

*Full Length Research Paper*

# **Evaluation of the delivery of biological specimens from health care facilities to the National Laboratory in Abidjan, Cote D'ivoire**

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In 2018, the National Institute of Public Hygiene (INHP) signed an agreement with a courier deliver company to transport specimens from health facilities at district level to the national laboratory in Abidjan. This study aims to evaluate the quality of the specimens transport system, one year after implementation. The duration of specimen's delivery was used as a quality indicator. It is the difference between the date of swabbing at health facility and the date of delivery at INHP. From January to September 2019, 2,352 specimens were sent from the healthcare facilities to the National Laboratory via the INHP. It came from 54 health districts over 86, with 62.8% as utilization rate and an average of 43 specimens per district. The median time to deliver specimens to INHP is 3.6 days [0-21 days]. In addition, 70% of the specimens from Abidjan arrive at INHP in less than 3 days with a significant relationship between the delivery time and the location of the districts. Case-reporting in all health districts should be implemented in the districts of the interior of the country to detect the outbreaks early. Collaboration should be strengthened, between the districts and the local agencies of the courier delivery company.

**Key words:** Specimens shipment, surveillance disease, delivery time.

## **INTRODUCTION**

Disease surveillance or clinical research can sometimes involve the transport of biological specimens and the transmission of data-associated can serve as a basis for scientific or biomedical research (Mungwira et al., 2015). In the interest of global public health, samples of human or animal origin must be transported quickly, efficiently, legally and safely from the place where they are taken to

the place where they will be analyzed (WHO Guidance, 2015-2016). But in certain situations, the times for carrying out biological examinations may be lengthened, due to delayed transport or when health facilities are very far from the laboratory, and the adequate storage of samples may be compromised by logistical constraints (Roche et al., 2016).

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In Côte d'Ivoire, the shipment of biological specimens is mainly done in the framework of the routine surveillance of epidemic prone diseases. The majority of the health facilities at peripheral level do not have sufficient technical platform for the realization of biological examinations. The country has 2252 health facilities with only 231 laboratories (Ministry of Health and Public Hygiene, annual health report, 2017) Thus the specimens are sent mainly by the public car transport companies to the Pasteur Institute of Côte d'Ivoire in Abidjan which hosted 17 national reference laboratories for epidemic prone diseases (Ministry of Health and Public Hygiene, Annual report of activities, 2017). However, the assessments of the surveillance system and the supervisions of healthcare workers carried out revealed difficulties including the contamination, the alteration and the loss of certain specimen and the non-compliant transit time (Ministry of Health and Public Hygiene, Sample Transport Assessment Report, 2018).

To overcome these difficulties, a new shipment mechanism for specimens from the health districts to the national laboratories was set up with the support of a company. This company which has several agencies conveys the samples coming from the districts. These new measures include the specimens' reception unit at INHP which forwards specimens received from health districts to the national reference laboratories. (Ministry of Health and Public Hygiene, Contract for the transport of samples, 2018). Indeed, the National Institute of Public Hygiene (INHP) is responsible for the control of transmissible, bacterial, viral and parasitic endemics. It thus coordinates activities related to the diseases under surveillance. The objective of this study is to determine the delivery time from health districts to laboratories specimens in order to assess the added value of this new mechanism one year after it has been put in place.

## MATERIALS AND METHODS

This is a cross-sectional study based on the analysis of the diseases surveillance data. The evaluation period runs from January to September 2019.

A biological specimen reception unit has been set up at INHP. It collects biological specimens sent from all health districts in the country. These include specimen of Cholera, Meningitis, Ebola Virus disease, Hemorrhagic Fever, Influenza and other public health events except diseases under surveillance in the Expanded Program on Immunization (EPI). These collected specimens are checked and shipped to IPCI, the National Laboratory in Abidjan the capital of the country. A copy of the notification forms and the packing slip are archived and recorded electronically by this unit. The specimens are sent daily to IPCI upon reception at INHP. Thus, the patient's sample leaves the health center, arrives at the district office then at the INHP and finally at the IPCI where the biological diagnosis is carried out.

The items in the notification form are: date of specimen taking at the health facility, sending date from the health district, sending and reception dates at INHP. The specimen delivery time was measured from health facility to INHP. It corresponds to the difference

between the date of specimen taking at the health facility and the reception date at INHP. Position parameters such as the average and the median were estimated for quantitative variables and proportions for qualitative variables. The comparison of the delivery delay was done through the  $\chi^2$  test. Data analysis was done by Stata MP 12 software.

## RESULTS

A total of 2352 specimens were sent from the health facilities to the national reference laboratories via INHP. These specimens came from 54 out of 86 health districts in the whole country. This corresponds to a service utilization rate of 62.8%, which provided specimens an average of 43 specimens per district.

The distribution of specimens by disease shows that dengue accounted for 78.87% and influenza for 13.56%. Pertussis accounted for 1.91% and Collective Toxi-food infection for less than 1% (Table 1). In addition, we noted that 76% of the specimens came from the health districts located in the region of the country's capital (Abidjan) and 24% from the countryside districts.

The monthly evolution of the number of specimens shipped has increased from 35 to 776 cases from February to July and then decreased until September to 105 cases. An average of 261 specimens is shipped per month from the districts to INHP (Table 2).

The scattering of specimens according to the delivery time of samples from health centers to INHP showed a median time of 3.6 days (0-21 days). The scattering of specimens by disease according to the average delivery times also revealed a delay of 6 days or more for meningitis, influenza and whooping cough. The delay for dengue specimens' delivery was 2.89 days (Table 1).

Note that 70% of the samples reached the INHP within the required 72 h. These are mainly dengue (69.65%), TIAC (50%) and cholera (33.36%) samples (Table 3). Among these 1340 samples received, 46% arrived in less than 24 h; 27.4% arrived between 24 and 48 h; 26.6% between 48 and 72 h.

The comparison of the delivery time between the health districts of Abidjan and those of countryside according to the 72 h showed that more than 70% of the specimens coming from the region of Abidjan reached INHP on time less than 3 days. Outside Duekoue district, almost all the districts with a delivery time between 1 and 3 days are located within 300 Km around Abidjan including Gagnoa (272 km from Abidjan), Toumodi (196 Km from Abidjan) and Aboisso (117 km from Abidjan).

There is also a significant relationship between the specimen delivery time and the location of the health districts from Abidjan ( $p = 0.000$ ) (Table 4).

## DISCUSSION

The shipment of biological specimens is an essential loop

**Table 1.** Type and delay of specimens of diseases under surveillance at INHP in 2019 in Cote d'Ivoire.

Variable	Specimen sent			Delivery delay (days)		
	No.	(%)	Average time	Min	Max	Standard deviation
Cholera	11	0.47	4.9	0	11	4.1
Whooping cough	45	1.91	6.1	6	7	0.3
Dengue	1855	78.87	2.9	0	17	2.3
Influenza	319	13.56	6.5	1	21	2.7
Meningitis	114	4.85	6.2	1	16	3.2
Food poisoning	8	0.34	5.4	3	14	3.7
Total	2352	100	3.6	0	21	2.8

**Table 2.** Monthly evolution of the number of specimens sent to INHP in 2019 in Cote d'Ivoire.

Variable	Jan	Feb	March	April	May	June	July	August	Sept	Total
Cholera	0	2	3	3	0	1	2	0	0	11
Whooping cough	0	0	0	4	0	0	31	10	0	45
Dengue	2	5	14	71	348	564	694	124	33	1855
Influenza	10	2	33	58	53	0	44	54	65	319
Meningitis	29	25	21	9	9	7	9	2	3	114
Food poisoning	0	1	2	0	1	0	0	0	4	8
Total	42	35	72	148	411	573	780	190	105	2352

**Table 3.** Distribution of sample types according to the 3-day period at INHP in 2019 in Cote d'Ivoire.

Variable	Delivery delay (days)		
	<3 days	>3 days	Total
Cholera	4(33.36%)	7 (63.64%)	11 (100%)
Cholera	0 (0%)	45 (100%)	45 (100%)
Dengue	1292 (69.65%)	563 (30.35%)	1.855(100%)
Influenza	22 (6.9%)	297 (93.1)	319 (100%)
Meningitis	18 (15.79%)	96 (84.21%)	114 (100%)
Food poisoning	4 (50%)	4 (50%)	8 (100%)
Total	1340 (56.97%)	1012 (43.03)	2.352 (100%)

of the surveillance system of epidemic prone diseases. Since 2018, an agreement has been concluded for this purpose, with the Post Company which has agencies in almost all cities in the country. However, despite this large representation of this company beyond the country, only 62.8% of districts sent at least one sample through this network. This could result from a lack of information for health districts or the underreporting (37.2%).

The gradual increase in the number of specimens sent per month could explain the gradual adoption of this system by the health districts. In addition, an average of 48 specimens was shipped per district in 9 months. This could be related to a lack of coordination of activity

between the health districts and the departmental agencies of the courier and parcel delivery company. This under notification could be related to the nature and prevalence of pathologies under surveillance. In fact, in 2017, the incidence of measles was 4 / 100,000 while it was 0.16 per 100,000 for meningitis (Ministry of Health and Public Hygiene, Annual report of the activities of the National Institute of Public Hygiene, 2017). For example, we expect more cases of measles than meningitis.

This reflects an underutilization or under-reporting of cases at the health facility level. An underestimation of the number of cholera cases has been observed in similar studies in Senegal despite the existence of a functional

**Table 4.** Comparison of the delivery delay of the specimens between the districts of Abidjan and those of countryside in 2019, Cote d'Ivoire.

Variable	<3 days	>3 days	Total
Abidjan	1287 (71.90%)	503 (28.10%)	1790 (100%)
the interior of the country	53 (9.43%)	509 (90.57%)	562 (100%)
Total	1340 (56.97%)	1012 (43.03%)	2352 (100%)

Pearson  $\chi^2(1) = 683.4018$ ; Pr = 0.000.

surveillance system (Roquet et al., 2018).

This underutilization of the new shipment system is greater in the districts from countryside. Indeed, all the health districts of Abidjan use this system and more than three quarters of the specimens come from these districts (76%).

The distribution of specimens by disease showed that dengue accounted for more than a quarter of the specimens (78.7%). This was related to the dengue epidemic that the country experienced. Over the period of the study, 3200 suspected cases of dengue fever have been recorded. This new mechanism helped to ship approximately 58% of district dengue specimens to the laboratories via INHP.

Regarding the specimens delivery delay, the average was 3.6 days [0-21 days]. This average delay ranges according to the location of the health district s. The reasons of this long delay are related to the distances between the districts and the capital where the national reference laboratories are located. Clinicians' satisfaction with the delay in delivering emergency results was significantly lower in establishments without an on-site laboratory (Brulé et al., 2018)

Moreover, the time for the feedback of the results varies according to the laboratory or the germ to diagnose. It was evaluated at 3 days minimum for cholera (Kenny et al., 2018). This delay takes into account the technique of identification of the germ and the process of transmission or storage of data within the laboratory. However, studies have noted a delay of 1 h and 30 min as the maximum transport time between the most distant healthcare establishments and the reference laboratory (Crozet et al., 2015).

This study has limitations. The calculation of the delivery delay did not take into account the date of reception by the laboratory, although the new mechanism allowed the daily delivery of the received specimens to the reference laboratory. In addition, our study has not included the delay of results feedback.

## Conclusion

The implementation of this new system of specimens' shipment has allowed to evaluate the performance indicators and to have an electronic database of

monitoring. This arrangement has helped to improve surveillance activities especially for the districts located in the region of Abidjan the capital. However, case reporting should be strengthened in all health districts far from Abidjan as well as the use of the specimens' shipment system in the health district located countryside. Collaboration at the operational level should also be strengthened, between the districts and the local agencies of the courier and parcel delivery company

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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