

Review Article:

Mobile Emergency Care Service

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Abstract

Aims: Prehospital care in Brazil is provided by the Mobile Emergency Care Service (SAMU), and aims to provide the best response to the demands of the population that seeks medical attention through the publicly funded Unified Health System. The aims of this study were to describe the principles of prehospital care in Brazil, to draw a profile of a metropolitan region in the state of Rio de Janeiro, and to assess trends in SAMU call volume over time in this region.

Data source: A non-systematic review was carried out by searching the Pub Med database and using data from a master's thesis, conference papers, and government databases. Namely, data from the Brazilian Institute of Geography and Statistics were used to determine the demographic profile of the region, while data on prehospital care in the region were drawn from a master's thesis.

Data synthesis: The temporal evolution of prehospital care in the seven municipalities of the selected metropolitan region from 2009 to 2013 was analyzed. Data showed that 590,902 calls were received by SAMU physician regulators, for an average of 9,848 calls per month. Year-by-year analysis demonstrated a significant reduction in call volume ($p=0.008$) between 2009 and subsequent years ($p<0.001$).

Conclusion: Among the municipalities analyzed, those with high Human Development Indices exhibited a decline in call volume in the first year of study, maintaining a stable rate thereafter. Adjustments to the SAMU system are needed to improve cost-effectiveness and maintain or expand available resources, which can help address issues regarding the quality and timeliness of prehospital care.

Keywords: Emergency mobile units; Emergency medical services; Prehospital, Brazil

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Introduction

Prehospital care is defined as medical care provided outside the hospital environment with the purpose of reaching the victim or patient quickly and providing assistance and/or adequate transportation to an appropriate health facility [1].

The first organized prehospital care initiative in Brazil was the Medical Assistance Service for Home Care and Emergencies, regulated in 1959. In 1968, a government act determined that all health institutes would be included under a single service, the National Institute of Social Security Medical Care. With the 1988 Constitution and subsequent implementation of the Brazilian Unified Health System, municipal managers and technicians became responsible for the management of health information in the country, as well as for analysis and dissemination of such data [2].

The Mobile Emergency Care Service (*Serviço de Atendimento Móvel de Urgência*, SAMU) was established by the initiative of the Brazilian federal government in 2003. By 2009, coverage of 53.9% of the population had been achieved [3]. Current data endorse coverage rates around 75% (Brazilian Ministry of Health). The purpose of the system was to standardize provision of prehospital care in the country, either by sending teams of healthcare professionals to the scene of each incident or by providing health information by phone. SAMU teams are controlled by regulatory centrals to ensure the best supply of resources for effective management of request.

The aims of this study were to describe the principles of prehospital care in Brazil, to draw a profile of the main characteristics of municipalities in Metropolitan Region 2 of the Brazilian state of Rio de Janeiro, and to assess trends in SAMU call volume over time in this region.

Method

A non-systematic review study was carried out by searching the Pub Med database for the keywords prehospital and emergency and by using previously selected sources, namely a master's thesis [4] and conference papers. Data from the Brazilian Institute of Geography and Statistics were used to characterize the demographic profile of the area [5].

The data for this paper were extracted from a professional master's thesis submitted for completion of the Graduate Program in Maternal and Child Health at the Fluminense Federal University School of Medicine in 2015 [4]. The thesis described a study of ICD codes represented in the Mobile Emergency Care Service, with special emphasis on chapters XV, XVI, and XVII. The purpose of this project was to establish the frequency of perinatal incidents as causes of prehospital care activation and investigate trends in these incidents over time from 2009-2013. Briefly, data were recovered from the SAMU system management server (Regulation system-SR-192)* for Metropolitan Region 2 of the state of Rio de Janeiro, Brazil. Descriptive analysis of variables (means and standard deviations) was performed. Evolution of variables over time was compared with the Kruskal-Wallis test and Tukey's post-hoc test. All analyses were performed in SPSS (Statistical Package for the Social Sciences) software.

Results

The next three subheadings will describe the SAMU system in Brazil, including its medical regulation system and telephone call flow; the characteristics of the region of Rio de Janeiro state in which this study was conducted; and finally, trends in EMS call volumes in the region.

The Brazilian mobile emergency careservice (SAMU 192)

SAMU has its origins in the French *Service d'Aide Médicale d'Urgence*, where teams composed especially of anesthetist physicians have been providing emergency care for approximately 50 years. In Brazil, the Mobile Emergency Care Service was established in 2003 by the National Emergency Policy, with federal funding, regionalization, professional training, network expansion, and management by emergency committees as its cornerstones. One of the responsibilities of these committees is to conduct systematic analysis of SAMU indicators in order to create detailed descriptions of emergency care in the country and thus contribute in intersectional actions [6,7].

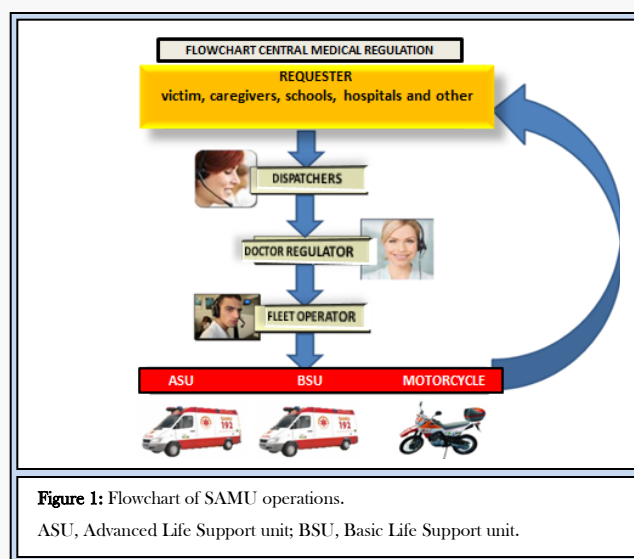
In 2011, The Brazilian Ministry of Health, with the objective of providing high-quality, rapid, and problem-solving care in emergency-room settings, issued Ordinance No. 1600 in July 2011, reformulating the 2003 National Emergency Care Policy and instituting the Emergency Care Network [7]. The creation of the National Emergency Plan (PNAU) as part of this policy played a crucial role in operationalizing the management of patient care in the emergency room setting [7].

Subsequently, the Ministry of Health issued National Intervention Protocols for Advanced Life Support and Basic Life Support in SAMU, covering relevant themes selected for their impact on morbidity and mortality [8].

SAMU is the main component of the national emergency medical care policy, and was the first component of the policy to be deployed [7]. It provides free EMS services, activated by a single telephone number (1-9-2), and was designed to ensure the quality of prehospital care within the Unified Health System, besides acting as an observatory of the healthcare service.

Within the Brazilian frame work, emergency prehospital care can be defined as any assistance provided outside the hospital environment in order to best respond to the demands of the population that seeks care through the Unified Health System. SAMU teams operate around the clock with the mandate of increasing each patient's odds of survival, preventing sequelae, and providing safe transport to the most appropriate referral facility for treatment.

The regulation (or standardization) of prehospital care in Brazil is based on several ordinances and laws issued since system implementation. Physician regulators (analogous to medical directors in other EMS systems) act as gatekeepers, determining the best care and appropriate service for each patient or victim's needs. All telephone calls received by SAMU dispatchers are logged and recorded in a computerized system. The dispatcher receives a call and records the identification of the caller and the location of the patient or victim. The dispatcher then transfers the call to a physician regulator, who establishes a presumptive diagnosis, defines the victim's needs, identifies the vehicle best suited to provide transport, and, on the basis of this assessment, sends either a Basic Life Support or Advanced Life Support unit to the scene (Figure 1) [7].



The organization and flow of ambulances in each region is not the responsibility of dispatchers or physician regulators; it is done by technicians known as fleet operators.

Basic Life Support units are staffed by a skilled driver and a nursing aide or nursing technician. It can only provide noninvasive supportive care measures, such as basic management of airway, breathing, and circulation, immobilization, and transport to emergency facilities [8]. Advanced Life Support units are staffed by a skilled driver, a registered nurse, and a physician, and can thus provide invasive ventilatory and circulatory support procedures and perform interfacility transfer, which is known in Brazil as medicalized transport [8,9].

SAMU is the structural axis of regional emergency care networks in Brazil. Responsibility for funding, human resources, supplies, equipment, and training is shared among the federal (Ministry of Health), state, and municipal health authorities. The administrative instances of each of these levels of government also act in concert to ensure patient access, regulation, and transport to urgent care and emergency facilities [10].

Rio de Janeiro metropolitan region²

This region consists of seven municipalities: Niterói, São Gonçalo, Itaboraí, Marica, Tanguá, Rio Bonito, and Silva Jardim (Table 1) [5]. A brief description of the characteristics of each municipality will be provided below.

Niterói

Niterói was founded in 1573 by Arariboia, chief of the Temiminó tribe, with the name São Lourenço dos Índios. From 1903 through 1975, it was the state capital of Rio de Janeiro. The municipality became the hub of one of the most important urban networks in Brazil and underwent a long period of urban interventions, starting with the construction of the

Presidente Costa e Silvabridge in the 1960s, which spans Guanabara Bay to connect the city of Rio de Janeiro to its then-capital Niterói. The loss of capital status, however, was followed by a substantial impact on the city economy.

Currently, the main economic activities are the service industry, trade, public administration, and manufacturing. According to the Brazilian Institute of Geography and Statistics, the nominal GDP of Niterói reached R\$11,258,565,000 in 2010, the fifth highest in the state of Rio de Janeiro. Quality of life in Niterói is also very high by Brazilian standards, with the seventh-highest Human Development Index in the country. It borders the municipalities of São Gonçalo and Marica, the Atlantic Ocean, and Guanabara Bay.

São gonçalo

São Gonçalo was founded in 1579 by Portuguese settlers and remained subordinate to Niterói until its elevation to municipality status in 1890. In the 1940s and 1950s, booming industrial growth earned it the nickname “Manchester of Rio de Janeiro”. Nowadays, however, the main economic activities are commerce and the service industry. São Gonçalo is the second most populous city in the state of Rio de Janeiro, and the sixteenthmost populous in the country, with a population distributed across both urban and rural areas. It borders the municipalities of Niterói, Marica, Guapimirim and Itaboraí, as well as Guanabara Bay.

Marica

The origins of Marica are unclear, but are believed to date back to Jesuit colonization in 1584. It was elevated to city status in 1889. Currently, the main economic activities are the oil and gas industry, construction, eco-tourism, trade, agriculture, livestock, and fisheries. Its territory includes both rural and urban populations, and borders the municipalities of Niterói, Saquarema, São Gonçalo, Itaboraí, and Tanguá, as well as the Atlantic Ocean.

Table 1: Socioeconomic characteristics of the seven constituent municipalities of Metropolitan 2 region, Rio de Janeiro, Brazil.

| Parameter | NITERÓI | SÃO GONÇALO | MARICÁ | ITABORAÍ | RIO BONITO | SILVA JARDIM | TANGUÁ |
|---|-----------|-------------|-----------|-----------|------------|--------------|-----------|
| Area (km ²) | 133,916 | 247,709 | 362,571 | 430,374 | 456,455 | 937,547 | 145,503 |
| Demographic density(pop/km) | 3,640.80 | 4,035.90 | 351.55 | 506.55 | 121.70 | 22.77 | 211.21 |
| Unified Health System facilities | 87 | 194 | 26 | 62 | 35 | 19 | 10 |
| Municipal Human Development Index - 2010 | 0.837 | 0.739 | 0.765 | 0.693 | 0.710 | 0.654 | 0.654 |
| Primary school enrollment, 2012 | 60,830 | 110,310 | 17,802 | 36,776 | 8,918 | 3,544 | 4,692 |
| Secondary school enrollment, 2012 | 20,359 | 26,481 | 4,003 | 7,618 | 2,213 | 575 | 662 |
| Number of local units | 18,842 | 13,556 | 2,453 | 3,342 | 4,115 | 330 | 474 |
| Total workforce | 218,269 | 139,390 | 19,410 | 53,659 | 28,161 | 3,828 | 5,059 |
| PIB per capita at current prices (Brazilian reais), 2012 | 30,728.51 | 11,786.62 | 39,467.09 | 13,912.07 | 17,054.73 | 11,195.03 | 11,452.92 |
| Estimated population, 2014 | 495,470 | 1,031,903 | 143,111 | 227,168 | 57,284 | 21,336 | 32,140 |
| Estimated population, 2010 | 487,562 | 999,728 | 127,461 | 218,008 | 55,551 | 21,349 | 30,732 |
| Resident population, overall | 487,562 | 999,728 | 127,461 | 218,008 | 55,551 | 21,349 | 30,732 |
| Resident population, male | 225,838 | 475,264 | 62,649 | 106,190 | 27,318 | 10,808 | 15,289 |
| Resident population, female | 261,724 | 524,464 | 64,812 | 111,818 | 28,233 | 10,541 | 15,443 |
| Literate population | 448,750 | 897,674 | 113,245 | 187,913 | 47,862 | 17,021 | 25,936 |
| Population attending educational facilities (daycare or school) | 138,281 | 285,552 | 33,555 | 67,951 | 16,824 | 6,884 | 8,786 |

Source: Brazilian Institute of Geography and Statistics (IBGE), 2013.

Itaboraí

Itaboraí was founded in 1672. By 1780, it was considered a major center for sugar production. The economic importance of the city increased greatly in April 23, 1860, when the first stretch of the Niterói-

Cantagalo Railroad was opened.

Itaboraí was elevated to city status in 1890. The resident population is rural and urban. The main economic activities are manufacturing (decorative and utilitarian ceramics), agriculture (particularly fruit and

subsistence farming), beekeeping, extensive livestock farming, mineral extraction, trade, services, transport, communications, construction, and tourism. Itaboraí borders the municipalities of São Gonçalo, Guapimirim, Cachoeira de Macacú, Tanguá and Marica.

Rio bonito

Rio Bonito was founded in 1768 and elevated to town status in 1846. The municipality is composed of two districts, Rio Bonito and Boa Esperança. The main economic activities are commerce, industry, and agriculture. Again, the resident population is both rural and urban. It borders the municipalities of Casimiro de Abreu, Cachoeira de Macacú, Silva Jardim, Saquarema, Tanguá, Araruama, and Itaboraí.

Silva Jardim

Silva Jardim was elevated to town status in 1841. The main economic activities are agriculture, trade, services, and eco-tourism. It borders the municipalities of Araruama, Cachoeira de Macacú, Casimiro de Abreu, Nova Friburgo, and Rio Bonito.

Tanguá

Tanguá was elevated to municipality status in 1999. The main economic activities are agriculture, commerce, and industry. It has rural and urban populations, and borders the municipalities of Itaboraí, Marica, Rio Bonito, Saquarema, and Cachoeirasde Macacú.

Call volume

The SAMU database for the Metropolitan 2 administrative region, which covers a population of approximately 2,000,000, was analyzed to draw a profile of the EMS call volume in the area.

The total number of calls answered by physician regulators was 590,902, for a monthly average of 9,848 (95%CI 8,875-10,820, SD = 3,764) across the seven municipalities. A year-by-year analysis revealed a

significant difference in call volume from years 2009 to 2013 (Kruskal-Wallis test, $p = 0.008$).

Analysis by municipality revealed a significant increase in the number of calls in Silva Jardim and Rio Bonito, while the other municipalities showed a downward trend over the period of analysis.

Final Conclusion

We conclude that the articulation and integration of SAMU into the other health services contributes toward better planning of care to end users and is consistent with the principles of the Brazilian Unified Health System.

Among the municipalities analyzed in this study, those with a good Human Development Index maintained stable rates of SAMU activation after a decline in the first year of study, and mostly showed a decrease in call volume thereafter. Adjustments are needed to improve cost-effectiveness and to allow maintenance or expansion of current resources. Improved planning of annual continuing education programs (particularly based on the leading reasons for SAMU activation), additional incentives and funding, and further research would help address the issues faced by prehospital care providers in this region, including quality and timeliness concerns.

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