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The *Igaraçu* fluvial mobile clinic: Lessons learned while implementing an innovative primary care approach in Rural Amazonia, Brazil

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In Amazonia, which includes regions in eight South American countries (and an enormous area in Northern Brazil) many of the inhabitants live in small communities scattered across a vast territory? Since too often they cannot be accessed by road, health services must be brought to them on specially constructed river barges, which are floating comprehensive primary care clinics. To effectively deliver health services to vulnerable populations living deep in the Amazon Rain Forest, the Municipal Health Authority of Borba, Brazil piloted the innovative technology of the *Igaraçu* Fluvial Mobile Clinic, a boat with full primary care services. The aim of this investigation is to do a case study of the pilot implementation of an innovative technology, *Igaraçu* the fluvial mobile clinic, which delivers primary care services in rural, Amazonas, Brazil. In Borba, the implementation of the *Igaraçu* has increased the number of people receiving primary care by over 10% and improved the quality of primary care provided, in particular, health promotion, maternal and child care, and treatment of chronic disease. Before the *Igaraçu* fewer people used services for the following reasons: (1) Insufficient professional healthcare staff (e. g. medical doctor and advanced practice nurses); (2) Lack of privacy during consultations; (3) Loss of exam samples; and (4) No continuity of care. Implications of this successful healthcare delivery innovation for the importance of coordination between national health authorities and local policy makers are discussed.

Key words: Amazonia, inhabitants, mobile clinic, primary care clinics.

INTRODUCTION

Frequently, the demographic characteristics of a region are associated with poor health outcomes for the local population. This is the case with the Amazonian region of

Brazil. Except for a few large cities, the population is dispersed over a vast area in small isolated communities located on riverbanks. This situation is a challenge to the

National Health System, which has a mission of providing universal coverage for 200 million Brazilian citizens wherever they reside. The aim of this investigation is to do a case study of the pilot implementation of an innovative technology (Burns and Grove, 2016), *Igaracu*, the fluvial mobile clinic which delivers primary care services in rural Amazonas, Brazil (Paim et al., 1979).

In this case study, we describe an innovative strategy that has demonstrated the potential for providing comprehensive primary care services for the rural Amazonian population, and we discuss the importance of dialogue between the Ministry of Health (MOH) and the local health authority in the implementation of effective alternative models of care (WHO, 2013). The *Igaracu* Fluvial Mobile Clinic is a healthcare delivery innovation that was piloted in the rural Amazonian community of Borba, Brazil.

Local setting

Since 1993, Brazil has delivered its primary care program through its Family Health Strategy. The development of the Unified Health System increased access to healthcare for a substantial proportion of the population, but universal coverage has not been realized (Victoria et al., 2011). This is particularly the case in Northern Brazil where people in the metropolitan areas have good access to healthcare, but those in rural communities have more limited access to these necessary services (Paim et al., 1979). The rural/urban disparity in healthcare in this region has spurred innovation in the model of health service delivery through a collaborative process involving the MOH and local governmental authorities (Fraxe, 2000).

The municipality of Borba is on the Madeira River, about 208 km from Manaus, the capital of the state of Amazonas. The Madeira is a large tributary of the Amazonas River. Travel from Manaus to Borba by an "express" boat takes 6 h. A small commercial plane carrying 5 passengers takes 50 min to fly between the cities. In Amazonia, it is more accurate to measure distances by time than by kilometers. A river journey's time varies by season and direction (going up or down river). It is less when waters are rising and more when they are receding. In times of flooding water, riverboats can take advantage of "shortcuts" that open up (Fraxe, 2000).

The most recent National census reported that Borba had 34,961 residents (5,931 were self-declared indigenous people) living in a territory that is slightly larger than Switzerland and twice as large as the state of

New Jersey in the US. There is a scattered distribution of residents, 60% of whom live in rural areas (Ministério da Saúde, 2013). Population density is low with 0.79 inhab/km². GDP per capita is low, around U.S. \$800 per year (Instituto Brasileiro de Geografia e Estatística, 2010; Ministério da Saúde, 2013). Also, the HDI is depressed (0.560) which is in the low human development range (Ministério da Saúde, 2015). About 20% of the population above 25 is illiterate.

Residents of rural Amazonas experience the same chronic diseases as other Brazilians (e. g. cardiovascular illnesses, cancer, and diabetes). Children from poorer families often show health conditions (e. g. anemia and stunting related to poor nutrition). However, residents in these tropical areas also suffer from illnesses which are still endemic in the region (e. g. tuberculosis, malaria, and other mosquito borne illnesses, STDS, and leprosy). Individuals who have good access to primary care, and if needed, more complex care, respond well to treatment (Instituto Brasileiro de Geografia e Estatística, 2010). However, many do not and consequently experience high morbidity and mortality from these diseases (Lancet, 2011).

Borba is served by 17 public health units, which are part of the National Health System. These include 12 facilities that are managed by the municipality. Besides that, there are 2 hospitals of medium complexity and 3 federal health units managed by the State of Amazonas and MOH respectively. Nine of the municipal facilities are primary care health centers, including Fluvial Mobile Clinic (United Nations Development Program, 2010).

MATERIALS AND METHODS

This investigation used a case study design (Burns and Grove, 2016). It is an intensive historical exploration of the development and pilot implementation of the *Igaracu*, the fluvial mobile primary care clinic used in Amazonas Brazil. Following this study design, researchers at the Oswaldo Cruz Foundation-Amazonia: (1) Collected historical information on the policy making relationship between the Brazilian Ministry of Health (MOH) and local health authorities in Amazonas; (2) Studied traditional methods of primary care health service delivery and outcomes in their region; (3) Developed a comprehensive description of the planning, financing, building, supplying and staffing of the fluvial mobile primary care clinic-- *Igaracu*; and (4) Compiled descriptive information and preliminary outcome data on the pilot implementation of the *Igaracu*.

All of this information is essential for the case study and is reported in the results section of the manuscript. Therefore, relationships between municipal health authority and the Federal MOH, traditional primary care service delivery, the planning and development of the *Igaracu*, and the initial outcome data collected on the pilot implementation of the fluvial mobile primary care clinic will be reported.

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RESULTS

Before *Igaraçu*, the healthcare team used a common wooden boat rented by the municipal health authority to deliver primary care services to people living in isolated riverbank communities. Consultations were done in community leaders' houses, churches or schools. There was very little privacy. To complete many exams, such as those for cervical cancer, the nurse had to do home visits and collect their specimens in patients' homes while children and other family members were present. Sometimes the specimens were lost before being analyzed. The mobile health team went to the community every 60 days, six times each year. Rarely a physician accompanied the team.

Dissatisfactions with this model of care delivery resulted in the Borba Health Authority to propose a pilot project to the MOH for the construction of a ship that could provide self-contained full primary care services. In 2012, the MOH responded with additional services and within a year *Igaraçu* Fluvial Mobile Clinic was launched. Currently, *Igaraçu* serves several river bank communities along the Madeira and its affluent. An *Igaraçu* roundtrip in this "liquid" territory takes 20 days. There is an interval of 40 days between trips. The health team includes one nurse unit manager, two nurse assistants, one physician, one dentist, one biomedical technician and twelve community health workers (community based).

In addition, there are six crew members. The community workers have a key role planning the agenda for each *Igaraçu* trip and serve as a communication link between the clinic and the local population. With the nurse supervision, they also develop patient tracking maps with all of the people who must be followed-up with special services such as pregnant women, children and adults with chronic disorders. Patient records are organized according to a therapeutic plan, e.g. maternal and child health, hypertension, diabetes, and geriatric issues (Figure 1).

The mobile health unit is 24 m in length and has two floors. The first deck is devoted to clinical activities, which includes offices for doctor, nurses, dentist and rooms to accommodate a pharmacy, laboratory, immunization and sterilizing suites. The upper deck includes the team's bedrooms, kitchen and administrative space. A typical workday begins at 7:00 a.m. and lasts until the last patient is seen. During the night, *Igaraçu* travels on the river to the next community where it begins seeing patients early in the morning.

Simple tests such as blood, urine, and stool analyses are completed in the *Igaraçu* laboratory while samples from more complex exams are sent to a laboratory in the largest community in Borba or to a clinical laboratory in Manaus. In cases where a patient must be referred for specialized care, sometimes they can be treated in the local hospital in Borba, however, when they require more complex treatment, the municipal health authority assists

them, so that they can obtain this needed specialized care in Manaus.

Two constraints on this new model of primary healthcare delivery were identified. First, there had to be an increase in Federal funding (in Brazil, the MOH provides funding for primary care, which is delivered locally). Second, a more effective method of collecting and processing samples and tracking patients had to be developed.

The development and testing of *Igaraçu* was part of a regional program supported by the MOH. Based on Borba's outstanding success, in 2012 the MOH implemented a program to build 64 Fluvial Health Units to be used in the nine Brazilian states of the Amazonian region¹. Federal funding was also allocated to the local health authorities for the maintenance of these floating clinics. Furthermore, the National Primary Care Policy was updated to address this new model of "Ribeirinha" Population Health. "Ribeirinha" is a riverside population that is deeply influenced by the cycle of waters (floods and droughts), in a type of dependence and symbiosis, traditional beliefs and subsistence family-based agriculture

The cost of providing approximately 3,400 persons with comprehensive primary care including pre-natal, pediatric, chronic disease (especially hypertension and diabetes), infectious disease, immunization, health education and epidemiologic surveillance through the *Igaraçu* is U.S. \$26,500 monthly. When this budget is broken down, 65% is for personnel, 23% is for fuel and 12% is for crew food and housing expense. Expenditures for laboratory supplies and pharmaceuticals are not additional because they are no more with the fluvial than the traditional health unit. The overall building cost for one Fluvial Health Unit was US\$530,000, which is equal to the cost of constructing four traditional land-based primary care clinics. However, because the population is spread over a vast territory, having 4 additional clinics would not substantially increase the healthcare coverage of the population. In addition, it would cost an estimated U.S.\$12,000 more per unit in maintenance expenditure. In Borba, the implementation of the *Igaraçu* has increased the number of people receiving primary care by over 10% and improved the quality of primary care provided in particular in the areas of health promotion, maternal and child care and diagnosis and treatment of chronic disease. Before the implementation of the fluvial mobile clinic, fewer people in rural Amazonas used services because of (1) insufficient professional healthcare staff, e. g. advanced practice nurses and medical doctors; (2) lack of privacy during consultations; (3) loss of examined samples; and (4) no continuity of care.

The Ministry of Health of the Federal Government of Brazil had advised that a systematic evaluation of 10 fluvial mobile clinics in the state of Amazonas and Para should be conducted (MOH Communication, January,



Figure 1. The "Igaraçu" Fluvial Mobile Clinic. A pilot project in Borba, Amazonas, Brazil. Source; Photo from Communication Oswaldo Cruz Foundation (2017).

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DISCUSSION

The Borba pilot project helped the Brazilian MOH to refine and make more effective its Fluvial Mobile Clinic initiative. Key issues that must be addressed for the sustainability of this innovative model of care had been identified. These challenges are assumed to exist in rural areas that have similar characteristics to Amazonia, e.g. vast undeveloped rural regions and widely dispersed populations with low incomes and education levels living along navigable rivers, including other Amazonian countries in South America.

The scheduled predictable and more frequent arrival and functioning of the *Igaraçu* Fluvial Mobile Clinic dispels the community's perception of service unreliability. Families can now return for appointments more regularly because they know they will be assisted by a complete health team, including a medical doctor who have their detailed medical histories, and will be examined and treated as required.

Highly bureaucratic and rigid healthcare delivery models, which often provide fragmented care, must be replaced by more accessible and flexible mobile clinics that have patient oriented highly cohesive clinical staffs (WHO, 2013).

This new model of care requires adjustments in work processes for providing health services (Table 1), and because of crucial differences regarding traditional land-based health units; it is highly desired to keep the same

health team and boat crew for no less than two years. This data in the table reflects information collected by the evaluation and monitoring team at the University of the Amazonis.

Conclusions

In countries with vast underdeveloped rural regions and widely dispersed populations with low income and education living on navigable rivers, national health authorities should work with local policy makers to develop innovative models of primary care delivery such as the "Igaraçu" Fluvial mobile clinic. Committed and cohesive teams of primary healthcare workers focused on the family unit, rather than the individual, will more effectively resolve problems of patient tracking, absences, and follow up. The scheduled, predictable, and more frequent arrival and functioning of the "Igaraçu" mobile fluvial clinic dispels the community perception of the unreliability of primary care services.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Table 1. Changes in work process to provide care between a landed based clinic and fluvial mobile clinic.

Parameter	Traditional health clinic	Fluvial mobile clinic
Patient approach	Focuses on individual assistance. Because the service is always available, people usually come to the health center alone or bring one or two family members. The rest of the family stay at home with other children or are doing domestic/agricultural activities	Focuses on familiar assistance. The service is not available full-time, all the family members come for consultation. The quality of care is improved because the clinician knows more about the familiar support, compliance with treatments etc.
Monitoring system	The clinical production can be reported to the national health system databases on a daily basis by internet	There is no internet connection available on board. Data are reported when Igaracu returns to Borba city. The MOH datacenter has a flexible deadline for the fluvial mobile clinics.
Team	All are health care workers and a community member with basic health training.	In addition to a traditional team, there are the crew members (a captain, navigation assistants, cooker)
Delivering service	Community search for health service. High level of absences and loss follow up.	Health service seeks patients. Patient absences and losses to follow up are reduced.
Cost	About US\$ 4.00 per person/month	US\$7.80 per person/month
Territory	Land-based. To serve approximately 3.000 people, the unit must cover a large territory, consequently the service is not well accessed	Demographically based. In this "liquid territory" the service is based on the quantity of people, no matter how they are distributed in the territory.

REFERENCES

- Burns N, Grove SK (2016). *The Practice of Nursing Research: Appraisal, Synthesis, and Generation of Evidence*, 8e. Philadelphia, PA: Saunders. pp. 256-257.
- Fraxe T (2000). *Homens Anfíbios: etnografia de um campesinato das águas*. AnaBlume.
- Instituto Brasileiro de Geografia e Estatística (2010). *Censo Demográfico 2010*.
- Ministério da Saúde (2012). *Unidades Básicas de Saúde Fluviais*. Retrieved from http://dab.saude.gov.br/portaldab/biblioteca.php?conteudo=ubs_fluvial
- Ministério da Saúde (2013). *Financiamento: as necessidades da atenção básica*. *Rev. Bras. Saúde Fam.* 14(35-36):78-81.
- Ministério da Saúde (2015). *Cadastro Nacional de Estabelecimentos de Saúde 2015*. Retrieved from <http://datasus.saude.gov.br/cadastro-nacional-de-estabelecimentos-de-saude>
- Paim J, Travassos C, Almeida C, Bahia L, Macinko J. The Brazilian health system: history, advances, and challenges (2011). *Lancet* 377(9779):1778-1797.
- United Nations Development Program (2010). *New Atlas of Human Development in Brazil*. Retrieved from <http://hdr.undp.org/en/content/new-atlas-human-development-brazil>
- Victoria CG, Barreto ML, do Carmo Leal M, Monteiro CA, Schmidt MI, Paim J, Bastos FI, Almeida C, Bahia L, Travassos C, Reichenheim M, Barros FC I (2011). Health conditions and health-policy innovations in Brazil: the way forward (2011). *Lancet* 377(9782):2042-2053.
- WHO (World Health Organization) (2013). *Research for universal health coverage: World health report 2013*. Available at: http://apps.who.int/iris/bitstream/10665/85761/2/9789240690837_eng.pdf?ua=1