, confidence intervala. Model fit: Hosmer-Lemeshow $\chi^2 = 1.6$, $p = .92$.

different buildings. The penal ration was not equally distributed to all buildings before and during the outbreak. Some detainees—such as the prisoners of building C with long term sentences—were isolated. They performed no chores and had no sources of income, and therefore had no access to additional food sources (e.g., market, external food sources, or garden). Consequently, they were more vulnerable to thiamin deficiency. For this group, the attack rate was the highest and the risk of illness was 5 times higher than for prisoners of building B. Prisoners with a history of cholera were also significantly at risk for illness.

There are several limitations to our study that require

discussion. The documentation of the beriberi outbreak in the MACA prison was performed retrospectively on the basis of data collected from October 2002 to April 2003. Consequently, no biological investigations were performed to confirm the clinical diagnoses. Missing data for some clinical symptoms did not permit an accurate count of all "probable cases" among all detainees. Therefore, the number of cases of beriberi and the global attack rate have probably been underestimated in this study. The temporal distribution of cases was based on the date of diagnosis of beriberi. The peak observed on February 21, 2003, was due mainly to active case detection organized that day in all buildings. The curve would probably have been more enlarged and spread over time if the case definition had been based on the date of the first clinical signs. In such conditions, the trend in weekly distribution should be interpreted carefully.

Because interviews were performed retrospectively, a possible differential recall bias between cases and controls could have influenced the magnitude of the odds ratios estimated for the association between beriberi and the studied risk factors. However, we estimated that interviewees had an acceptable memory recollection when events such as cholera infection occurred, and the data collected were systematically cross-checked with information contained in the medical files.

Beriberi outbreaks resulting mainly from inadequate

food aid rations have been described among internally displaced and refugee populations [9, 11, 21–25]. Elsewhere, thiamin deficiency has been described in an apparently healthy population of workers in the Middle East, due to the limited variety of food and no provision of essential nutrients by their employers [26]. Prisoners are also at risk for beriberi for similar reasons [8, 10, 20, 27]. The penal food ration in our study was comparable in nutritional terms to those described in Taiwan and Thailand [8, 22]. We determined that these rations provide less than one-fifth of the recommended daily thiamin intake, and because cooking reduces the vitamin content by up to 50%, the thiamin intake was most likely less than the estimated value. Because supervision of buildings inside the prison was mostly self-managed by the prisoners themselves, there were reports of unequal distribution of food rations. Additional factors associated with beriberi in prison populations include being detained in the isolation ward, not having additional food sources or financial support, the length of detention, and having no network of relations among the prisoners [8].

In the case-control study, we showed that prisoners with a history of cholera were at risk of developing beriberi. This was not found to be the case for patients with a history of shigellosis, probably because the number of shigellosis cases was so small. Although fever, diarrhea, and vomiting have been described as predisposing causes of beriberi, to our knowledge the relationship between cholera and beriberi found in our study has not previously been described in the literature [13, 14, 28]. Further research is necessary to confirm these findings and to better understand the physiopathological role that diarrheal infections can play in the onset of illness. In a population where there is a chronic thiamin deficiency, diarrheal diseases can worsen that deficiency and pave the way for beriberi.

Micronutrient deficiency diseases such as beriberi, pellagra, and scurvy are frequently underreported in prison populations. In this specific population, antisocial behavior in young adult prisoners seemed to be significantly reduced when supplementary vitamins and minerals were provided [29]. In the Abidjan detention center, the control measures taken by the authorities and by Médecins Sans Frontières starting in February 2003 were appropriate for preventing the appearance of new beriberi cases. Therefore, because it was known that the food ration for prisoners did not

provide the necessary nutrient intake recommended by international standards, these measures should have been taken much earlier. We demonstrated that QB MIX, a food supplement added to the meal, was easy to use and feasible over the long term in such a context. It is a good alternative to a daily oral medication for preventing nutritional deficiency. Providing a food supplement of vitamins and micronutrients should be systematically discussed for such an at-risk population. Overall, the measures taken to control the beriberi outbreak and prevent similar outbreaks from occurring were proven to be efficient while giving a true awareness of the nutritional needs of this at-risk population. In December 2005, Médecins Sans Frontières withdrew from the MACA prison while keeping a close relationship with the prison authorities and its medical staff. Since then, no new beriberi outbreak has been reported up to November 2006.

In a prison context, regular assessment of the quantity and quality of the food ration should be performed, taking great care to identify factors aggravating vulnerability linked to the detention patterns. Health care providers should be aware of clinical signs of beriberi in order to detect such events earlier. They should be familiar with and actively inquire about the risk factors. In case of an outbreak, preventive supplements of thiamin should systematically be provided to at-risk detainees, especially to those with acute diarrheal infection or malnutrition. Access to diversified food enriched in thiamin should be promoted in detention centers to prevent outbreaks of beriberi and its consequences in terms of mortality and long-term sequelae.

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