

Needs Assessment for Establishment of Telepathology in the Philippines*

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ABSTRACT

Objective. The Philippines has more than a hundred ten million population with a very limited number of general pathologists and subspecialist pathologists. Consultation of pathologists with other pathologists is important to ensure accurate results for difficult cases. However, pathologists are not always accessible to review slides. Telepathology can provide access to other pathologists by sending microscopic images through the internet. This study explores the needs of pathologists for consultation in their practice that may be aided by telepathology. The status of current pathology practice and subspecialty consultations across the different regions in the Philippines were determined and the readiness of pathologists for telepathology was identified.

Methodology. This is a cross-sectional descriptive study using an 18-item online survey questionnaire based on the World Health Organization guidelines on needs assessment for medical devices. The survey was distributed among anatomic pathologists practicing in the Philippines.

Results. One hundred forty (140) pathologists responded and were included in this study. 5-10% of cases of respondents required subspecialty referral. Diagnostically challenging cases and confirmation of malignancy are the most common reasons for consultation. Respondents practicing outside the National Capital Region (NCR) have fewer subspecialist pathologists available for referrals within their region. Turnaround times for signing out challenging cases are longer outside NCR (>7 days) compared to NCR (4-7 days). Most respondents have access to the basic equipment to perform telepathology, which includes, an internet link, a smartphone with high-resolution camera and a computer. Almost all respondents will use telepathology if it is available.

Conclusion. A hub-and-spoke telepathology network can provide access to subspecialty consultation to reduce the diagnostic turnaround time and to increase the accuracy of results for challenging cases. The availability of the minimum telepathology infrastructure and the positive attitude of the pathologists towards telepathology may be indicators of readiness for a local telepathology system in the Philippines.

Key words: telepathology, Philippines, pathology, needs assessment, telemedicine, informal telepathology

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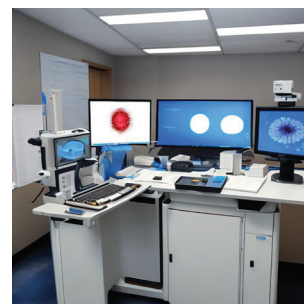
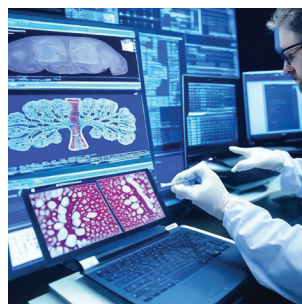
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INTRODUCTION

The Philippines is a low- to middle-income country populated by 110 million people with geographically disadvantaged areas for receiving health care services. Based on the 2019 data from the Philippine Society of Pathologists



AI Generated images using prompts “telepathology,” “whole slide imaging,” “digital pathology,” “desktop computer,” “online.”



(PSP), there are 603 registered anatomic pathologists in the country with only less than fifty subspecialist pathologists (unpublished data from the PSP).

Telepathology is driven by the need to provide access to subspecialized pathologists in areas where they are not available.¹ In remote areas with solo general pathologists, telepathology may be the only means of seeking diagnostic assistance from subspecialist pathologists.^{1,2} Telepathology consultations can also bring confidence and enhancement of general pathologists' diagnostic skills, which can further help in solving the geographic maldistribution of pathology services.³ Furthermore, telepathology also facilitates teaching, research and quality assurance in the diagnosis.^{4,5}

Telepathology allows the practice of remote pathology by the transmission of images through a telecommunication system.⁴ A basic telepathology setup consists of a camera mounted on a microscope linked to a computer connected to the internet.⁶ Digital images are then transmitted to a referral center or an expert pathologist for consultation.⁵ The biggest advantage of telepathology is the rapid diagnostic support for obtaining expert opinion without compromising diagnostic performance.^{2,7}

A meta-analysis of 10,410 histology samples showed that diagnosing cases through digital images is comparable with diagnosing through light microscopy.⁷ Discrepancy rates in telepathology consultations are also comparable with traditional pathology consultations.^{1,8} Discrepancies in both forms of consultation are attributed to difficulty of cases, unavailability of immunohistochemical stains and lack of training and expertise of the referring pathologist.¹

In 1993, the Armed Forces Institute of Pathology (AFIP) launched a telepathology program to provide expert consultation to pathologists internationally. AFIP's telepathology service was mostly utilized by solo pathologists rather than pathologists working in small groups or large departments.^{1,2} Many of the laboratories that referred cases lacked access to immunohistochemistry studies.¹ The technical challenges encountered in the telepathology consultations include unreliable internet connection and lack of high-resolution camera.¹

The cost of infrastructure, such as whole-slide imaging, and quality of internet connection are major concerns for implementation of telepathology in developing countries.⁹ But with the current technology, use of images or videos taken from smartphones are possible alternatives.^{9,10} Contrary to previous concerns, image compression does not negatively affect the accuracy and diagnosis of telepathology and digital images maybe compressed down to one-tenth of its original size.¹¹ An Android phone with at least 8-megapixel camera mounted to a commercially available adapter may be adequate for telepathology.⁹ With smartphones with high resolution cameras becoming more affordable and accessible to developing countries, telepathology has become more feasible in low-resource areas.⁹

In Eastern Africa, telepathology-referral center based in United States enabled 91.7% of surgical pathology cases in four hospitals with limited resources and manpower.¹² A telepathology referral center based in Germany significantly

improved the diagnostic procedures in a hospital in Tanzania where a pathologist cannot be employed.¹³

In 2011, a nationwide telepathology consultation was implemented in China where three regional centers and twenty provincial centers participated.¹⁴ Eighty expert pathologists were part of the study. In two years, 16 247 cases were referred, and majority of the cases were submitted due to diagnostic difficulty.¹⁴ The two-year telepathology program indicated that telepathology can provide a solution for the uneven distribution of pathology resource.¹⁴

Following a hub-and-spoke model, a central hub for subspecialist pathologists can ensure the accuracy and quality of pathologic diagnoses of general pathologists from remote areas.³ A referral network, consisting of general pathologists (spokes) and subspecialist pathologists (hub), will support general pathologists.³ Collaboration with international pathology networks can also form telepathology consultation platforms that will not only benefit areas with few pathologists, but also foster education and research among international parties.¹⁵

The first telepathology consult in the Philippines was performed between University of the Philippines, Department of Pathology and AFIP in 1996.³ However, despite the advances in technology around twenty-five years later, use of telepathology in the Philippines is still limited.

This study aims to explore the needs of anatomic pathologists in their consultations that may be aided by telepathology. The current practice of anatomic pathologists in the Philippines was ascertained by identifying their place of practice, diagnostic turnaround time and access to immunohistochemistry. The status of pathology consultations was also determined through the consultation turnaround time, methods of consultation, number of cases consulted, reasons for consultation, access to other pathologists and type of practice (solo versus group practice). The readiness for telepathology was assessed by determining the availability of the infrastructures as well as the awareness and attitude of the anatomic pathologists towards telepathology. The perceived barriers for implementation of telepathology were also identified.

The data gathered in this study can guide in designing a local telepathology framework in the Philippines. Establishing telepathology in the Philippines will potentially increase the accessibility of diagnostic services to geographically disadvantaged areas and improve patient treatment by providing earlier and accurate diagnosis.

METHODOLOGY

This is a cross sectional descriptive study through survey questionnaire. A 18-item online questionnaire (based on the World Health Organization's guidelines on needs assessment for medical devices)¹⁶ were distributed among anatomic pathologists practicing in the Philippines.

The online survey was created using Google Forms. The invitation and link to the survey with accompanying informed consent were given to all the members of the

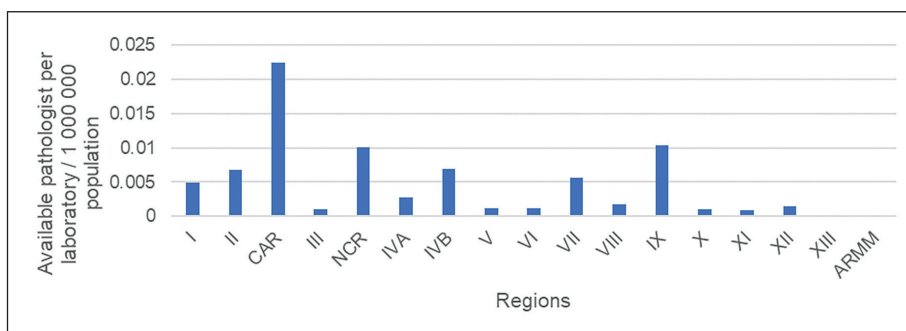


Figure 1. Distribution of practice among the respondent pathologists across different regions.

online group for anatomic pathologists in the Philippines. The online group has 214 members and was created by the PSP for all anatomic pathologists recognized by the Society. The invitation to the survey was also submitted to the main office of PSP for distribution to other pathologists that may not be reachable through the online group. Only pathologists accredited by the PSP were included in this study. Non-practicing pathologists were excluded. No identifiers were collected, and all responses were anonymized. The survey was available online for two weeks. Microsoft Excel was used to analyze data and generate descriptive statistics.

This study was conducted in accordance with the principles of the Declaration of Helsinki and Data Privacy Act. All

the respondents provided answered informed consent prior to enrollment. No personal information such as name, address, e-mail address, phone numbers and IP addresses were collected in this study.

RESULTS

Current pathology practice

A total of 140 responses were collected from the survey. Table 1 shows the frequency distribution of practice among the respondents in the different regions of the Philippines.

The majority of the respondents practice pathology in NCR (58.3%, n = 81). The higher number of practicing pathologists in NCR may be attributable to the greater number of laboratories and the population density in the area. The standardized regional distribution of the pathology practice with respect to the number of laboratories (17) and the population of the region (18) (ratio of pathologist to laboratory per one million population) is summarized in Figure 1. Findings showed that CAR has the highest number of pathologists relative to the number of laboratories and population of the area. There is also a notable variation in the distribution of respondent pathologists across the different regions (mean = 0.006 respondent pathologist per laboratory per one million population, SD = 0.005).

Table 2 summarizes the turnaround time of the pathologists for signing out uncomplicated and challenging cases. In the survey, “turnaround time” was operationally defined as the time from receiving the slide to signing out of the case. The usual turnaround time for uncomplicated cases is 2 to 3 days both in NCR and outside NCR. On the other hand, the turnaround time for challenging cases is higher, ranging from 4 to 7 days to more than a week. The turnaround time is also longer in regions outside NCR which takes more than a week compared to NCR which only takes 4 to 7 days.

Pathologists practicing in NCR have more access to immunohistochemical stains (70.3%) compared to those who are practicing outside NCR (30.5%). More than half of pathologists practicing outside NCR (57.6%) only have very limited access to immunohistochemical stains (one to five stains) and 11.9% have no access to it (Figure 2).

Status of pathology consultation

Most pathologists refer between 5 to 10% of their cases to other pathologists (Figure 3). This is their usual rate

Table 1. Distribution of practice among the pathologists across different regions

Region	Frequency	
	Absolute (n)	Relative (%)
Pathologists practicing in one region only	111	79.9
Luzon	88	63.3
NCR – National Capital Region	58	41.7
Region I – Ilocos Region	3	2.2
Region II – Cagayan Valley	3	2.2
CAR – Cordillera Administrative Region	5	3.6
Region III – Central Luzon	8	5.8
Region IVA – Calabarzon	8	5.8
Region IVB – Mimaropa	2	1.4
Region V – Bicol Region	1	0.7
Visayas	16	11.5
Region VI – Western Visayas	6	4.3
Region VII – Central Visayas	9	6.5
Region VIII – Eastern Visayas	1	0.7
Mindanao	7	5.0
Region IX – Zamboanga Peninsula	4	2.9
Region X – Northern Mindanao	1	0.7
Region XI – Davao Region	1	0.7
Region XII – Soccsksargen	1	0.7
Region XIII – Caraga	0	0.0
BARMM – Bangsamoro Autonomous Region of Muslim Mindanao	0	0.0
Pathologists practicing in multiple regions	28	20.8
NCR and other regions	24	17.8
NCR and Region I	1	0.7
NCR and Region III	4	3.0
NCR and Region IVA	18	13.3
NCR, Region III and Region IV	1	0.7
Regions outside NCR	4	3.0
Region I and III	1	0.7
Region II and III	2	1.5
Region III and IV	1	0.7

*Four to five immunohistochemical stains available

Table 2. Turnaround time for uncomplicated and challenging cases in NCR and outside NCR

Turnaround Time*	NCR		Outside NCR		Total	
	Absolute (n)	Relative (%)	Absolute (n)	Relative (%)	Absolute (n)	Relative (%)
Uncomplicated cases						
1 day	14	17.3	7	11.9	21	15.0
2 to 3 days	45	55.6	26	44.1	71	50.7
4 to 7 days	22	27.2	22	37.3	44	31.4
More than 1 week	0	0.0	4	6.78	4	2.9
Challenging cases						
1 day	0	0.0	0	0.0	0	0.0
2 to 3 days	4	4.94	3	5.08	7	5.0
4 to 7 days	42	51.9	26	44.1	68	48.6
More than 1 week	35	43.2	30	50.8	65	46.4

*From receiving the slide to signing out

Table 3. Rate of consultation of the respondents, availability of immunohistochemistry and the number of specialists known to the respondent

Cases consulted	Immunohistochemical stains						Number of subspecialist pathologists known to the respondent							
	Not available		Available, but very limited*		Available		None		Less than 5		5 to 10		More than 10	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Less than 5%	3	37.5	18	32.1	31	41.3	14	37.8	8	36.4	9	45.0	20	33.9
5 to 10%	4	50.0	34	60.7	34	45.3	19	51.4	13	59.1	10	50.0	30	50.8
10 to 50%	0	0.0	4	7.1	10	13.3	3	8.1	1	4.5	1	5.0	9	15.3
More than 50%	1	12.5	0	0.0	0	0.0	1	2.7	0	0.0	0	0.0	0	0.0

*Four to five immunohistochemical stains available

of consultation regardless of the accessibility to immunohistochemical stain or the availability of subspecialist pathologists within the region (Table 3).

However, most solo pathologists (66.7%) consult only less than 5% of their cases. Among the pathologists with group

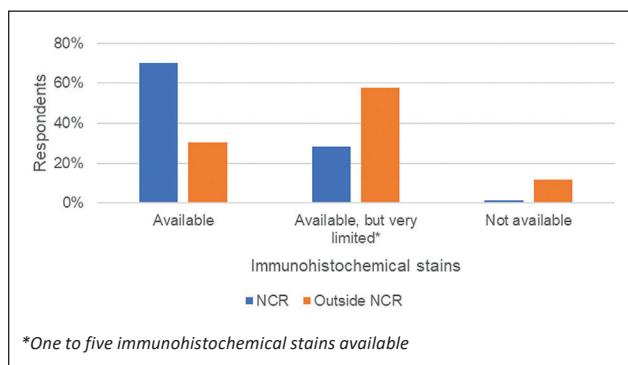


Figure 2. Availability of immunohistochemistry among the pathologists.

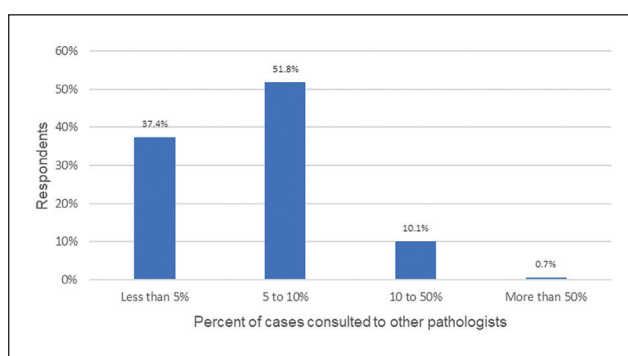


Figure 3. Percent of total cases that need consultation with other pathologists.

practice, those who have fewer members in a group practice are also less likely to consult their cases. The immediate availability of another pathologist within the practice maybe affecting the consultation rate.

The majority of the cases consulted are malignant cases (Figure 4). Cases are usually consulted because of difficulty (95.7%). Confirmation of dysplasia or malignancy is another common reason for consultation (75.7%). Table 4 summarizes the reasons for consultation with other pathologists.

In the majority of cases, pathologists practicing in the NCR receive responses for referrals within 2 to 7 days (84%). However, for pathologists practicing in regions outside NCR, whether in solo or with group practice, take longer, between 4 days to more than a week (77.7%).

The longer turnaround time for consultation may be attributable to the availability of other pathologists known to the respondents. The majority of the pathologists (71.3%) in NCR know more than ten subspecialist pathologists within their region. On the other hand, the majority of the pathologists from the regions outside NCR (60.3%) do not know any specialists in their region. If the respondents

Table 4. Reasons for consultation with other pathologists

Reason for consultation	Frequency (%)
Opinion on known difficult/challenging diagnoses	95.7
Confirmation of dysplasia or malignancy	75.7
Discrepancy with clinical findings	44.3
Disagreement with the original report on an outside case	42.1
Lack of access to immunohistochemical stains	32.1
Advice on wording of report	32.1
Quality assurance	28.6
Mandatory consult	17.1
Coordination of definitive specimen with biopsy finding	<1
Patient requests for second opinion	<1

wanted to seek the diagnostic opinion of a general pathologist, those from Luzon may have more advantage compared with the other regional groups. In Luzon, most pathologists know more than ten other general pathologists in their region, but for those in the Visayas and Mindanao, most pathologists know only around five to ten other general pathologists in their region.

The most common method of consultation is through direct personal referral (89.3%) followed by sending of images via the internet through mobile phone or e-mail (67.1%). Pathologists who consult through a messenger (39.3%) may ask pathology residents or other pathology colleagues to facilitate the consultation. Only 16.4% of the respondents use courier services. One respondent reported using a slide scanner connected to a server to consult specialists.

Readiness to telepathology

The majority of pathologists from NCR and regions outside NCR already have the equipment to perform a basic telepathology consultation. These include internet access (99.3%), a computer (98.6%) and smartphone with high-resolution camera (81.4%). Other reported equipment includes USB with microscope eyepiece holder, slide scanner and a high-resolution camera for gross pathology.

Figure 5 shows the responses of the pathologists to questions regarding their familiarity and attitude with telepathology. Most pathologists are familiar with telepathology (84.2%, 117 out of 139 responses) and are willing to use telepathology if it is available (98.5%, 135 out of 137 responses).

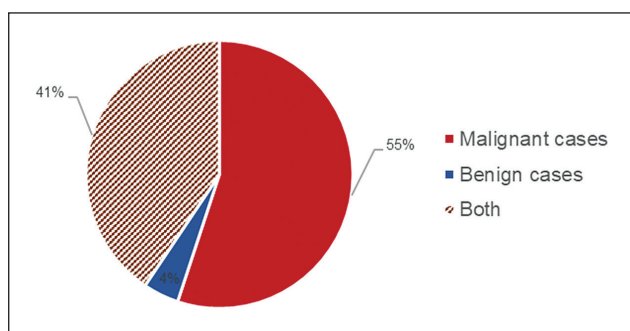


Figure 4. Type of cases that need consultation with other pathologists.

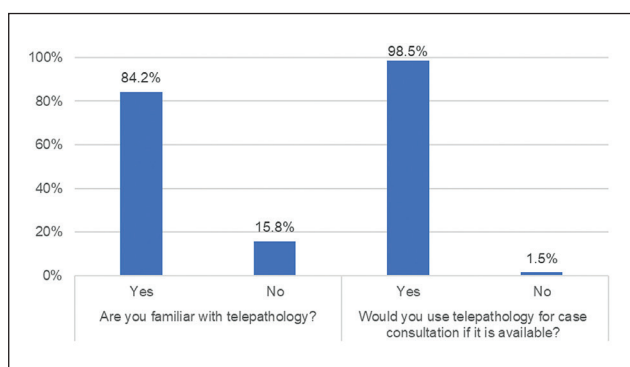


Figure 5. Familiarity and attitude of the respondents towards telepathology.

The perceived barriers in the implementation of telepathology are listed in Table 5. The most commonly foreseen barrier is internet speed (88.2%) followed by the availability of equipment for the set-up (65.4%).

DISCUSSION

The distribution of anatomic pathology practice across the regions in the Philippines is highly variable. The longer turnaround time for difficult cases especially in areas outside NCR is a pressing concern. Difficult cases are generally more time-consuming since more thorough slide evaluation, in-depth research and analysis of the case and opinion from another pathologist may be needed. Repeating the preparation of the slides may also be warranted to improve the diagnostic quality of the sample.

In regions outside NCR, the limited access to immunohistochemistry can make cases more difficult to resolve. Additional specimen sampling and consultation with another pathologist or a specialist pathologist may be strongly necessary to increase the diagnostic confidence of a general pathologist. While taking these additional steps may lengthen the turnaround time, they provide the advantage of a more accurate diagnosis in the absence of immunohistochemistry. However, even inter-pathologist consultation can be challenging since many pathologists outside NCR also do not have access to subspecialist pathologists within their area.

Although case consultation is not the sole reason for the longer turnaround time in signing out difficult cases, improving the access to diagnostic assistance from other pathologists can improve turnaround time and minimize diagnostic errors despite minimal use of immunohistochemistry.

Around 5 to 10% of total cases need specialty consultation. Most of these pertain to cases that determine whether a tissue is malignant or not, and therefore a correct diagnosis is crucial. For malignant cases, a fast turnaround time is

Table 5. Possible barriers in telepathology perceived by the respondent pathologists

Possible barriers	Responses (%)
Slow internet	91.2
No setup available	66.2
<ul style="list-style-type: none"> • Microscope with camera • Slide scanner • High-resolution camera 	
Administration barriers	60.3
Reimbursement	39.7
Logistics	
<ul style="list-style-type: none"> • Availability of specialist and finding a shared time • Lack of funding • Software and available platforms • Cloud-based storage 	
Digitalization of slides	
<ul style="list-style-type: none"> • Time consumed on slide scanning • Potentially large file sizes 	
User-related	
<ul style="list-style-type: none"> • Level of capability with using computers • Learning how to use the software with ease • Trustworthiness on the proficiency of the residents taking the representative samples and appropriate photomicrograph 	
Lack of standardized telepathology protocol	
Privacy issues	
Concerns on diagnostic accuracy (i.e., discrepancy in tissue appearance in real life and in camera)	

important to avoid significant disease progression and to facilitate early patient treatment. A general pathologist may be left with the dilemma of delaying the management and spending more time and resources to get a more accurate diagnosis through specialty referral, or to release a result based on the best of her or his ability for the patient to have earlier treatment.

A telepathology network following a hub-and-spoke organization can provide a lifeline to pathologists outside NCR who need diagnostic support.¹⁹ If a consultation hub with subspecialist pathologists is accessible to general pathologists via telepathology, the turnaround time and diagnostic accuracy for difficult cases can be improved. A telepathology consultation hub can also provide financial savings for the spoke sites by not having to hire subspecialist pathologists for a low volume of subspecialized cases.²⁰ On the other hand, subspecialist pathologists at the hub site will have more educational exposure to cases which can further improve their diagnostic skills.²⁰ Cases referred to the hub site may also be used for academic training of residents.

In this study, around seventy percent of the pathologists already perform an informal telepathology consultation by sending digital images of their cases through the internet. The availability of camera phones, internet connection and messaging applications may have contributed to this practice. Many pathologists have the minimum equipment to connect to a telepathology network suitable for a low-resource setting. The general positive attitude of the pathologists towards telepathology can facilitate its widespread implementation.¹⁵

Establishing a hub-and-spoke telepathology network can be expensive.²⁰ In designing a telepathology framework, the infrastructural, logistical, legal, procedural and user-related issues raised by the pathologists in this study should be carefully considered to have a usable, stable and cost-effective system.²⁰ The local telepathology system should also be designed and developed to coincide with the Philippine e-Health Strategic Framework and Plan. This will help in creating a sustainable system with good national collaboration and directed towards the e-Health goals of the Philippines. It can also be the framework for other image-intensive specialties like radiology and dermatology.

CONCLUSION

Access for consultation with subspecialist pathologists can reduce the turnaround time and improve the diagnostic accuracy for difficult and challenging cases. In the Philippines where there are limited number of subspecialist pathologists, a hub-and-spoke telepathology network can provide diagnostic assistance to general pathologists. The availability of the minimum telepathology infrastructure and the positive attitude of the pathologists towards telepathology may be indicators of readiness for a local telepathology system.

Although many pathologists perceive the need for high-speed internet and sophisticated equipment to facilitate telepathology, the gap between the pathologists and establishment of telepathology is not the infrastructure.

The gap is the lack of a system that can deal with the administrative and logistical challenges of telepathology in a low-resource setting. These include funding, availability of subspecialists for consultation, standard protocol and legal guidelines. These type of healthcare needs are already identified and addressed in the Philippine e-Health Strategic Framework and Plan. Hence, for telepathology to be established sustainably in the country, future efforts should be directed on designing telepathology framework that fits the national e-Health system.

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STATEMENT OF AUTHORSHIP

The author certified fulfillment of ICMJE authorship criteria.

AUTHOR DISCLOSURE

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