

# Assessment of the timeliness for notification of dengue in the state of Paraná

Avaliação da oportunidade de notificação da dengue no Estado do Paraná

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## Keywords

Dengue; Disease notification; Health evaluation; Public health nursing; Health information systems

## Descritores

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## Abstract

**Objective:** To evaluate the timeliness for notification of dengue in the State of Paraná.

**Methods:** Normative assessment study of the attribute timeliness, according to the Centers for Disease Control and Prevention and the parameters of the Ministry of Health. The population consists of the total of 132,979 dengue notifications registered in the Notifiable Diseases Information System (SINAN) online in the state of Paraná in the periods of 2011/2012 and 2012/2013. It is a descriptive analysis of the time (in days) elapsed in steps of notification, investigation, typing and closure, median calculation, percentage, and cumulative percentage of intervals.

**Results:** Ninety percent of cases were notified within 6-12 days (mean: 2-4); 90% and more with investigations initiated on the day of notification; 90% entered in 10-74 days (mean: 10-74); and 80% closed within 38-61 days after notification (mean: 20-45).

**Conclusion:** Ninety percent and more of cases had their investigations initiated on the day of notification. Improvements are needed in the other steps to help in the control and prevention of dengue.

## Resumo

**Objetivo:** Avaliar a oportunidade de notificação da dengue no Estado do Paraná.

**Métodos:** Estudo de avaliação normativa do atributo oportunidade, segundo *Center for Disease Control and Prevention* e parâmetros do Ministério da Saúde. População constituída do total de 132.979 notificações de dengue registradas no Sistema de Informação de agravos de Notificação (*Sinan*) online do Estado do Paraná nos períodos 2011/2012 e 2012/2013. Análise descritiva do tempo (em dias) transcorrido nas etapas de notificação, investigação, digitação e encerramento, cálculo da mediana, percentual e percentual acumulado dos intervalos.

**Resultados:** Noventa por cento dos casos notificados entre 6-12 dias, (média: 2-4); 90% e mais com investigações iniciadas no mesmo dia da notificação; 90% digitados entre 10-74 dias, (média: 10-74) e 80% encerrados entre 38-61 dias após a notificação, (média: 20-45).

**Conclusão:** Noventa por cento e mais casos tiveram suas investigações iniciadas no mesmo dia da notificação. Melhorias são necessárias nas demais etapas para auxiliar o controle e prevenção da dengue.

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## Introduction

Dengue is an acute viral disease of rapid spread and compulsory notification.<sup>(1)</sup> It can cause everything from asymptomatic infections to death.<sup>(2)</sup> A study on the prevalence of dengue in the world estimated that 3.9 billion people in 128 countries are at risk of infection with this virus, and 36 of these countries had previously been classified as free of the disease.<sup>(3)</sup> Dengue virus has spread rapidly in tropical regions, with increased frequency of outbreaks, severe cases of the disease, and hyperendemicity of its various serotypes.<sup>(4)</sup>

The Brazilian scenario, with a high transmission rate, had special prominence in 2013, when there were more than 1.6 million notifications during the first half of the year, with a concentration in the Southeast, Midwest, and South regions.<sup>(5)</sup> In the state of Paraná, in the period between August 2012 and July 2013, there were 110,774 notifications, with 105,616 occurring between January and July, 2013.<sup>(6)</sup>

A research study measuring the economic and social burden of dengue in the Americas for the period between 2000 and 2007 concluded that there was a loss of US\$2.1 billion per year, which exceeds the cost of other viral diseases, such as human papilloma virus (HPV) and rotavirus.<sup>(7)</sup> Dengue is notified via the Notifiable Diseases Information System (SINAN), with the objective of collecting, transmitting, and disseminating data generated by the Epidemiological Surveillance System through a computer network, supporting the research process, and indicating the risks of notifiable diseases.<sup>(8)</sup> In early 2011, SINAN online was implemented by the Ministry of Health, to improve the timeliness attribute of notifications, providing support in a quick and full way to analyses and decision-making, simultaneously ensuring monitoring and evaluation of the epidemiological situation of dengue by the three spheres of government.<sup>(9)</sup>

Timeliness is an important attribute for assessing the speed of the Epidemiological Surveillance System, reflecting promptness to effectively accomplish the various stages of the system. Traditionally, it starts to be assessed at the time of the appearance of the first symptoms of a case of disease under sur-

veillance, with time elapsed until its detection by a health service, its notification, and its information disclosure being calculated.<sup>(10)</sup> Timeliness is a feature that is poorly researched in the information systems of the Unified Health System (SUS),<sup>(11)</sup> and its study is essential, given the need for information in a timely manner in the management of nursing actions.

Such assessment helps to improve the dengue surveillance system in the state, nursing work processes in information management, planning, and decisions in a quick and timely manner. After four years of implementation of the on-line version of SINAN, and in the presence of a significant increase in the number of reported cases, the general aim of this study was to evaluate the timeliness for dengue notification in the State of Paraná.

## Methods

This is a normative assessment study of the attribute timeliness obtained using the Centers for Disease Control and Prevention's methodology.<sup>(10)</sup> It was a research study conducted in the state of Paraná, southern Brazil, composed of 22 health regions divided into four macro-regions (North, East, West, and Northwest). The data source was the SINAN on-line bank (dengue) of the State Department of Health. The population consisted of 132,979 individual notifications registered between 2011 and 2013.

Data were analyzed according to a division into two chronological periods: 2011/2012 and 2012/2013. Each period started on the first epidemiological week (EW) of August and ended on the last EW of July of the following year, totaling 52 EWs (the procedure used in the state).<sup>(6)</sup> Data were collected between November 2014 and April 2015.

Records with birth dates typed as equivalent to the onset of symptoms (0.2% in the first period and 0.4% in the second), no date for investigation (0.9% and 1.5%, respectively), and no closing date (0.1% and 0.2%, also respectively) were excluded from the analysis.

The notification form, research form, and data dictionary were consulted to select the variables: date of notification; onset of symptoms; research; typing; and closure. The timeliness surveillance

steps<sup>(10)</sup> were evaluated by calculating the intervals between the dates, according to the parameters of the Ministry of Health (Chart 1).<sup>(8,12)</sup>

In the descriptive statistical analysis, the intervals (difference between dates and days), the frequency of breaks, percentages, cumulative percentage, and percentiles of 25%, 50% (median), and 75% of timeliness steps were calculated for macro-health regions, and in each period.

The results were considered adequate from a methodological point of view, when all macro-regions achieved the established indicator.

The study was carried out in compliance with national and international standards of ethics in research involving humans (Brazil register/Platform CAAE - *Certificado de Apresentação para Apreciação Ética*: 34879214.7.0000.5225).

## Results

Of the 132,979 notifications of dengue recorded in SINAN on-line (which is installed in all 399 municipalities of the state) between 2011/2012 and 2012/2013, it was observed that in the last period there was an increase of almost 400% compared to the previous one (23,400 and 109,579, respectively). In the first period the macro-North region had 54% of the notified cases (12,549), a figure that, in the second period and in the macro-Northwest region, reached 61% (66,441 cases). The macro-East region was the one with the lowest proportion of cases notified in both periods - respectively 2.5% (574 of 23,400) and 1.2% (1,323 of 109,579).

Regarding the timeliness for notification, in the two periods only the Macro-North region reached the indicator parameters, with 94% of cases noti-

fied within seven days after the onset of symptoms. The Macro-East region was the last to reach the indicator: 91% in 10 days, and 90% in 12 days after the date of symptoms onset, respectively, compared to the first and second period, but it had the lowest percentage of notified cases (2.5% and 1.2%, respectively, in the periods). In the second period, the Macro-Northwest region accounted for the majority of notified cases (61%), with 88% of cases notified within seven days, thus approaching the indicator (Figure 1).

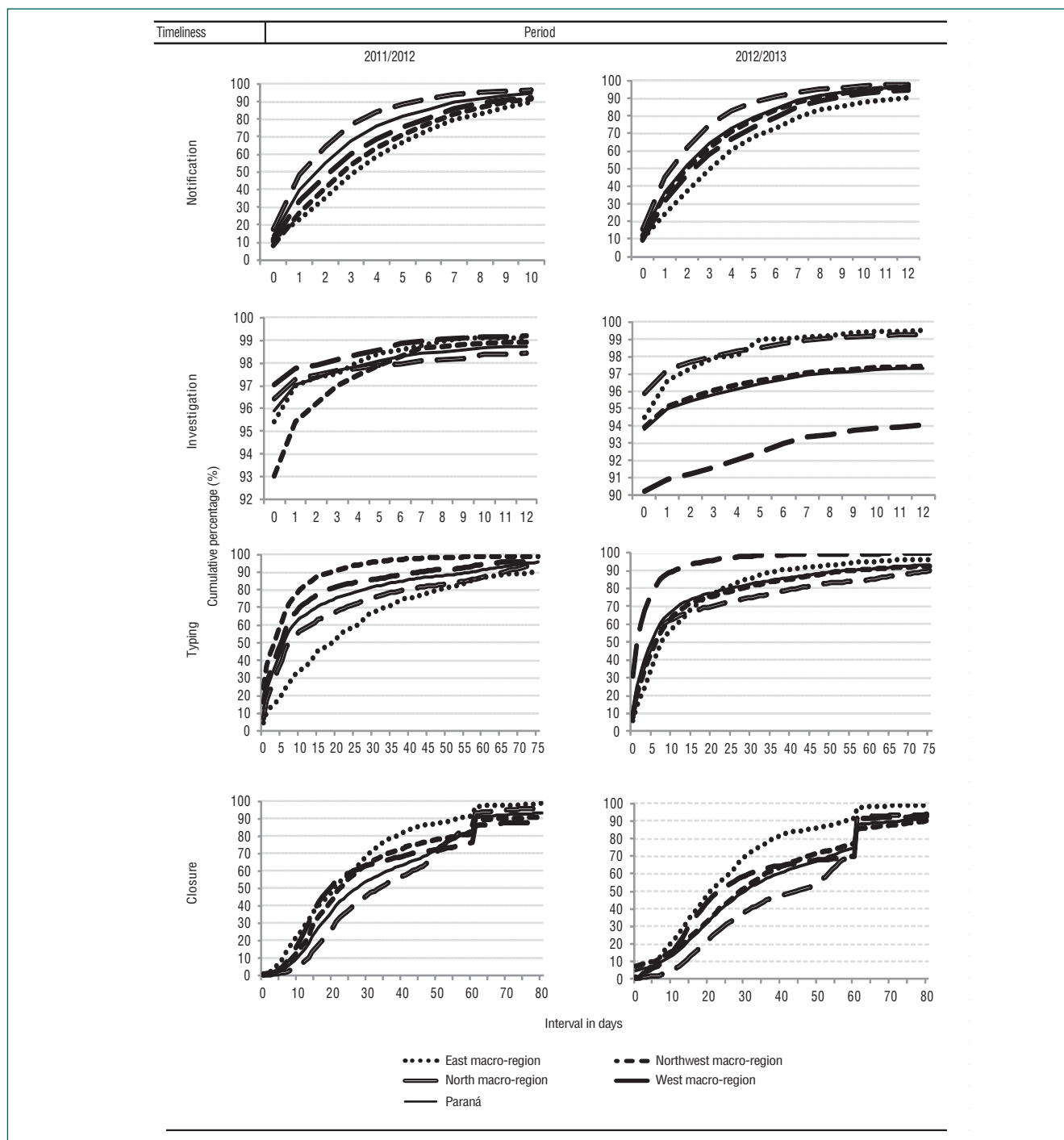
The median showed a similar pattern in both periods. In the first it was two (Macro-North) to four days (Macro-East), with 75% of cases notified between three and seven days. In the second period it was also two (Macro-North) to four days (Macro-East), but with 75% of cases notified between four and seven days (Table 1).

The evaluation of **research timeliness** showed that in both periods, more than 90% of cases had their investigations initiated on the day of notification, reaching similar percentages of 100% in seven days after notification. In the first period, the macro-West had 99% research timeliness for the cases within seven days, falling in the second, to 93% (Figure 1).

As for **typing timeliness**, none of the health macro-regions reached the indicator of 90% of cases typed within seven days of notification. The Macro-West region was the one that was closest to the indicator, with 85% of cases typed in the second period, within seven days of notification. To achieve 90% of typed cases, it took between 18 (Macro-Northwest) and 72 days (Macro-East) in the first period. And in the second period, 10 (Macro-West) and 74 days (Macro-North) (Figure 1). In the first period, 5% to 21% of cases of dengue were typed on the same day of notification, reaching between 8% and 31% in the second.

**Chart 1.** Stages of timeliness, intervals, and parameters of evaluation

Stages of timeliness	Time interval (in days) obtained from the difference between dates	Case assessment parameters
Notification (case knowledge)	Notification and onset of symptoms	90% notified up to seven days after the onset of symptoms
Investigation (beginning of case investigation)	Investigation and notification	90% with investigation started up to seven days after notification
Typing (of data in the system)	Typing and notification	90% typed up to seven days after notification
Closure (case closure)	Closure ad notification	80% closed up to 60 days after notification



**Figure 1.** Cumulative percentage of intervals of timeliness for notification of dengue, state of Paraná and health macro-regions

The median of the typing interval in the first period was between four (Macro-Northwest) and 19 days (Macro-East) and the second between two (Macro-West) and eight days (Macro-East) (Table 1).

In assessing the timeliness for closure, it was observed that in the first period almost all health

macro-regions reached 80% of cases closed within 60 days of notification; the exception was the Macro-West region. In the second period, only the Macro-East region reached the indicator in 38 days. The time needed to reach closure of 80% or more of the cases notified in both periods was between 38

**Table 1.** Percentiles of intervals of timeliness for notification of dengue, Paraná and health macro-regions

Period		2011/2012					2012/2013				
Macro-region Timeliness		E	NW	N	W	PR	E	NW	N	W	PR
Notification	Mean	5	5	3	5	4	6	4	3	5	4
	Max	67	375	367	375	375	368	740	731	398	740
	P75	7	6	3	5	4	7	5	4	6	5
	P50	4	3	2	3	2	4	3	2	3	2
	P25	2	1	1	1	1	2	1	1	1	1
	Min	0	0	0	0	0	0	0	0	0	0
Typing	Mean	38	8	21	15	17	19	20	22	5	18
	Max	470	452	769	554	769	758	642	621	482	642
	P75	39	8	29	14	20	19	19	30	5	17
	P50	19	4	7	5	6	8	6	6	2	5
	P25	7	1	3	1	2	4	2	2	0	1
	Min	0	0	0	0	0	0	0	0	0	0
Closure	Mean	26	63	39	43	44	26	44	54	125	45
	Max	372	781	762	509	781	758	653	605	758	758
	P75	34	43	52	57	52	34	57	61	30	61
	P50	21	22	34	20	27	21	29	45	21	30
	P25	11	14	19	12	15	12	16	22	17	17
	Min	0	0	0	0	0	0	0	0	0	0

MAX - Maximum; P - Percentile; P50 - Median; MIN - Minimum; E - East; NW - Northwest; N - North; W - West; PR - Paraná

(Macro-East) and 61 days (Macro-North, North-west, and West) (Figure 1).

The median in the first period was between 20 (Macro-West) and 34 days (Macro-North) and, in the second period, between 21 (Macro East and West) and 45 days (Macro-North) (Table 1).

## Discussion

The limitations of the study are inherent to the bias related to the use of secondary data. Although not significant in percentage, some records were found to contain typing errors or lack of dates. The lack of studies in the area and the lack of standardization in the parameters make the comparison with other studies difficult.

This research is unique, as it has evaluated the effectiveness of the dengue surveillance system in accomplishing its steps with results that contribute to its immediate practical use in health regions and municipalities. There is also the challenge of building a dengue analysis notebook, something that is still lacking, to equip nurses and other professionals for the assessment and monitoring of cases.

The timeliness is the availability of data from the monitoring system in a timely manner; this reflects the

time elapsed between the steps, including the collection, analysis, and interpretation of data and dissemination so that control measures are taken.<sup>(13)</sup> Dengue is an acute, fast-spreading viral disease. The timely notification of cases is an essential measure for surveillance to be able to follow the pattern of transmission and the endemic curve of this disease in a certain area<sup>(14)</sup> in order to help prevent new cases and deaths.

The timeliness for notification was better performed in the regions with a greater number of notified cases. In the first period, the Macro-North region, with 54% of cases, showed 94% of notification within seven days of the onset of symptoms, which may indicate higher service sensitivity to the detection. In the second period, the Macro-North-west region, with 61% of cases, obtained 88% of notifications in the same interval, and the North 94%. The macro-region with fewer cases (East) had fewer timeliness of notification: 80% in the first period and 79% in the second.

The median was similar in both periods, with values between two and four days, with 90% of cases notified between six and 12 days. The need for improvement of the timeliness for notification was considered because, of the four macro-regions, three did not hit the indicator parameter for each period.

These data are similar to the median time for dengue notification in Brazil - four days, with 90% of cases notified in approximately 13 days.<sup>(15)</sup> In other countries such as South Korea, Taiwan, and Australia, the median was two days/15 days, four days, and two days/10 days, respectively.<sup>(16-18)</sup> Proper surveillance, adequate case definition, stimulus and motivation of the teams, integration of the reporting units, strengthening training, and ongoing supervision are factors indicated by the Pan American Health Organization for improvement of notification.<sup>(13)</sup>

In Brazil, the dengue surveillance system establishes that an active search of severe suspected cases in health facilities is performed, and immediate notification is made to the surveillance service.<sup>(14)</sup> Active surveillance strategies are important components in the study of transmission epidemiology of dengue, as observed in Iquitos, Peru, where the home visit system was shown to be more sensitive for the detection of symptomatic cases.<sup>(19)</sup>

Difficulties reported by dengue surveillance professionals in the active case finding were lack of transport vehicles, reduced number of technicians, and resistance by homeowners to access the house. Ongoing training of the professionals involved, adequacy of human resources, and expanded infrastructure have been suggested as improvements to the dengue surveillance system.<sup>(20)</sup>

The phase of the epidemiological investigation of dengue cases is a very important step to detect the likely site of infection, to break the chain of transmission, and to prevent outbreaks.<sup>(14,21)</sup> In the analysis of the research timeliness, an excellent performance of the surveillance system was observed - between 90% and 96% of cases initiated investigations on the day of notification. Similar results were found in the evaluation of the national dengue system at 90%,<sup>(15)</sup> and in the study of the national databank of leptospirosis at 89%.<sup>(22)</sup>

However, the above authors state that this finding may not reflect reality, because they argue that the research data is likely being filled in within the same date of the notification. However, the results support the guidance of the Ministry of Health, that the filling in of the investigation form should

be performed on the first visit by the professional who raises the diagnosis hypothesis.<sup>(8)</sup>

The online system has been increasingly adopted in many countries to support programs for the control and prevention of infectious diseases. In 2004, the Chinese government launched a real-time system, with a view to what was learned from the epidemic of severe acute respiratory syndrome (SARS) that occurred in 2003.<sup>(23)</sup> This information system is also essential for characterizing the response to control of schistosomiasis, which is endemic in China.<sup>(24)</sup>

The analysis of typing timeliness showed a higher median in the first period than in the second - respectively 4-19 and 2-8 days. The median for data typing of national dengue in the SINAN Net in 2009 was 14 days from the onset of symptoms, and even during outbreaks this pattern remained, despite the increase in the number of cases.<sup>(25)</sup> The authors infer that the system seems to the epidemic periods, given the hiring of a greater number of support staff in health departments, but they think that the timeliness for typing does not receive due importance in periods of low disease transmission.

About 5% of suspected cases of rash, meningitis, and dengue were entered into earlier versions of the national database on the same day as the notification, with the median considered unsuitable (10-14 days).<sup>(15)</sup> In this research, it was observed that, during the first period, between 5% and 24% of the cases were typed on the same day of the notification and, in the second period, between 6% and 31%.

There was an emphasis on the Macro-West region that, with seven days, reached 85% of the cases typed. However, this initial rate was not uniform in other macro-regions, which was considered unsuitable, with respect to typing in a timely manner, in both periods. This result corroborates the national study of leptospirosis, which identified 35% of data typed within seven days, considering a parameter of 75%.<sup>(22)</sup> Despite the evolution of the system, it is assumed that structural factors may interfere with the performance of typing timeliness, such as lack of typists and computers,<sup>(25)</sup> which may have occurred in the Macro-North region.

A study with epidemiological surveillance coordinators pointed out other problems, such as delay in arrival and release of notification forms for typing, constant power failures, unavailability of computers, incorrect filling, work overload, and loss of about 24% of the data during transmission of lots.<sup>(20)</sup>

In China, real-time surveillance is limited by Internet deficiency in many rural areas where schistosomiasis is endemic.<sup>(24)</sup> This problem has also been reported in the Maldives and in Australia, where doctors from regional hospitals have access to the on-line system to enter data for disease notifications, but tend to prioritize assistance.<sup>(18)</sup>

“Dengue imposes great challenges to health professionals, due to its magnitude and increasing occurrence of severe cases. [...] Surveillance is still one of the main activities for its prevention.”<sup>(20)</sup> Internet-based surveillance systems are economically more attractive, but they do not have the ability to replace traditional surveillance systems, and should not be seen as an alternative, but rather as a reinforcement extension to the capacity of coping with emerging infectious diseases such as influenza and dengue.<sup>(26)</sup>

The results of the typing timeliness for this study demonstrate the importance of data being available in time for the analysis of health status, generating credibility to the on-line system, and considering that the achievement of its goal depends on the optimal use by those professionals involved and on the management political commitment.

## Conclusion

The on-line system of dengue surveillance showed suitability regarding investigation timeliness - in over 90% of cases the investigation was started on the same day as the notification. The remaining steps need improvement, especially notification; of the four macro-regions, three have not reached the indicator in both periods.

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## Collaborations

Goto, Larocca, and Felix contributed to the conception and design of the study, data analysis and interpretation, writing, and final review of the article. Kobayashi and Chaves collaborated in the data analysis and interpretation, and the final article review.

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