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Access to health care facilities of suspected dengue patients in Rio de Janeiro, Brazil

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Abstract *Rio de Janeiro maintains a recurrent history of dengue epidemics. There is scarce evidence about the route of the population to get health care. The study aimed to describe the pattern of suspected dengue patients flow in search of health care services in Rio de Janeiro. The following data were analyzed: dengue reports from 2011 to 2013; the neighborhoods of patient's residence; the neighborhoods of health services. Neighborhoods of the city were used as unit of analysis focusing on access to health facilities of municipal Planning Area (AP) 3.3. Flow maps were elaborated to describe the routes between the neighborhood of residence and the heath service. Between 2011 and 2013 48,576 suspected dengue cases living in program area 3.3 were reported, 72% got health care in the AP 3.3, 37% of which in primary care. A total of 12,545 suspected cases attended health facilities outside the AP 3.3. A great geographical variation was observed in the search for Primary Care within the AP 3.3, as well as a relevant movement to the center and south zone of the city on access to care, comprising 2,647 different flows. The findings indicate a large flow within the municipality.*

Key words *Dengue, Health services accessibility, Primary Health Care spatial analysis*

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Introduction

The main entry point to the health system for people with suspected dengue is primary care. However, all levels of care should be prepared to provide timely and quality patient care and ensure adequate clinical management and referral of severe cases[1]. It is therefore essential to ensure adequate access to primary care services[2,3].

Access is influenced by the geographical distribution and availability of health services, which can either facilitate or hamper service use[4]. Santos[5] showed that cases of dengue were less likely to develop into severe forms in neighborhoods with larger numbers of Family Health Strategy (FHS) health centers (primary care facilities) in relation to population size. This finding reinforces the role FHS teams play in improving access to other levels of care and enabling the monitoring of clinical warning signs and timely referral of potentially serious dengue cases. Other authors[6,7] have also found that the implementation of the FHS led to improved access to primary care services. However, despite progress, the reality of Brazil's Unified Health System (SUS, acronym in Portuguese) stills remains one of inequality and exclusion[7].

Access to health services was analyzed by comparing different geographical areas to identify the different forms of entry into the SUS and determine the coverage of health services and quality of services provided. Geoprocessing allows health managers to identify health service hubs and analyze the regionalization of care and the distances traveled by patients, thus contributing to better healthcare planning and evaluation[8,9].

The State of Rio de Janeiro recorded 24% (335,986) of all suspected cases of dengue reported in Brazil between 2011 and 2012. The city of Rio de Janeiro accounted for 65 and 19%, respectively, of all reported and confirmed dengue cases in the state over the same period and reported 176 dengue deaths, which is equivalent to 9.2% all deaths reported nationwide over the same period[10].

The expansion and maintenance of the circulation of the dengue virus and its mosquito vector are influenced by a combination of structural and conjunctural factors, one of which is rising population density. As a result of rapid population growth, around 20% of Brazil's urban population live in *favelas* or slums, where insufficient water supply and inadequate sanitation lead to a proliferation of potential mosquito breeding sites[11-14].

Furthermore, authors have highlighted recurring problems in health services in high-density neighborhoods, such as difficulties in hiring health professionals and high rates of staff turnover, especially in slum areas where violence is particularly pronounced[15-18].

In view of the above, this study explored travel patterns among residents of a huge social vulnerability neighbourhood in the northern zone of the City of Rio de Janeiro seeking health services for the treatment of suspected dengue.

Methodology

An ecological study was conducted using data on confirmed and suspected cases of dengue recorded in the national notifiable diseases information system (*Sistema Nacional de Agravos de Notificação* - SINAN) between 01/01/2011 and 12/31/2013. The units of analysis were the neighborhoods of the City of Rio de Janeiro, focusing on access to health facilities in Planning Area (AP, acronym in Portuguese) 3.3.

The City of Rio de Janeiro has a population of 6,320,446 inhabitants and covers 1,224.56 km², making it the country's second largest city. The city is divided into ten APs: AP 1.0, comprising downtown Rio de Janeiro and the port region; AP 2.1, covering the entire southern zone; APs 2.2, 3.1, 3.2, and 3.3, forming part of the northern zone and Leopoldina; and APs 4.0, 5.1, 5.2, and 5.3, comprising the western zone of the city (Figure 1). According to the City Health Department, each planning area has a primary health care coordinating office.

AP 3.3 covers 7,689.88 km² and has a population of 952,638 inhabitants distributed across 29 neighborhoods. The AP has the city's third highest population density (13,821 people per km²) and around 50% of the population live in *favelas*[16,19,20]. The region has 25 primary healthcare centers, two specialized care units, two general hospitals, six emergency care units, two maternity hospitals, and one specialist hospital. Health services in the AP have expanded from 29 family health teams in 2009 to 119 family health teams, one street clinic team, 48 oral health teams, and eight family health support centers in 2017[21].

The SINAN database was obtained from the city council's Epidemiological Surveillance Coordinating Office. The National Registry of Healthcare Establishments (CNES, acronym in Portuguese) database, containing the addresses and geographic coordinates of the health estab-

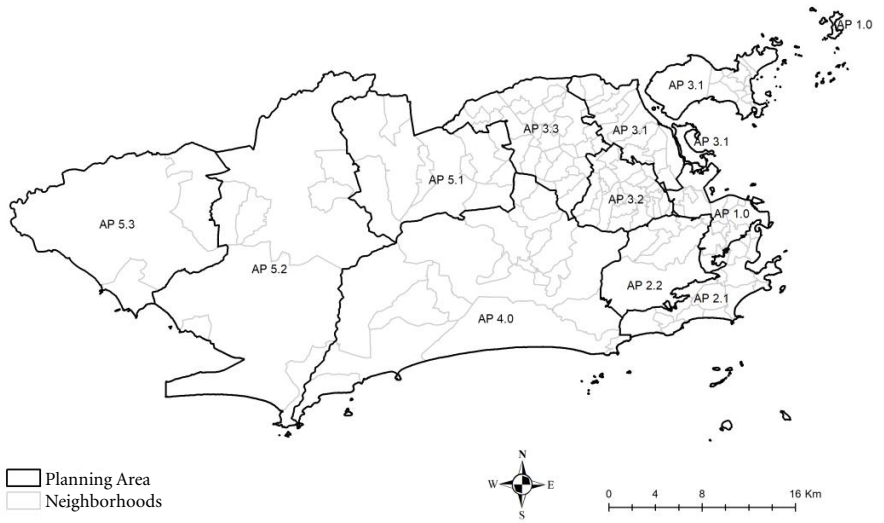

Figure 1. Map of the municipality of Rio de Janeiro according to planning areas.

lishments, was obtained from the city council's Superintendency of Health Surveillance. The digital network of the census tracts used to cluster the neighborhoods and create flow maps was downloaded from the IBGE website[22].

The addresses and coordinates of the healthcare facilities were merged into the SINAN database using the CNES code. Records with all variables left in blank or only the "health unit" variable filled in, without the name of the establishment or CNES number, and where it was not possible to identify the neighborhood were excluded. The respective codes of the health facilities were consulted on the CNES website to complete the data[23].

The following variables were used: notification date; neighborhood of residence; health facility and geographic coordinate; and type of administration (public or private; primary, secondary, or tertiary care; and municipal, state or federal).

Given that new neighborhoods were created in 2012, the 2011 neighborhood codes were revised, updated, and standardized. Origin and destination flow maps were created using the variables "neighborhood of residence in AP 3.3" and "notifying health unit" to analyze the travel patterns of residents seeking care.

To generate the flow maps, the neighborhoods were georeferenced based on the IBGE neighborhood code considering the centroid of each neighborhood. The health facilities were georeferenced based on the CNES code according to their geographic coordinates. Two flow maps were generated: the first displaying travel patterns among AP 3.3 residents seeking primary health services in AP 3.3, and the second showing travel patterns among AP 3.3 residents seeking secondary and tertiary healthcare facilities across the city. Given the lack of health facility geographic coordinates, there was a loss of 3.9% of records when the first map was created, resulting in a total of 14,486 records, and a loss of 4.8% when the second map was created, resulting in 33,508 records.

The centers with the highest number of records were highlighted on the flow map displaying the travel patterns of residents seeking primary health services in AP 3.3. For the map showing the travel patterns of AP 3.3 residents seeking secondary and tertiary healthcare services across the city, four flow strata were defined with the following patient flows: from one to 50 patients; 51 to 100 patients; 101 to 1,000 patients; and 1,001 to 2,460 patients. To facilitate visualization, the first flow stratum (one to 50 patients) was presented on a separate map. The linear distances traveled by residents were calculated automatically, together with the mean and median. The flow maps were generated using the geoprocessing software TerraView 4.22. The outputs in the vector format were imported into ArcGIS to

improve results presentation. Descriptive analysis was conducted using the statistical software package SPSS version 20.0.

For the purposes of this article, health service visits refer to all notifications of suspected cases of dengue recorded in the national notifiable diseases information system for AP 3.3, since the health units do not have an integrated and consolidated dengue information system. It was therefore assumed that the number of reported cases was equal to or less than the number of patients treated at each health center. This study was approved by the Ethics Committee of the Sergio Arouca National School of Public Health of the Oswaldo Cruz Foundation and by the Research Ethics Committee of the city council's Department of Health.

Results

Between 2011 and 2013, 50,261 suspected cases of dengue were reported among residents of AP 3.3. The majority of these patients (87%) sought treatment in public health services, 72% of which in health centers in AP 3.3 (Figure 2).

Figure 2: Number of residents in Planning Area 3.3 reported as suspected cases of dengue, according to location and type of notifying facility.

Of the notified cases, 38,345 (76.3%) were reported by the fourth day of the disease, 6,009 (12%) during the defervescence phase (between the fourth and sixth day), when there is a greater risk of developing severe dengue, and 5,166 (10.2%) at a later stage. The results show that 896 residents were hospitalized, 31% of which were reported by the fourth day of the disease, 36% during the defervescence phase, and 31% after the seventh day of illness. All notifications were made in secondary and tertiary care facilities.

Twenty of the residents died: six between the first and fourth day after the onset of symptoms, seven between the fifth and sixth day, and seven after the seventh day. Only one of the residents who died was reported by a primary care facility. All others were reported by facilities providing other levels of care. The distribution of notifications extends across various neighborhoods. One-quarter of the notifications occurred in secondary and tertiary facilities outside AP 3.3. The results also show a large variation in the geographic distribution of visits to primary care services within AP 3.3, with a significant number of patients seeking treatment in health centers in neighborhoods located far from their homes (Figure 3). Twelve care facilities across the city accounted for 44.8% of all notifications of residents of AP 3.3 with suspected dengue. Eight of these were tertiary and secondary care facilities located in AP 3.3 and four were located in neighboring APs (Figure 4).

Among the primary care centers in AP 3.3, four stood out in terms of number of notifications of suspected cases of dengue. These centers received residents from several different districts of AP 3.3. The median and average distances travelled by people seeking treatment were 4.2 and 4.1 km, respectively, while the longest distance traveled was 8 km (Figure 3).

The results show 2,647 different flows, 95.9% of which (n = 2,539) with up to 50 patients, corresponding to 36.6% of all the notifications (Figure 4). Two flows accounted for 11.7% of all reported cases.

Flows with a higher number of patients tended to show shorter average distanced travelled than those with a smaller number of patients. Each flow represents the travel patterns of one or more patients between their neighborhood of residence and reporting facility. Each health facility can have up to 160 flows, corresponding to the number of neighborhoods in the City of Rio de Janeiro (Figure 4).

The highest flows (from 1,001 to 2,460 notifications) involved patients treated in their neighborhood of residence. The remaining flows involved patients travelling to other neighborhoods within the AP 3.3 and neighborhoods surrounding the AP.

The facilities that made the highest number of notifications and accounted for a significant portion of patient flow within AP 3.3 were a general hospital with a small emergency unit and urgent care centers. These facilities were responsible for 45% (n = 13,419) of all notifications made by public secondary and tertiary care facilities (n = 30,085) (Figure 5).

Discussion

Access to health services has been addressed by several authors and is influenced by several factors, ranging from technical and organizational issues to social, economic, and symbolic aspects[24-26]. For the purposes of this article, access refers to the ease with which an individual can obtain healthcare, which goes beyond the limits of availability and capacity to respond to the health needs of the population[27].

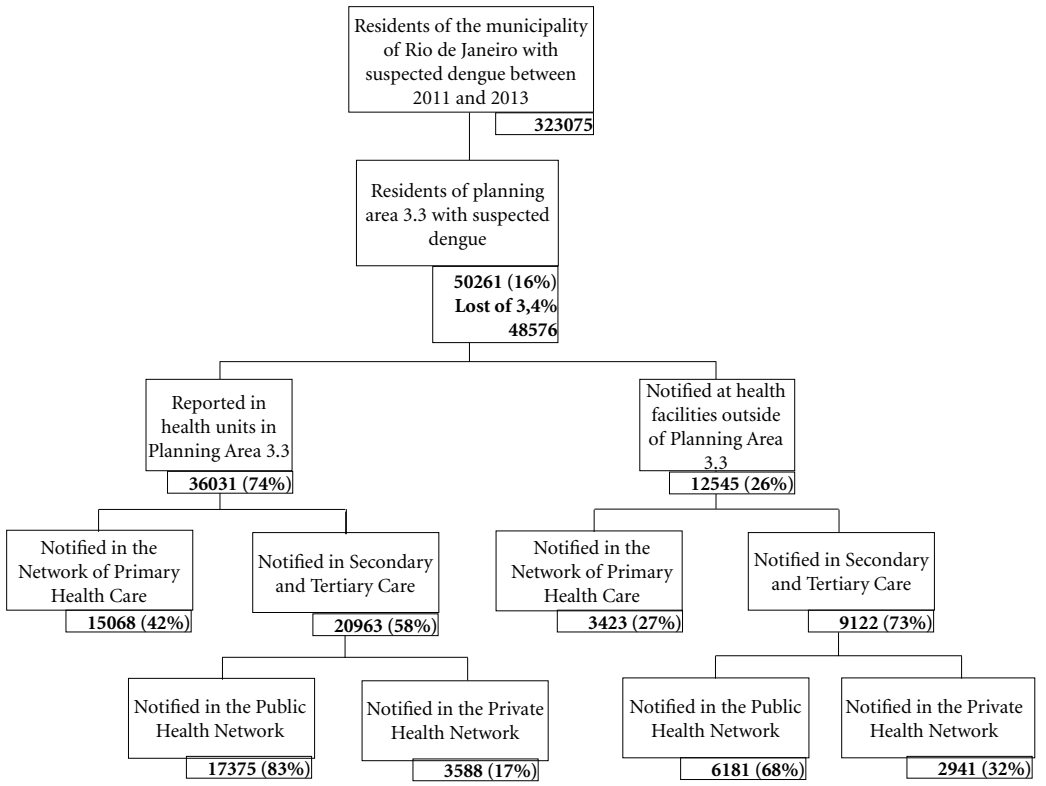

Figure 2. Number of Planning Area 3.3 residents wich suspected of dengue, according location and type of notifying unit.

Inequalities in access to primary care services, the main point of entry to the SUS, lead to so-called "pilgrimages" in search of healthcare[28].

The effective organization of health services is essential for tackling epidemics of diseases such as dengue. In this respect, it is vital to ensure effective disease risk classification, appropriate clinical management, and timely referral of patients based on the proper monitoring of clinical warning signs of severe dengue. Although primary care is usually the preferred point of entry for suspected cases of dengue[1], other health services should be prepared to receive patients and provide adequate treatment and referral when necessary.

The World Health Organization supported the adoption of measures to expand primary healthcare in Brazil through the implementation of the Family Health Strategy[29]. Evidence shows that primary care makes a significant contribution to the improvement of individual and collective health, resulting in indirect gains such as a diminishing healthcare costs and a reduction in inequalities among population subgroups[2,7]. Our findings reveal barriers to accessing primary health care services in AP 3.3, since only 30% of residents with suspected dengue were reported by primary care units located in the area. This may be partially explained by the limited coverage of an expanding primary care system, whereby facilities tend to be concentrated in more disadvantaged areas[30].

Although the coverage of the family health strategy in the City of Rio de Janeiro increased from 3.5% in 2008 to 40% in 2013, implementation of the ESF has been uneven across the city[31]. The Municipality of Rio de Janeiro had the lowest rate of family health coverage among all state capitals in 2009, when primary care reforms were introduced. This rate increased to 51% in 2016[32].

Sufficient resources should be allocated to primary health centers to ensure the provision of adequate care in these facilities, thus easing demand on hospital facilities[1]. The findings show

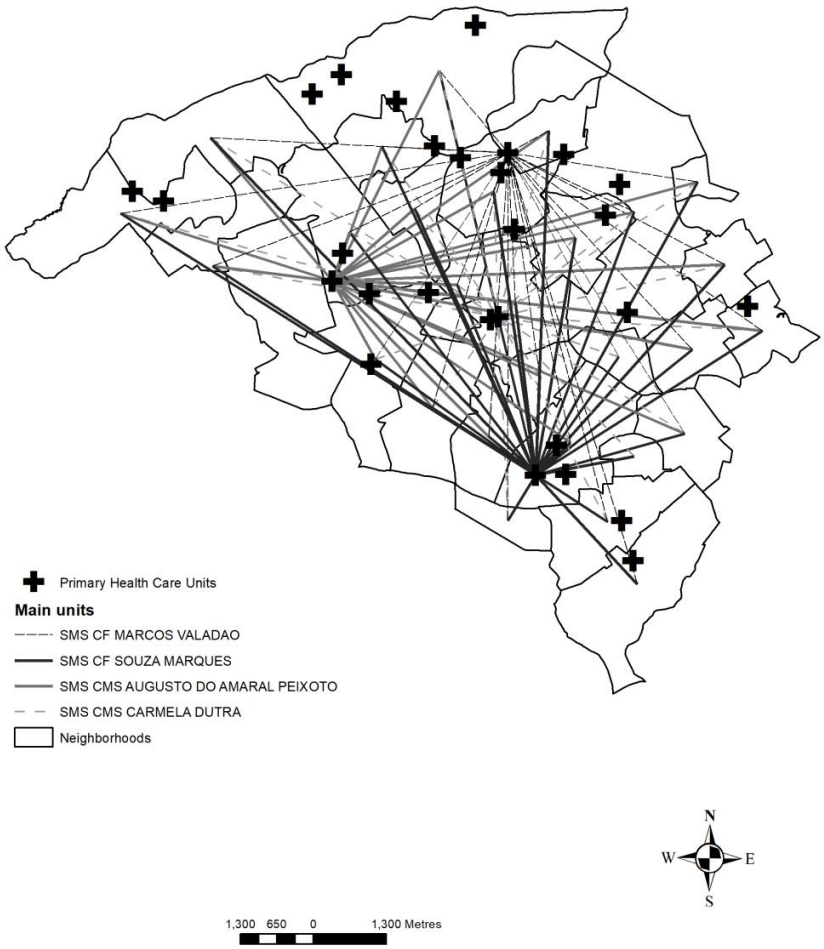

Figure 3. Flow of the AP 33 residents between the neighborhood of residence and the Units of Primary Health Care on AP 3.3 with the most relevant flows between 2011 and 2013.

that the majority of residents with suspected dengue sought treatment in general hospitals or urgent care centers. Factors such as deficiencies in primary health facilities, shortage of appointments, and low levels of resolvability can contribute to a particularly pronounced demand for hospital services[33]. The provision of adequate care to patients with suspected dengue in primary care settings requires effective clinical evaluation, laboratory testing facilities for special groups (children, patients aged over 60 years, pregnant women, and patients with comorbidities), and qualified professionals who know how to recognize warning signs and give appropriate guidance on hydration[1].

Flows with large numbers of patients were not very frequent and consisted of residents seeking care in secondary and tertiary care facilities within AP 3.3. In this respect, the largest flow was to the general hospital, which has an emergency unit and served as a hydration center for patients with dengue[34]. In 2012, the flows with the greatest number of cases in AP 3.3 were to this hospital and two primary health care centers also set up as 12-hour hydration centers to deal with the significant increase in suspected dengue cases[34]. These centers are located in easily accessible areas, which may have contributed to the pronounced demand for the services provided by these facilities. The implementation of hydration centers increases the provision of adequate, timely treatment and eases demand for hospital services, thus decreasing the occurrence of severe cases and reducing dengue-related deaths[5]. The implementation of these centers in the City of Rio de Janeiro in 2008 was a positive experi-

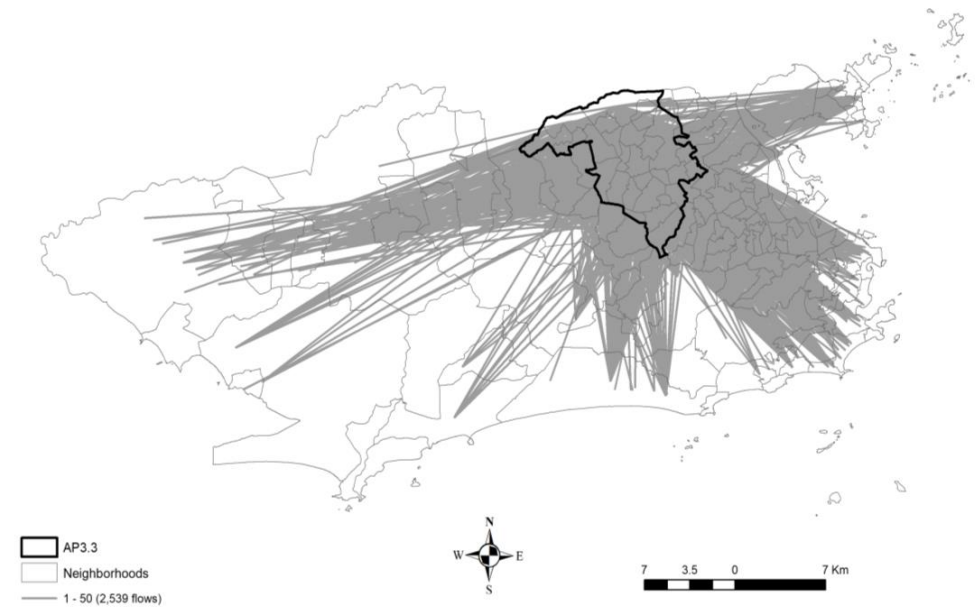

Figure 4. Map of the strata of flows with up to 50 AP 3.3 residents to demand of care in secondary and tertiary care health units of the AP, or in other areas in the city of Rio de Janeiro, according to the number of notifications in the years 2011 to 2013.

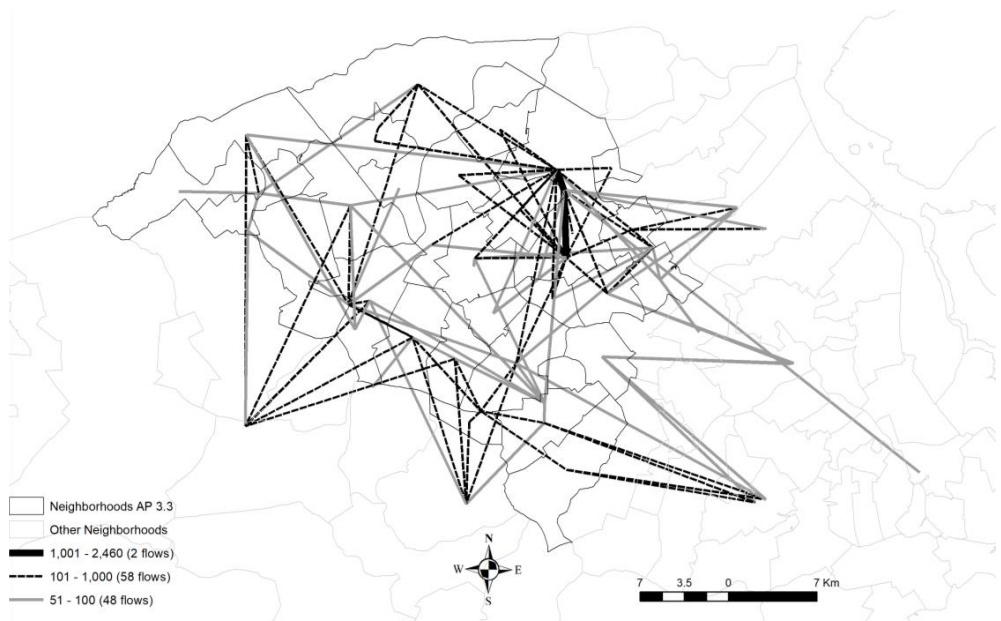

Figure 5. Map of the strata of the most relevant flows increased from 50 to 2460 residents of AP 3.3 to demand of care in health units of secondary and tertiary care of the AP, or in other areas of the city of Rio de Janeiro, according to the number of notifications in the years 2011 to 2013.

ence[35]. This finding indicates that residents may prefer to visit health centers close to their home when they provide specialized services.

It is interesting to note that over one-third of the residents travelled to health centers outside AP 3.3 located throughout the city (in 104 of the city's 160 neighborhoods). Although more distant areas accounted for the largest quantity of flows, the number of cases per flow was lower in these flows than in the flows to neighborhoods in APs near to AP 3.3. Despite these variations, in terms of patient quantity, flows were greatest within AP 3.3.

A study that investigated the quality of hospital care provided to patients with severe dengue in two Brazilian cities found that most deaths occurred on the day of hospitalization, which may be attributed to the fact that patients had already reached the advanced stage of the disease by the time they were admitted. Studies have identified the following problems in relation to the treatment of dengue: poor application of the dengue risk classification protocol; lack of knowledge of the protocol among the health team; inadequate clinical management; and limitations of primary care services in preventing serious forms of the disease[36,37]. Health professionals should be able to recognize when the infection develops into severe dengue, especially in children, given that in the initial stages the illness can often be asymptomatic. Ensuring adequate and timely clinical monitoring at all levels of care is vital, given that there is no specific treatment or widely available vaccine for dengue.

The findings show that 90% of the residents who died were reported by secondary and tertiary care services, suggesting that they were admitted to hospital too late. This reinforces the importance of the effective organization of health services networks and the key role played by primary care in preventing preventable deaths. In this respect, further research is necessary to evaluate patient travel patterns and access to health services.

The results suggest that there are barriers to access to health services in the area. In this respect, it is important to conduct a more in-depth analysis of the travel patterns, since they may reflect a hospital-centric patient vision of health services or the fact that people seek care at facilities close to their place of work or study. However, these reflections go beyond the scope of this study. Population-based studies should be conducted to determine the causality of the travel patterns of AP 3.3 residents seeking care. It is worth mentioning that flow maps have been shown to be a particularly useful tool, despite the fact they do not show the route taken by the patients.

Although efforts have been made to improve the quality of healthcare services in AP 3.3, the findings show that the distribution of public health services remains unequal, driving the population to seek quality, equitable, and comprehensive care elsewhere.

The local health authority, with support from other spheres of government and other health networks, should establish flows with the support of healthcare networks. In this respect, the number and capacity of the area's health facilities should be scaled up to match the demand for healthcare services in the region and measures taken to enhance inter and cross-sectoral integration with a view to improving the quality of health services delivered to the population.

Collaborations

DA Freitas participated in study conception and design, data analysis, and in drafting and critically revising this article. R Souza-Santos participated in study conception and design, data analysis, and in critically revising this article. MD Wakimoto participated in study design, data analysis, and in critically revising this article.

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