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Investigation of Crew Member Deaths aboard KM Sri Mariana Indonesia: A Case Study Differentiating Leptospirosis and Beriberi

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A B S T R A C T

The death of six crew members aboard the KM Sri Mariana during a prolonged voyage in the Sunda Strait in August 2024 raised concerns of a potential outbreak caused by infectious diseases, particularly leptospirosis. Objective This article aims to analyze the causes of death and illness among the crew members of KM Sri Mariana based on epidemiologial, clinical, and laboratory data, with emphasis on the differential diagnosis between leptospirosis and beriberi. Methods A descriptive case-based study was conducted using data from epidemiological investigations, laboratory examinations of human and environmental specimens (PCR, serology, and vitamin B1 status assessment), and a review of relevant literature on infectious and nutritional deficiency diseases among maritime workers.

Results is Laboratory investigations did not provide strong evidence supporting leptospirosis as the primary cause of the event. In contrast, vitamin B1 deficiency was identified in the majority of examined crew members. These findings were consistent with clinical manifestations, including peripheral edema, muscle pain and weakness, and respiratory distress. The pattern of illness demonstrated a close association between prolonged sea voyages, heavy physical workload, limited nutritional intake, and the development of beriberi. Beriberi due to vitamin B1 deficiency is the most likely etiology underlying the deaths and illnesses among the crew members of KM Sri Mariana.

INTRODUCTION

Maritime workers, including fishermen and ship crew members, are exposed to unique occupational health risks due to prolonged working hours, harsh environmental conditions, limited access to healthcare, and restricted nutritional intake during long sea voyages. These factors may predispose crew members not only to infectious diseases but also to non-communicable conditions related to nutritional deficiencies, which are often overlooked in modern clinical practice.[1-3]

In August 2024, a cluster of deaths occurred among crew members aboard KM Sri Mariana during a prolonged voyage in the Sunda Strait, Indonesia. Six crew members died, while several others experienced acute illness requiring hospitalization. The event raised immediate concern for a possible outbreak of infectious disease, particularly leptospirosis, a zoonotic infection commonly associated with humid environments, poor sanitation, and occupational exposure to contaminated water. Given the working conditions aboard fishing vessels, leptospirosis is frequently considered a primary differential diagnosis in similar maritime incidents.[4]

However, preliminary clinical observations revealed manifestations that were not entirely consistent with severe leptospirosis alone. Severe leptospirosis is typically characterized by acute febrile illness accompanied by jaundice, acute kidney injury, hemorrhagic manifestations, and pulmonary involvement rather than progressive peripheral edema and chronic muscle weakness.[5-6]

In contrast, the presence of progressive peripheral edema, muscle weakness, and respiratory distress observed among the crew members raised suspicion of an alternative or concurrent etiology related to nutritional deficiency, specifically vitamin B1 (thiamine) deficiency leading to beriberi. These clinical features are well documented in wet beriberi and have been reported in outbreaks among populations experiencing prolonged dietary insufficiency, including refugees, institutionalized populations, and maritime workers undertaking long voyages with limited food diversity.[7-8]

Several outbreaks of beriberi among commercial fishermen have been documented in Southeast Asia, particularly in Thailand, where prolonged sea voyages, monotonous diets, and heavy physical workload were identified as major risk factors. These reports highlight the ongoing relevance of beriberi as an occupational health problem in maritime settings and underscore the importance of considering nutritional deficiencies in the differential diagnosis of cluster deaths at sea.[7,9]

This article aims to investigate the causes of death and illness among the crew members of KM Sri Mariana by integrating epidemiological data, clinical findings, and laboratory results. By systematically differentiating between leptospirosis and beriberi, this case-based analysis seeks to contribute to the limited literature on nutritional deficiency-related mortality among maritime workers and to emphasize the need for comprehensive occupational health surveillance, including nutritional assessment, for crew members engaged in prolonged sea voyages.

METHOD

This study employed a descriptive case-based design to investigate a cluster of deaths and illnesses among crew members aboard KM Sri Mariana. The investigation integrated epidemiological, clinical, and laboratory data to identify the most likely etiology of the event.

Epidemiological data and case reports were obtained through a field investigation conducted by the Ministry of Health of the Republic of Indonesia, Directorate General of Disease Prevention and Control. Information collected included demographic characteristics of crew members, timeline of symptom onset, clinical manifestations, duration of the voyage, working conditions aboard the vessel, and availability of food and medical facilities during the voyage.

Laboratory investigations were performed to assess both infectious and non-infectious etiologies and were conducted through a combination of Public Health Laboratories in Salatiga and Jakarta, Hospital Infectious Diseases Laboratory, as well as the National Health Biology Laboratory. Human specimens examined included blood, serum, urine, and lung tissue obtained from deceased cases. Environmental samples, including water and food from the vessel, were also collected where available. Diagnostic testing for leptospirosis included polymerase chain reaction (PCR) and serological assays. In selected specimens, metagenomic analysis was conducted to detect potential infectious agents. To evaluate non-infectious causes, serum vitamin B1 (thiamine) levels were measured in crew members who underwent clinical evaluation.

A literature review was conducted to contextualize the findings of this case within existing evidence on leptospirosis and beriberi, particularly among maritime workers and other populations exposed to prolonged dietary insufficiency and high physical workload. Relevant peer-reviewed articles, outbreak reports, and international guidelines were reviewed and used to support interpretation of the results.

This study utilized secondary data collected as part of a public health response and outbreak investigation. All data were analyzed descriptively, and results are presented in narrative and tabular form without individual identifiers.

RESULTS

Epidemiological Findings

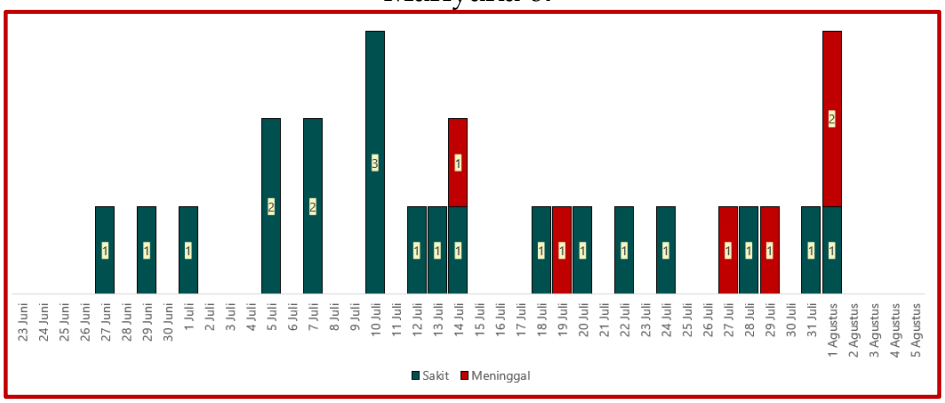
The epidemiological investigation identified a cluster of illnesses and deaths among crew members aboard KM Sri Mariana during a prolonged fishing voyage that commenced in October 2023 and continued until August 2024. The vessel carried a total of 32 crew members who lived and worked in a closed and crowded environment with limited access to healthcare services, fresh food supplies, and nutritional variety.

Of the 32 crew members, six deaths were reported within a relatively short period, while 14 additional crew members developed acute to subacute clinical symptoms requiring medical evaluation and hospitalization after disembarkation. The remaining crew members reported varying degrees of fatigue and reduced physical performance. No similar illnesses were reported

among contacts outside the vessel, supporting an exposure limited to on-board conditions.

Symptom onset occurred predominantly during the later phase of the voyage, after several months at sea, and followed a progressive pattern rather than an acute onset. The most frequently reported symptoms included generalized weakness, myalgia, lower extremity edema, dyspnea, and decreased exercise tolerance. Fever was not a consistent finding among affected crew members.

Grafik 1. The epidemic curve of Suspected Leptospirosis Cases on KM Sri Mariyana 07



The epidemiological curve did not demonstrate features suggestive of a point-source outbreak or rapid person-to-person transmission. Instead, the temporal distribution of cases indicated a cumulative exposure pattern associated with prolonged duration at sea, heavy physical workload, monotonous diet dominated by refined carbohydrates, and limited intake of fresh protein, vegetables, and vitamin-rich foods.

Environmental and occupational assessments revealed demanding physical labor, long working hours, and minimal rest periods. Although the vessel environment included conditions that could theoretically support zoonotic transmission, no specific exposure event, such as flooding, rodent infestation outbreak, or acute contamination episode, was identified during the investigation. Overall, the epidemiological characteristics were more consistent with a chronic occupational and nutritional exposure rather than an acute infectious disease outbreak.

Laboratory Findings

Laboratory examinations were conducted to evaluate both infectious and non-infectious etiologies. Diagnostic testing for leptospirosis using polymerase chain reaction (PCR) and serological assays did not demonstrate consistent evidence of acute leptospiral infection among the examined cases. In selected specimens, metagenomic analysis failed to identify a dominant pathogenic organism that could explain the cluster of severe outcomes.

Table 1. Laboratory Findings for Infectious Etiologies

Specimen	Type of Examination	Result	Laboratory
Serum & Whole Blood (14)	Leptospira PCR (LipL32 & 16S rRNA)	Negative	Regional PHL, Jakarta

Urine (30)	Leptospira PCR (LipL32 & 16S rRNA)	Negative	Regional PHL, Jakarta
Drinking Water & Clean Water (6)	Leptospira PCR (16S rRNA)	Positive (5 samples)	Regional PHL, Jakarta
Lung Tissue (1)	Hanta Virus & Leptospira PCR	Negative	National Laboratory, Salatiga
Whole Blood & Serum (DM)	IgM RDT Serology	Positive	Hospital Infectious Diseases Laboratory
Serum & Whole Blood (14)	Multiplex/Panel of various pathogens	Negative for Leptospira	the National Health Biology Laboratory
Clean Water Sample	Metagenomic WGS for pathogens	Leptospira, Cupriavidus metallidurans, and Bradyrhizobium sp. were found	the National Health Biology Laboratory

In contrast, assessment of nutritional status revealed decreased serum vitamin B complex levels in the majority of symptomatic crew members who underwent laboratory testing. These findings were supported by the absence of laboratory indicators typically associated with severe leptospirosis, such as marked hepatic dysfunction or acute renal failure, in several cases.

Table 2. Laboratory Findings of Vitamin B Complex Examination

N0.Subject	B1 (ng/mL)	B2 (ng/mL)	B3 (ng/mL)	B5 (ng/mL)	B6 (ng/mL)	B9 (ng/mL)	B12 (ng/mL)
Subject 1	6.66	5.96	4.76	24.30	-3.22	-1.12	0.01
Subject 2	5.44	8.21	0.94	11.53	-3.29	-2.35	0.01
Subject 3	5.15	5.47	2.67	34.35	-3.21	-0.86	0.03
Subject 4	4.86	4.95	10.70	13.76	-3.19	-1.48	-0.01
Subject 5	3.87	7.18	7.11	19.63	-3.24	-1.04	0.04
Subject 6	8.20	6.12	35.59	42.06	-2.96	-1.62	0.08
Subject 7	21.56	14.08	81.53	66.97	-2.09	-0.15	0.11
Subject 8	7.49	11.97	39.28	36.62	-2.09	0.61	0.02
Subject 9	6.27	5.36	14.40	20.39	-3.06	-0.71	0.02
Subject 10	53.37	04.02	8.00	28.74	-2.90	-1.49	0.05
Subject 11	11.68	4.32	0.65	19.52	-3.01	-0.62	0.02
Subject 12	8.49	4.56	1.52	16.52	-3.13	-1.37	0.02
Subject 13	13.21	5.81	21.64	33.37	-2.60	-0.05	0.04
Subject 14	7.32	4.19	16.67	18.78	-2.93	-0.62	0.04
Subject 15	07.01	7.74	7.64	19.66	-3.04	-0.91	0.01
Subject 16	4.76	4.80	-2.98	13.72	-3.27	-2.03	-0.04
Subject 17	4.90	3.16	-9.61	6.43	-3.33	-2.23	-0.04
Subject 18	4.41	2.10	2.33	7.23	-3.31	-2.23	0.01

Subject 19	4.20	2.40	2.57	13.07	-3.20	-2.30	-0.05
Normal Range	30 - 77	40 - 240	500 - 8450	22.7 - 429.2	5 - 50	2 - 20	0.2 - 0.3
Units	ng/mL = ppb (or parts per billion)						

Clinical Correlation

The integration of epidemiological patterns, laboratory results, and clinical manifestations indicated a stronger consistency with a nutritional deficiency disorder rather than an acute infectious disease outbreak. The constellation of symptoms observed among affected crew members progressive peripheral edema, generalized muscle weakness, reduced exercise tolerance, and respiratory distress was compatible with deficiencies of B-complex vitamins, which play a critical role in energy metabolism and neuromuscular function.
Laboratory findings demonstrating reduced levels of vitamin B1, together with the epidemiological evidence of prolonged dietary insufficiency and monotonous food intake, support the likelihood of a broader vitamin B-complex deficiency rather than isolated thiamine deficiency alone. Such deficiencies have been reported in populations exposed to long-term inadequate nutrition combined with high physical workload, including maritime workers during extended sea voyages.

Taken together, these findings suggest that vitamin B-complex deficiency was a major contributing factor to the illness and deaths among crew members aboard KM Sri Mariana. This clinical correlation underscores the importance of considering nutritional deficiency syndromes in the differential diagnosis of cluster illnesses occurring in closed occupational settings such as fishing vessels.

DISCUSSION

This case-based investigation highlights a cluster of deaths and illnesses among crew members aboard KM Sri Mariana that was more consistent with nutritional deficiency than with an acute infectious disease outbreak. Although leptospirosis was initially suspected due to the maritime environment and overlapping clinical features, the combined epidemiological, laboratory, and clinical evidence did not support severe leptospirosis as the primary etiology.

From an epidemiological perspective, the temporal pattern of illness was characterized by gradual onset after several months at sea, progressive worsening of symptoms, and the absence of a clear point-source exposure. This pattern is inconsistent with most acute waterborne or zoonotic infectious outbreaks, which typically present with sudden onset and clustered transmission. Instead, the observed distribution of cases suggested cumulative exposure related to prolonged duration at sea, heavy physical workload, and chronic inadequacy of nutritional intake. The absence of secondary cases outside the vessel further supports a non-transmissible etiology confined to on-board conditions.

Laboratory findings reinforced this interpretation. Diagnostic testing for leptospirosis using polymerase chain reaction, serological assays, and metagenomic analysis did not demonstrate consistent evidence of acute infection. In contrast, reduced vitamin B1 levels, together with epidemiological

evidence of prolonged dietary insufficiency, pointed toward a nutritional deficiency disorder. Given the monotonous diet and high energy expenditure during extended voyages, a broader vitamin B-complex deficiency is biologically plausible and may better explain the spectrum of clinical manifestations observed.

Clinically, the constellation of progressive peripheral edema, generalized muscle weakness, decreased exercise tolerance, and respiratory distress aligns with manifestations of vitamin B-complex deficiency, particularly those affecting cardiovascular and neuromuscular function. While thiamine deficiency is classically associated with beriberi, deficiencies of other B vitamins may coexist and contribute to overlapping symptoms in settings of chronic malnutrition. Such combined deficiencies have been reported among populations exposed to prolonged dietary insufficiency and heavy physical labor.

The findings of this study are consistent with reports of beriberi outbreaks among commercial fishermen in Southeast Asia, particularly in Thailand, where prolonged sea voyages, limited dietary diversity, and demanding working conditions were identified as key risk factors. These similarities underscore that nutritional deficiency disorders remain a relevant and underrecognized occupational health problem among maritime workers, despite being commonly perceived as historical diseases.[7,8]

From a public health and occupational health perspective, this case highlights important gaps in health surveillance for seafarers. Pre-departure and routine health assessments often prioritize infectious disease screening while overlooking nutritional status. The lack of enforceable standards for dietary diversity, vitamin supplementation, and ongoing health monitoring during prolonged voyages may increase the risk of preventable morbidity and mortality among crew members.

Several limitations should be acknowledged. This investigation relied on secondary data collected during a public health response, and comprehensive assessment of all B-complex vitamins was not available for every affected individual. Nevertheless, the convergence of epidemiological patterns, laboratory findings, clinical features, and supporting international literature provides a coherent and plausible explanation for the observed outcomes.

In conclusion, this case emphasizes the need to incorporate nutritional assessment into outbreak investigations and occupational health surveillance in maritime settings. Strengthening regulations related to food provision, vitamin supplementation, and routine health monitoring for seafarers is essential to prevent similar incidents during prolonged sea voyages.

CONCLUSION

This case-based investigation demonstrates that the cluster of deaths and illnesses among crew members aboard KM Sri Mariana was most likely attributable to nutritional deficiency, particularly vitamin B-complex deficiency,

rather than severe leptospirosis as the primary etiology. The convergence of epidemiological patterns, laboratory findings, and clinical manifestations supports a non-infectious cause related to prolonged dietary insufficiency and high physical workload during extended sea voyages.

These findings highlight that nutritional deficiency disorders remain a relevant and underrecognized occupational health risk among maritime workers. Outbreak investigations in maritime settings should therefore extend beyond infectious disease surveillance to include systematic assessment of nutritional status.

Strengthening regulations related to food provision, dietary diversity, vitamin supplementation, and routine health monitoring for seafarers is essential to prevent similar incidents during prolonged voyages and to improve the overall health and safety of maritime workers.

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