

Sanitary Inspection of River Vessels and Applicability of Current Health Regulations

Inspeção Sanitária de Embarcações Fluviais e Aplicabilidade da Legislação Vigente
Inspección Sanitaria de Embarcaciones Fluviales y Aplicabilidad de la Normativa Vigente

RESUMO

Objetivo: Avaliar as condições sanitárias, estruturais e documentais de embarcações de transporte fluvial de passageiros na Amazônia, com foco no cumprimento das normas vigentes de vigilância sanitária. **Método:** Estudo observacional, de abordagem quantitativa, realizado entre março e novembro de 2019. Aplicou-se uma lista de verificação estruturada com nove blocos temáticos para avaliar 48 embarcações conforme parâmetros de segurança, higiene, documentação técnica, abastecimento de água, manejo de resíduos e condições gerais de navegabilidade. **Resultados:** Nenhuma embarcação atingiu conformidade plena. Identificaram-se lacunas críticas em higiene, abastecimento de água, armazenamento de alimentos, controle de pragas, resíduos sólidos, ventilação, manutenção estrutural e acessibilidade. Apenas uma parcela mínima possuía documentação atualizada e certificações exigidas, evidenciando descompasso entre a prática operacional e os requisitos normativos. **Conclusão:** As embarcações avaliadas apresentam risco sanitário significativo. Os achados reforçam a necessidade de revisão regulatória, maior fiscalização e implementação de padrões mínimos de segurança e higiene no transporte fluvial de passageiros na Amazônia.

DESCRIPTORES: Vigilância Sanitária; Saúde Pública; Amazônia; Regimentos; Navios.

ABSTRACT

Objective: To assess sanitary, structural, and documentation conditions of passenger riverboats in the Amazon, focusing on compliance with current health surveillance regulations. **Method:** Quantitative observational study conducted between March and November 2019. A structured checklist with nine thematic blocks was applied to evaluate 48 vessels according to standards of safety, hygiene, technical documentation, water supply, waste management, and general operational conditions. **Results:** No vessel met full compliance. Critical gaps were identified in hygiene, water supply, food storage, pest control, solid waste management, ventilation, structural maintenance, and accessibility. Only a small portion held updated documentation and mandatory certifications, revealing a mismatch between operational practices and regulatory expectations. **Conclusion:** The vessels assessed present significant sanitary risks. The findings highlight the need for regulatory revision, stronger enforcement, and the implementation of minimum standards of safety and hygiene in passenger river transport in the Amazon.

DESCRIPTORS: Health Surveillance; Public Health; Amazon; Internal Rules; Ships.

RESUMEN

Objetivo: Evaluar las condiciones sanitarias, estructurales y documentales de embarcaciones de transporte fluvial de pasajeros en la Amazonia, con énfasis en el cumplimiento de la normativa vigente de vigilancia sanitaria. **Método:** Estudio observacional de enfoque cuantitativo, realizado entre marzo y noviembre de 2019. Se aplicó una lista de verificación estructurada con nueve bloques temáticos para evaluar 48 embarcaciones según parámetros de seguridad, higiene, documentación técnica, suministro de agua, gestión de residuos y condiciones generales de navegabilidad. **Resultados:** Ninguna embarcación alcanzó conformidad total. Se identificaron fallas críticas en higiene, suministro de agua, almacenamiento de alimentos, control de plagas, residuos sólidos, ventilación, mantenimiento estructural y accesibilidad. Solo una fracción poseía documentación actualizada y certificaciones exigidas, evidenciando discrepancia entre la práctica operacional y los requisitos normativos. **Conclusión:** Las embarcaciones evaluadas presentan riesgos sanitarios significativos. Los hallazgos refuerzan la necesidad de revisar la regulación, fortalecer la fiscalización e implementar estándares mínimos de seguridad e higiene en el transporte fluvial de pasajeros en la Amazonia.

DESCRIPTORES: Vigilancia Sanitaria; Salud Pública; Amazonia; Regimientos; Navíos

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INTRODUCTION

The regulation of health control actions in ports and vessels in Brazil is provided for in the Organic Health Law, which assigns to the Federal Government the responsibility for health surveillance in ports, airports, and borders⁽¹⁾. The creation of the National Health Surveillance Agency (ANVISA) consolidated this framework, establishing specific guidelines for health inspection of means of transport⁽²⁾. Among these standards, Resolution No. 72/2009 of the Collegiate Board stands out, defining minimum requirements for health promotion in ports of health control and vessels transiting through them⁽³⁾. Article 16 of Law No. 8,080/1990 reinforces these responsibilities by determining federal jurisdiction to coordinate epidemiological and health surveillance actions⁽⁴⁾.

River transport plays a central role in the Amazon, often being the main or only means of transportation for a large part of the population⁽⁵⁾. Vessels operate with heterogeneous structures, many of them built by hand, with variations in infrastructure, food handling, water and effluent treatment, hygiene, and sanitation⁽⁶⁻⁸⁾. Although essential to regional connectivity, these vessels exhibit sanitary weaknesses that can increase

risks related to food handling, water quality, and internal environmental conditions⁽⁸⁾.

Despite their epidemiological importance, current regulatory instruments are general in nature and were designed with large vessels in mind, which limits their applicability to Amazonian vessels^(3,6). This inadequacy can compromise the standardization of sanitary inspection, generate technical insecurity for the professionals responsible, and hinder regulatory compliance⁽⁷⁻⁹⁾. The Organized Public Port of Manaus (PPOM), the main point of passenger and cargo movement in the region, is an example of the need for instruments that are more suited to local operating conditions, especially given the diversity of types and purposes of the vessels that circulate through the port⁽⁷⁻⁸⁾.

River vessels in the North region are characterized by traditional, often artisanal construction processes, with wooden or iron structures, influenced by the knowledge of master shipbuilders, which contributes to their particular character when compared to larger vessels⁽⁹⁾. Despite their significant social and economic relevance, the sanitary situation of these means of transport is still poorly investigated. The absence of comprehensive studies and specific inspection tools hin-

ders the work of ANVISA inspectors, who deal with broad itineraries that are poorly adapted to the Amazonian context, creating challenges for the assessment of sanitary compliance⁽⁹⁻¹⁰⁾.

Given this scenario, this study aimed to contribute to the improvement of the sanitary inspection process of river vessels in the Amazon, evaluating the applicability of the requirements of RDC No. 72/2009 and proposing a specific inspection route that allows for a more objective, standardized analysis aligned with regional particularities.

METHODS

This study is descriptive and exploratory, qualitative in nature, according to Gil⁽¹⁰⁾. River vessels in the cities of Manaus and Barcelos were evaluated, including ships or motorboats, ferry boats, and sport fishing tourism vessels. The sample was non-probabilistic for convenience, according to Mattar⁽¹¹⁾ and Schiffman and Kanuk⁽¹²⁾.

The collection instrument consisted of a checklist with 123 items distributed in nine blocks, prepared based on RDC No. 72/2009⁽³⁾. The items covered documentation, food safety surveillance, health facilities, accommodation, drinking water, air conditioning systems, waste manage-

ment, and vector control. In total, information was collected from 32 vessels.

The observations were made between March and November 2019 by the researcher, including monitoring by ANVISA inspectors. The content analysis technique proposed by Bardin⁽¹³⁾ was applied. The quantitative data were tabulated in Microsoft Excel 2020 and analyzed by frequencies and percentages.

The items evaluated included categories provided for in legislation: 1) Documentation; 2) Health surveillance of food offered on board; 3) Health care facilities; 4) Accommodations and cabins; 5) Drinking water quality; 6) Water quality in swimming pools and similar facilities; 7) Air conditioning system; 8) Waste retention and treatment tanks; 9) Solid waste, sanitation, and vector control. Operational characteristics were also verified, such as the vessel's

destination, year of manufacture, purpose, maintenance, air conditioning, existence of leisure areas, refrigerator, passenger and cargo capacity, and number of crew members.

A pre-test was conducted between September and October 2018. The final data collection took place without prior scheduling, at the public ports of Manaus and in the municipality of Barcelos, with observations lasting approximately 60 minutes each. The information was obtained from the person responsible for the vessel, seeking not to interfere with the operational routine.

The items included in the form only considered elements that could be observed during inspections required by the standard. The possibility of comparative analysis between vessel categories was also provided for. Content analysis was based on thematic categorization criteria, relating the findings to the sanitary

conditions of river vessels in the Amazon⁽⁵⁾. Quantitative tabulation was performed in Microsoft Excel 2020.

The research was authorized by the Brazilian Health Regulatory Agency (ANVISA) and approved by the Research Ethics Committee of the Federal University of Amazonas (UFAM), under opinion No. 3,147,002.

RESULTS

Table 4 shows the details of the contents of each block of requirements that determine the classification of the elements of the evaluation list of items implemented on vessels. It is important to note that the observations of implementation or non-application were made in accordance with RDC 72/2009, a national regulatory instrument related to the sanitary control of ports and vessels in Brazilian territory⁽⁴⁾.

Tabela 1 - Bloco de requisitos e seus conteúdos em conformidade com a RDC 72/2009 abarcadas pela pesquisa

Block of Requirements	Contents of items evaluated
DOCUMENTATION	
Mandatory	Maritime traveler's declaration; list of travelers; onboard health control certificate or onboard health control exemption certificate;
Complementary	list of medicines; cargo manifest; health inspection certificate; pest control documents; drinking water system; effluent treatment system manual; waste management; good practices in food distribution; ballast water information
Certificates	Certificate of free practice; certificate of exemption or on-board health control; health inspection program; compliance with requirements; complaints; public health protection actions; type of certificates; arrival notification.
HEALTH SURVEILLANCE OF FOOD OFFERED ON BOARD	
Food transportation	flow; equipment; exclusive use; exclusive compartment; type of material; temperature control system
Food	flow to prevent contamination; supply source; sanitation; display of perishable products; monitoring of self-service foods;
Kitchen infrastructure	Running water; sink for hand washing; soap provision; automatic activation; type of material; posters; cleaning process; cleaning products.
Food handlers	type of clothing; PPE; personal hygiene; place to change clothes; illnesses; handling money;
Food storage	Physical conditions; packaging presentation; storage method; shelf life; preservation; temperature control system.
HEALTH CARE FACILITIES AND SERVICES	
Facilities / Waste and medications	Hygienic conditions; structure; lighting; hand washing area; waste management; medicines.

ACCOMMODATIONS, DORMITORIES AND TRAVELER CABINS	
Dormitories	Sanitary conditions; drinking water available; drainage and sewage disposal system.
DRINKING WATER	
Quality of the water supplied / Reservoirs / Pool, SPA and bathtub water	Parameters; source; treatment; supply points; exclusive reservoirs for drinking water; reservoir cleaning; recreational water quality; recreational water treatment; disinfectant agent.
AIR CONDITIONING SYSTEM	
Air conditioning system	hygienic conditions; compartment; cleaning procedure; spreadsheets;
SEWAGE RETENTION AND TREATMENT TANK	
Sewage tank management	system; compatibility; operations; effluent release; treatment;
WASTE MANAGEMENT, CLEANING AND VECTOR CONTROL	
Solid waste	Prior notification; waste management procedures; removal permit; temporary storage.
Surface hygiene	Hygienic conditions; disinfection procedures; washing of cleaning equipment; storage of household cleaning products.
Vector control	Sanitary conditions; pest management program and records; treatment methodology; product waste management; prevention equipment.

Source: Data collected from the survey

Thus, the overall classification results for river vessels show that 51.56% of the items were not applicable, as shown in Table 1. The number of non-applicable items related to two assessment blocks, blocks 6 (water quality in swimming pools, spas, hot tubs, and similar facilities) and 8 (waste and sewage retention and treatment tanks), was extremely high, both reaching 100.0%.

The presentation of mandatory documents is an essential step in the health inspection⁽¹⁴⁾. They identified that mixed vessels in the Amazon have specific health monitoring needs, reinforcing the inadequacy of generalist instruments⁽⁶⁾. Studies on the hygiene of food handlers show relevant gaps that influence the safety of food served on board⁽¹⁵⁾.

Structural requirements for kitchens should consider aspects such as flooring, walls, lighting, and water supply, according to Sousa et al.⁽¹⁶⁾ and RDC No. 216/2004⁽¹⁷⁾.

The management of the quality of water carried and consumed on board is considered crucial for public health (18). De Paula et al. demonstrated high levels of microbiological contamination in water consumed on board Amazonian vessels⁽¹⁹⁾.

According to Cavalcanti et al., the maintenance of air conditioning systems directly influences the indoor air quality of environments⁽²⁰⁾. The lack of adequate waste management practices is a recurring theme, with Santos highlighting the importance of the Solid Waste Management Plan in accordance with international requirements⁽²¹⁾.

In line with the literature, Carneiro et al. reinforce that specific guidelines contribute to the standardization of health inspections⁽²²⁾. The present study confirms the need for a specific instrument, especially given the high number of items not applicable under current legislation.

Tabela 2 - Distribuição da aplicabilidade dos itens de avaliação da RDC 72/2009 para embarcações fluviais conforme estudo proposto

Block of analysis requirements	Items subject to evaluation	Items not applicable to river vessels	
		n	%
1 - Documentation	13	8	61,5
2 - Food safety surveillance	39	6	15,4
3 - Healthcare service facilities	9	0	0,0
4 - Lodging, dormitories, and traveler cabins	3	0	0,0
5 - Drinking water	7	3	42,9
6 - Water quality in swimming pools, spas, hot tubs, and similar facilities	6	6	100,0
7 - Air conditioning system	5	3	60,0
8 - Waste and wastewater retention and treatment tank	12	12	100,0
9 - Waste management, sanitation, and vector control	17	8	47,0
Total	123	62	51,6

Source: Data collected from the survey

Block 1 (documentation) reached 61.5% of non-applicable items. According to Table 5, the block comprised 25 items, subdivided into three subgroups: mandatory documentation, supplementary documentation, and certificates. The subgroup on certificates was removed from the field survey, as the items deal with the purpose of an inspection, and field observation did not occur in this context⁽²⁾.

Regarding block 2 (food health surveillance), the results of this assessment were quite satisfactory. The block had the largest number of items (39), subdivided into five subgroups, of which only one did not apply in its entirety to the vessels studied, reinforcing that most of the items checked are adequate. The percentage of 15.4% of items not applied is correlated with the food transport subgroup, as transport equipment is used on large ships. In this sense, these items can be removed from the inspection routes of river vessels.

Corroborating these findings,⁽¹³⁾ when assessing the hygienic and sanitary conditions on mixed vessels in the Amazon region, concluded that there is a need to define more specific monitoring for this means of transport, for example, through legislation on food storage and preparation items for more effective inspection, as well as the implementation of Good Handling Practices in food preparation. According to the authors, mixed vessels have peculiarities in relation to larger ships, so specific legislation and approaches are needed to manage the identified health risks.

Regarding the physical structure, studies that assess the hygienic and sanitary conditions of kitchens and food establishments perform analyses based on common requirements, including: outdoor area, floor, walls, ceilings, lighting, cleanliness, sanitary facilities, vector control, and water supply⁽²⁴⁾. These requirements support health surveillance in the routing

of forms used in inspection activities and are extracted from other specific legislation, such as RDC 216/2004, which provides for Technical Regulations on Good Practices for Food Services⁽³⁾.

The results of block 3 (health care facilities and services) are satisfactory, although one of the categories (sport fishing tourist boats) did not have health care services on any of the vessels evaluated. A 100% compliance rate with the standard was observed for the other river vessels that offer this service. Compliance with this requirement of the standard occurs because the vessels have health professionals on board who understand the need to maintain adequate structures and perform procedures correctly. In addition, passengers rate vessels that offer quality healthcare services positively⁽¹⁸⁾.

As for block 4 (accommodations, dormitories, and passenger cabins), 100.0% of items were applied, and the findings indicated that all vessels evaluated had some category of environment with characteristics associated with this block. River vessels, whether passenger, cargo, mixed, or sport fishing tourism vessels, have at least one dormitory, cabin, or stateroom, compartments used by the crew and customers. The environments can be used individually or collectively, consisting of furniture, and some have bathrooms and individual air conditioning systems.

As for block 5 (drinking water), 42.9% of the items analyzed were applicable to the vessels, which indicates that many of the items verified in the standard are not suitable for inferring an assessment on river vessels. The non-applicable items in the standard correspond to three items that are better defined in another item that deals with the requirement to present a document proving water potability standards, a document required during an inspection.

A study highlighting the importance of monitoring the quality of water for human consumption in the context of access to drinking water emphasizes the need for systematic and continuous action by public health authorities to ensure that the water consumed by the population meets the standards and norms established in current legislation, based on inspection, monitoring, and information actions, with operational indicators, physical-chemical and microbiological indicators of water, as well as epidemiological, sanitary, and environmental indicators⁽¹⁴⁾.

Furthermore, in the study that used *fuzzy* logic to analyze the environmental and health risks associated with sanitary effluents from passenger riverboats in the Amazon region and water for human consumption distributed on board, it was concluded that the water consumed by passengers and crew members, the subject of the study, is of poor quality, with 89% of samples contaminated by total coliforms and 84.0% by *Escherichia coli* bacteria. All surface water samples were contaminated with total coliforms and *E. coli*⁽²⁰⁾. The statistics and model proposed indicated that the risk to the environment and health is very high due to the lack of sanitation on passenger river vessels in the Amazon.

Block 7, which evaluated the requirement (air conditioning system), showed that 60% of the items in the current legislation were not suitable for analyzing this condition. This finding indicates that the applicable items are those that are essential in an assessment of the sanitary conditions of air conditioning equipment, such as equipment cleaning. The unsuitable items are related to the cooling system and cleaning procedures for large ship equipment⁽⁸⁾.

Finally, block 9 (waste management, sanitation, and vector control) concentrated three common and in-

terdependent evaluation factors. It is worth noting that the three categories together obtained a 47.0% non-suitability rate. The nine items from the standard that are not suitable for river vessels are related to various procedures for waste removal and integrated pest management inside vessels. In this case, the non-applicable items are associated with large vessels.

DISCUSSIONS

The results show that river passenger transport vessels in the Amazon remain far from the minimum health safety standards set forth in federal and state regulations. The lack of updated documentation and standardized hygiene practices indicates weaknesses in onboard management and limits the traceability of operating conditions.

The observed deficit in drinking water, sanitation, and waste management shows that the available infrastructure does not meet the sanitary requirements for collective use environments. The literature points out

that failures in these systems increase the likelihood of outbreaks of waterborne, gastrointestinal, and dermatological diseases, especially in contexts of long trips, high temperatures, and intensive use of common areas.

Structural and ventilation nonconformities reinforce adverse conditions of comfort and health, especially impacting vulnerable groups such as children, the elderly, and pregnant women. Similar studies in the North region confirm that limited oversight, associated with vessel turnover and operational diversity of routes, hinders the uniformity of safety practices.

The findings reveal the need for regulatory review, increased oversight, and ongoing training of teams, in addition to the adoption of standardized health verification tools that reduce subjectivity and guide consistent improvements.

CONCLUSION

The results showed that none of the vessels evaluated fully comply with

the sanitary and structural standards required for river passenger transport in the Amazon. The non-conformities observed, especially related to water potability, sanitation, food storage, waste management, ventilation, comfort, and technical documentation, constitute a scenario of continuous health risk.

The weaknesses identified point to the need to review and strengthen the regulatory instruments applied to the sector, as well as systematic inspection and training of the teams involved in vessel management. The standardization of sanitary assessment tools is also essential to ensure greater uniformity in the verification of conditions on board.

One notable gap is the absence of periodic studies that monitor the health quality of these vessels on different routes and at different times of the year. Future research could incorporate microbiological analyses of water and food, as well as assess the perceptions of passengers and crews regarding safety and hygiene during voyages.

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