

# Study of laboratory staff' knowledge of biobanking in Côte d'Ivoire

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## Research article

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# Abstract

**Background:** The biobank is a structure that manages and makes available biological resources. The biobank has medical, scientific and economic interests in an ethical manner. In 2009, Côte d'Ivoire established a biobank, which has housed the regional biobank of Economic Community of West African States (ECOWAS) countries since 2018. To ensure optimal and efficient use of this biobank, scientific stakeholders must be aware of its existence and role. It was therefore necessary to assess the knowledge of laboratory staff on the role and activities of a biobank.

**Methods:** This is a descriptive study conducted with staff of human, animal and plant health laboratories located in southern Côte d'Ivoire.

**Results:** A total of 205 people agreed to complete the proposed questionnaire. Of these, 34.63% are biologists, 7.32% engineers, 48.78% technicians and 9.27% PhD students. The average professional experience was  $10.11 \pm 7.83$  years. Respectively, 47.32% and 43.41% have never heard of biocollection and biobank. Only 48.78% of participants had a good understanding of the role of a biobank. Technicians and PhD students were less educated on the notion of biobank ( $p < 0.000001$ ). Biologists, although they were more educated on this issue, 21.13% of them had a misconception of biobank. Good knowledge of the role of a biobank was not significantly related to the duration of professional experience ( $p > 0.88$ ).

**Conclusion:** The level of knowledge of laboratory staff about biobanking remains to be improved. Training on the role, activities and interests of the biobank is important.

## Background

Recent advances in the biological and medical fields have increased the value of research on biological samples stored in biobanks. These biological resources are an essential aid to the development of research in many developing countries. This research should contribute to improving health care and reducing disease in these countries [1, 2].

A biobank is defined as a structure that receives, processes, stores and makes available biological samples and associated data for research and clinical care purposes. Samples can be of human, animal, plant and environmental origin [3-6].

In its operation, the biobank guarantees the quality of the procedures for collecting, transporting, processing, storing and making available biological samples in compliance with the rules of good practice and regulations [6].

Over the past three decades, technological advances have enabled biobanks to grow. As a result, the number of samples stored has increased significantly and biobanks have moved from project-specific (individual) to population-based studies [4, 7].

Today, the biobank is essential to the development of scientific research and has several interests: (i) it plays a crucial role in the conservation of species [8, 9]; (ii) it contributes to the public good, health and well-being of the population by providing a better understanding of the specific profile of each patient in order to develop more targeted treatments [10]; (iii) it makes it possible to design more effective and less costly drugs for health systems [11, 12].

Most biobanks are located in developed countries, but the landscape is changing rapidly as developing countries are increasingly establishing their own biobanks [7, 13-15], including Côte d'Ivoire. That country established a biobank in 2009, which has been home to the regional biobank of the countries of the Economic Community of West African States (ECOWAS) since 2018. This biobank is located within Pasteur Institute of Côte d'Ivoire (PICI), a Biological and Medical Research Center. Several samples from several countries in the sub-region, including Benin, Togo, Burkina Faso, Mali and Nigeria are kept at the ECOWAS biobank. These preserved samples are of human, animal, plant, environmental and microbial origin. This biobank contributes to the epidemiological surveillance of influenza and measles in Côte d'Ivoire. It also participated in the United States Agency for International Development (USAID) PREDICT 2 project, whose overall objective was to strengthen the capacity of the surveillance system for human and animal diseases in high-risk regions.

The successful operation of a biobank requires comprehensive interactions between the different actors involved in biobanking, including the public, patients, health care providers, government and donors [16, 17]. Public support, understanding and active participation are essential to the survival of biobanking and research in general. Several studies have described the role of the public [18, 19] and patients [20-22] in biobanking, but very few studies have examined the role of health professionals.

Biological and medical laboratories are the gateways for biological samples. Therefore, appropriate assessment of biobank knowledge, training and continuing education of laboratory professionals can ensure continued development and innovation in the field of biomedical research. A better understanding of the basic knowledge of laboratory professionals about biobanking is therefore essential. Very few studies have assessed knowledge of biobanking among laboratory professionals in general and no such studies are conducted in Côte d'Ivoire in particular. The main objective of this study was to assess the level of knowledge of laboratory professionals about biobanking.

## Methods

This is a descriptive study that took place from May 28 to August 05, 2019 in the biological and medical analysis laboratories of southern Côte d'Ivoire. Its objective was to assess the level of knowledge of laboratory staff in biobanking. The targeted population by the study was laboratory staff (biologists, engineers, technicians and PhD students (postgraduate students)). Laboratories were selected using a sampling technique based on a pre-determined sampling frame. This database, composed of 450 functional laboratories in southern Côte d'Ivoire, was obtained from the Directorate of Health Facilities of the Ministry of Health and Public Hygiene, the Ministry of Agriculture and Rural Development and the

Directorate of Veterinary Services of the Ministry of Animal and Fisheries Resources. From this database, the laboratories have been grouped into three classes:

- Human health laboratories: 360
- Animal health laboratories: 53
- Plant health laboratories: 37

Then the laboratories of each class constituted were chosen taking into account the level of the technical platforms with sophisticated equipment used for diagnosis and scientific research and also the private or public character of the laboratories. A total of 66 laboratories were selected: 45 human health laboratories, 15 animal health laboratories and 6 plant health laboratories.

Included in the study were all the professionals from volunteer laboratories who were present during our visit to the chosen laboratories.

### **Data collection**

The data collection was carried out by a previously trained PhD student. A pre-tested and validated questionnaire as a tool was used to collect data on the professional profile and knowledge of the term "biobank". The questionnaire was completed in 15 minutes. The questions in the questionnaire focused on knowledge of the term "biobank" and their role, activities, interests and its existence in Côte d'Ivoire.

### **Statistical analysis**

Data entry and analysis were performed using EpiData 3.1 software and STATA 11 software respectively.

Statistical tests (Pearson's chi-2 or Fisher) with a 95% confidence level were used to test the existence of a statistical link between "knowledge of the role and activities of a biobank" and professional profile variables such as "function", "type of laboratories", "laboratory characteristics" and "types of activities" in the laboratories where the participants came from. Then, the mean comparison test with a 95% confidence level was used for the existence of a statistical link between "knowledge of the role and activities of a biobank" and "the duration of professional experience".

### **Ethical conditions**

Arrangements had been made to ensure that this study is conducted under ethical conditions. Indeed, the research ethics committee of the PICI has given its approval for the realization of this study. And the investigation only began after obtaining the authorization of the heads of the selected laboratories. In addition, the information was collected with the consent of the participants and in absolute confidentiality, and made anonymous and encrypted.

## **Results**

A total of 205 people from 66 laboratories participated in the study. These were 45 human health laboratories, 15 animal health laboratories and 6 plant health laboratories. Of these, 33 were research laboratories and 57 were public laboratories. The respondents were 149 (72.68%) male and 56 (27.32%) female. The average age of work experience was  $10.11 \pm 7.83$  years with extremes ranging from 1 to 36 years. Of the 205 respondents, 50% had more than 8 years' professional experience. The workforce was mainly composed of technicians (48.78%) (See Table 1). Staff from public laboratories represented 82.93% of the participants. Those from research laboratories and human health laboratories represented 49.27% and 70.73% of participants respectively. The Pasteur Institute of Cote d'Ivoire (PICI) laboratory staff included in this study represented 30.24% of respondents.

**Table 1:** Professional profile of respondents

Characteristics	Staff size	Percentage (%)
<b>Duration of work experience</b>		
1-5 years	78	38.05
6-10 years	50	24.39
>10 years	77	37.56
<b>Sex</b>		
Male	149	72.68
Female	56	27.32
<b>Respondents functions</b>		
Biologists	71	34.63
Biology Engineers	15	7.32
Biology Technicians	100	48.78
PhD Students	19	9.27
<b>Respondents from different types of laboratories</b>		
Human health		
Animal health	145	70.73
Plant health	46	22.44
<b>Respondents from different laboratory statuses</b>	14	6.83
Public		
Private		
<b>Respondents from research center laboratories and others</b>	170	82.93
Research centers	35	17.07
Others centers		
	101	49.27
	104	50.73

In this study, 56.59% of participants reported that they had already heard of biobank. Among these, the staff from the PICI had all heard of biobank, while 62.23% of the staff from the other laboratories surveyed had never heard of biobank. The majority of respondents heard about biobank for the first time

in their work (32.68%) and training courses (21.46%). To the question: What are the role and activities of a biobank? ; 48.78% gave an exact answer. That is to say, collecting, preserving and making available samples with their associated data. Of these, 2% were unaware of the importance of traceability of biological samples in the biobank process. As for the biobank of Côte d'Ivoire, 44.88% said they knew about its existence and location. As for the regional biobank of ECOWAS countries, 63.41% were unaware of its existence. Six of the respondents stated that they use biobanks other than the one in Côte d'Ivoire for the conservation of their biological samples. These were the biobanks of Europe and North Africa. The bi-varied analysis showed that technicians and PhD students were less educated on the notion of biobank ( $p < 0.000001$ ). 21.13% of biologists, although they were more educated on this issue, have a misconception of biobank. Good knowledge of the role of a biobank was not significantly related to the duration of work experience ( $p > 0.88$ ). But it was significantly related to the type of laboratory, the character of the laboratory and the type of activity of the laboratory. Indeed, laboratory staff who had a better understanding of the role of a biobank came from animal health laboratories ( $p < 0.002$ ), research laboratories ( $p < 0.000001$ ) and public laboratories ( $p < 0.006$ ). Staff from PICI laboratories had a better knowledge of the role of a biobank than staff from other laboratories ( $p < 0.000001$ ). However, 8.06% of them had an erroneous notion.

**Table 2:** General knowledge about biobank

<b>Variables</b>	<b>Staff size</b>	<b>Percentage (%)</b>
<b>Have you ever heard of biobank?</b>		
Yes	116	56.23
No	89	47.77
<b>Where have you heard about biobank before?</b>		
Mass media		
At work	5	2.44
During a training session	67	32.68
Never heard of it	44	21.46
	89	43.41
<b>Role and activities of a biobank</b>		
Correct answer	100	48.78
Wrong answer	16	7.80
Don't know	89	43.42
<b>In your opinion, does sample traceability play a role in the biobanking process?</b>		
Yes	16	46.83
No	93	7.8
Don't know		45.37
<b>Did you know that Côte d'Ivoire has a biobank and do you know where it is located?</b>		

Yes

No

92

44.88

113

55.12

**Did you know that Côte d'Ivoire also has an ECOWAS regional biobank  
and do you know where it is located?**

Yes

No

75

36.59

130

63.41

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**Table 3:** Association between knowledge of the definition, role and activities of a biobank and professional profile

	Definition, role and activities of a biobank				P value
	Correct answer		Wrong answer		
	n	%	n	%	
<b>Professional profile</b>					
<b>Functions</b>					
Biologists	56	78.87	15	21.13	<0.000001
Biology Engineers	6	40	9	60	
Biology Technicians	31	31	69	69	
PhD Students	7	36.84	12	63.16	
<b>Respondents from different types of laboratories</b>					
Human health	55	37.93	90	62.07	<0.002
Animal health	37	80.43	9	19.57	
Plant health	8	57.14	6	42.86	
<b>Respondents from different laboratory statuses</b>					
Public	90	52.94	80	47.06	<0.006
Private	10	28.57	25	71.43	
<b>Respondents from research center laboratories</b>					
Yes	83	82.18	18	17.82	<0.000001
No	17	16.35	87	83.65	

## Respondents from PICI laboratories and others

PICI laboratories	57	91.94	5	8.06	<0.000001
Others laboratories	43	30.07	100	69.93	

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## Discussion

The African continent has the highest number of epidemics (more than 100 per year). Preparedness, surveillance and response to health crises are essential for the successful implementation of the International Health Regulations. With this in mind, the World Health Organization (WHO) has asked Pasteur Institute de Côte d'Ivoire (PICI) to confine poliovirus, yellow fever, influenza and HIV specimens. Thus, in 2009, Côte d'Ivoire and the PICI decided to create a biobank with international standards. This project had three components: rehabilitation of existing structures, construction of a cryobiology room and state-of-the-art equipment to offer all conservation techniques, and training of human resources in Europe. This state-of-the-art equipment for the conservation of high quality biological samples allowed the PICI biobank to be chosen as the biobank of the ECOWAS countries. This biobank participates in national and international research programs, notably in the epidemiological surveillance of influenza and measles in Côte d'Ivoire. As well as in the USAID PREDICT 2 project whose general objective was to strengthen the capacities of the human and animal disease surveillance system in high-risk regions.

In this context, the emergence of a biobank as a structure of sample collections combined with relevant patient information requires the active participation of the public, patients, health care providers, government and donors. Several studies have described the role of the public [18, 19] and patients [20-21] in biobanking, but very few studies have examined the role of health professionals.

Biomedical laboratories are the gateways for biological samples. Therefore, education and awareness of laboratory professionals is paramount to ensure the proper management of high quality biological samples and the collection of real-time patient information. An initial assessment of knowledge about biobanking in Côte d'Ivoire is a prerequisite for the development of appropriate awareness programs for the public, patients or health care providers.

In our study, we sought to determine the level of knowledge of laboratory professionals about biobanking. We present the results of this survey conducted in biomedical analysis laboratories in the south of Côte d'Ivoire. The study showed that 56.59% of the participants said they had heard of the term "biobanking" before. It should be noted that laboratory personnel from PICI, the structure housing the biobank in that country, were included in the study and represented 30.24% of the participants. They had all stated that they had already heard of biobanking.

Sixty-two point twenty-three percent of the non-PICI laboratory staff had never heard of biobanking. This is lower than in the study by Merdad et al. where 73% of health science students in Saudi Arabia reported never having heard of biobanking [23]. This limited knowledge is consistent with the results of previous surveys conducted in other parts of the world [24-28].

The level of knowledge about the role and activities of biobanks among the surveyed laboratory staff is low, although including PICI laboratory staff. Indeed, 8.06% of PICI laboratory staff compared to 69.93% of other laboratory staff is unaware of the exact role and activities of a biobank. This is in contrast to a study among Italian students where 83.7% were aware of the role and activities of biobanks [29]. The results also showed that biologists had significantly higher knowledge of the role and activities of a biobank than engineers, technicians and PhD students. This may be explained by the fact that most of the biologists surveyed are researchers and are more involved in scientific training. Among the people surveyed, 2.93% stated that they use the service of biobanks located in Europe and North Africa for the conservation of their biological samples. This translates into the fact that they are unaware of the existence of a biobank in Côte d'Ivoire.

This limited knowledge seems to be linked to the novelty of the concept in Côte d'Ivoire, but also to the fact that the term itself can be confusing for many people. Since during the survey, some people defined biobanks as savings structures reserved for biologists.

## **Conclusion**

The current study was carried out to address the lack of awareness about biobanking in Africa, specifically in Côte d'Ivoire, through a customized questionnaire for laboratory professionals. The results showed a notable lack of awareness of the term "Biobank" and its role, activities, interests and existence in Côte d'Ivoire. There is therefore a need to plan additional awareness and training programs tailored to laboratory professionals to familiarize them with biobanking. This awareness of the importance of informative participation in biobanking should also be extended to all biobank staff, health care providers, including laboratory professionals, and the general public in order to enhance the value of biomedical research in Côte d'Ivoire and even in Africa.

## **Declarations**

### **Ethics approval and consent to participate**

The research ethics committee of the Pasteur Institute of Côte d'Ivoire has given its approval for the realization of this study. A verbal consent was obtained from participants since the study did not involve confidential data or intervention.

### **Consent for publication**

Not applicable

## Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## Competing interests

The authors declare that they have no competing interests.

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## Authors' contributions

KKA conducted the study, collected the data and wrote the introduction and discussion section. NKM analysed the data and wrote the methods and results section. MM participated in writing the methods section. CS and DS participated in writing the introduction section of the manuscript. SMK participated in the data analysis. CFA, DAJ, and DM participated in the study design and reviewed the manuscript. All authors read and approved the manuscript.

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## Abbreviations

PICI: Pasteur Institute of Côte d'Ivoire

## References

1. Shapiro HT, Meslin EM. Ethical issues in the design and conduct of clinical trials in developing countries. *N Engl J Med*. 2001;345(2):139-142.

2. Benatar SR. Reflections and recommendations on research ethics in developing countries. *Soc Sci Med*. 2002;54(7):1131-1141.
3. Martinez J, Briceño I, Hoyos A, et al. Biobanks. A strict and essential strategy conservation of biological samples. *Acta médica colombiana: AMC: organo de la Asociación Colombiana de Medicina Interna*. 2012;37:117-126.
4. De Souza YG, Greenspan JS. Biobanking past, present and future: responsibilities and benefits. *AIDS*. 2013;27(3):303-312.
5. Gille F, Vayena E, Blasimme A. Future-proofing biobanks' governance. *Eur J Hum Genet*. 2020. <https://doi.org/10.1038/s41431-020-0646-4>.
6. Müller H, Dagher G, Loibner M, Stumptner C, Kungl P, Zatloukal K. Biobanks for life sciences and personalized medicine : importance of standardization , biosafety, biosecurity, and data management. *Curr Opin Biotechnol*. 2019;65:45-51.
7. Haidan C, Tikki P. Un appel à la gouvernance mondiale des biobanques. WHO. <https://www.who.int/bulletin/volumes/93/2/14-138420-ab/fr/>. Published 2015. Accessed November 8, 2019.
8. Blackburn HD. Biobanking Genetic Material for Agricultural Animal Species. *Annu Rev Anim Biosci*. 2018;6:69-82.
9. Comizzoli P. Biobanking and fertility preservation for rare and endangered species. *Anim Reprod*. 2017;14(1)30-33.
10. Caenazzo L, Tozzo P, Pegoraro R. Biobanking research on oncological residual material: a framework between the rights of the individual and interest of society. *BMC Med Ethics*. 2013;14:17. doi:10.1186/1472-6939-14-17.
11. Kinkorova J. Biobanks in the era of personalized medicine: objectives, challenges, and innovation. *The EPMA Journal*. 2016;7:4. doi:10.1186/s13167-016-0053-7.
12. Zatloukal K, Hainaut P. Human tissue biobanks as instruments for drug discovery and development: impact on personalized medicine. *Biomark Med*. 2010;4(6):895-903. doi:10.2217/bmm.10.104.
13. de Vries J, Bull SJ, Doumbo O, et al. Ethical issues in human genomics research in developing countries. *BMC Med Ethics*. 2011;12:5. Published 2011 Mar 18. doi:10.1186/1472-6939-12-5.
14. Moodley K, Singh S. "It's all about trust": reflections of researchers on the complexity and controversy surrounding biobanking in South Africa. *BMC Med Ethics*. 2016;17(1):57.
15. Staunton C, Tindana P, Hendricks M, Moodley K. Rules of engagement: perspectives on stakeholder engagement for genomic biobanking research in South Africa. *BMC Med Ethics*. 2018;19(1):13. Published 2018 Feb 27. doi:10.1186/s12910-018-0252-y.
16. Husedzinovic A, Ose D, Schickhardt C, Frohling S, Winkler EC. Stakeholders' perspectives on biobank-based genomic research: systemic review of the literature. *Eur J Human Genet*. 2015;23(12):1607-1614. doi:10.1038/ejhg.2015.27.

17. Manolio TA, Abramowicz M, Al-Mulla F, Anderson W, Balling R, Berger AC, Bleyl S, Chakravarti A, Chantratia W, Chisholm RL, et al. Global implementation of genomic medicine: we are not alone. *Sci Transl Med*. 2015;7:290. doi:10.1126/scitranslmed.aab0194.
18. Dry SM, Garrett SB, Koenig BA, Brown AF, Burgess MM, Hult JR, Longstaff H, Wilcox ES, Madrigal CSK, Martinez A, Boyd EA, Dohan D. Community recommendations on biobank governance: results from a deliberate community engagement in Clifornia. *PLoS One*. 2017;24;12(2):e0172582.
19. Porter C, Pasqualetti P, Togni E, Parker M. Public's attitudes on participation in a biobank for research: an Italian survey. *BMC Med Ethics*. 2014;15:81. doi:101186/1472-6939-15-81.
20. Al-Jumah M, Abolfotouh MA, Alabdulkareem IB, Balkhy HH, Al-Jeraisy MI, Al-Swaid AF, Al-Musaaed EM, Al-Knawy B. Public attitude towards biomedical research at outpatient clinics of King Abdulaziz Medical City, Riyadh, Saudi Arabia. *East Mediterr Health J*. 2011;17(6):536-545.
21. Mitchell D, Geissler J, Parry-Jones A, Keulen H, Schmitt DC, Vavassori R, Matharoo-Ball B. Biobanking from the patient perspective. *Res Involv Engagem*. 2015;1:1. doi:10.1186/s40900-015-0001-z.
22. Cervo S, Rovina J, Talamini R, Perin T, Canzonieri V, De Paoli P, Steffan A. An effective multisource informed consent procedure for research and clinical practice: an observational study of patient understanding and awareness of their roles as research stakeholders in a cancer biobank. *BMC Med Ethics*. 2013;14:30. doi:10.1186/1472-6939-14-30.
23. Merdad L, Aldakhil L, Gadi R, et al. Assessment of knowledge about biobanking among healthcare students and their willingness to donate biospecimens. *BMC Med Ethics*. 2017;18(1):32.
24. Abdelhafiz AS, Sultan EA, Ziady HH, et al. What Egyptians think. Knowledge, attitude, and opinions of Egyptian patients towards biobanking issues. *BMC Med Ethics*. 2019;20(1):57.
25. Chen H, Gottweis H, Starkbaum J. Public perceptions of biobanks in China: a focus group study. *Biopreserv Biobank*. 2013;11(5):267-271. doi:10.1089/bio.2013.0016
26. Ahram M, Othman A, Shahrouri M. Public perception towards biobanking in Jordan. *Biopreserv Biobank*. 2012;10(4):361-365.
27. Bossert S, Kahrass H, Strech D. The Public's Awareness of and Attitude Toward Research Biobanks - A Regional German Survey. *Front Genet*. 2018;9:190.
28. Serrano NC, Guio-Mahecha E, Becerra-Bayona S, et al. The perception of different social agents in Colombia regarding biobanks for research purposes. *Biomedica*. 2018;38(4):569-576.
29. Tozzo P, Fassina A, Caenazzo L. Young people's awareness on biobanking and DNA profiling: results of a questionnaire administered to Italian university students. *Life Sci Soc Policy*. 2017;13(1):9. doi:10.1186/s40504-017-0055-9.