

Impact of Telepathology on Diagnostic Efficiency in Remote Areas of Brazil

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ABSTRACT

Telepathology is the practice of pathology from a distance, sending macroscopic and microscopic images over telecommunication networks for remote interpretation (telediagnosis), second opinions or consultations (teleconsultation), and educational purposes. The actual material is physically isolated from a remote consultant (telepathologist), who will interpret a representative image of it. The digital or analogue image is shown on a computer monitor or mobile phone screen. Access to the Internet or other broadband telecommunications networks is ubiquitous, allowing for nearly global picture sharing. As a result, telepathology has been used to help an expanding number of laboratories worldwide provide pathology services by enabling them to contact professionals easily. SPSS software was utilised to conduct primary data analysis in the investigation. The descriptive statistical analysis includes a correlation coefficient analysis, a chi-square, and a parameter analysis. In Brazil, telepathology, in collaboration with AI technology in tumor analysis, raises many challenges related to moral and monitoring attention. Brazil law no. 2,264/2019, monitor the telepathology use. It is important to secure the confidentiality and safety of individual data. It is also crucial to acknowledge the agreement for application of telepathology. Additionally, the rules of corporations dealing with telepathology plus AI must be in accordance with the General Data Protection Law. Thus, telepathology is the advanced technology that needs to be used in each pathology lab to get accurate, advanced and secure information and personalized treatment to improve the healthcare sector worldwide. Telepathology has even been used to increase the efficiency of pathology services between institutions less than a mile apart. With pathology's increasing subspecialization, using telepathology to contact subspecialists (such as neuropathologists) has proven extremely beneficial. Conversely, telepathology is not limited to diagnostic work; it may also be used for quality assurance education and research.

Keywords: Telepathology (TP), Diagnostic Efficiency (DE), Remote (RR), Telecommunications (TC)

INTRODUCTION

The term "telepathology" was discovered in 1986 in literature, and by the year 2016, there were 1,000 available peer-review, and 137 U.S patented articles on that topic. Telepathology is not like the preceding method "video microscopy". In telepathology, a telepathologist inspects the slide; he knows how many slides should be zoomed in and what parts of the slide should investigate at what distance. This technology is very effective and has been used successfully in Europe since 1986 and in the US since 1996. The interest in telepathology comes from the expert pathologists and their clients. The expert pathologist's access varies around the world. For instance, a medical centre in the US comprises various sections for different organs such as the heart or brain. Some countries have few expert pathologists and surgical pathologists. The surgical pathologist might have a different opinion on whether they opted for a second opinion from a specialist. For instance, if the US needs a second opinion for novel cancer cases, there is a need for more telepathologists. In some areas of Canada, the second opinion is already used in rural and urban areas. In some cases, pathology cases are diagnosed routinely by an expert pathologist. Most of the cases are diagnosed by a general pathologist. A procedure by which diseases studied that are of far-off areas are studied by the application of telecommunication links so that the transfer of electronic images of digital pathology can be enabled. A study of diseases from remote areas and transfer of all those microscopic or macroscopic images by using those approaches by which electronic transfer of information over long distances can be possible. This information can be found in the form of voice messages, text, images, or video. All these procedures and efforts are performed to

diagnose, discuss, and aid the field of education. One of the best things about Telepathology is that it makes it possible for the inhabitants of remote areas to approach and then study the images of patient slides from too far in the live communication[1]. Ronald S Weinstein is the scientist who is considered the father of Telepathology. Those fields where Telepathology is seen too much are negotiation, identification, authentication, and all the studies related to medicine. This phenomenon proves very helpful in solving the problem of the absence of a pathologist in all those areas where no such expert has been found. There are three different ways in which the telepathology system[2]. 1. Virtual Slide Systems, 2. Real-time systems, 3. Image-based systems. Certain components make this system of Telepathology possible and easy. This system includes a remote-controlled microscope. This remote-control microscope is then connected to a video camera whose power of resolution is very high. The workplace of a pathologist involves all those components that make this telecommunication phenomenon very easy, like a microscope, a video monitor whose resolution power is very high, and a link that makes telecommunication very easy. Digital pathology is the phenomenon in which a glass slide is digitized by using a scanner based on the whole slide image and then observing all the digital pictures with image viewer[3]. This viewing process is usually performed on a computer monitor or the screen of a mobile [4]. If Pathology is studied and elaborated in simple words, then one can come to know that it is the study and diagnosis of disease with full focus. In clinical pathology, all those organs which are removed after surgery are examined with full attention. These surgically removed organs may also include tissues,

body fluids, and sometimes the whole body[5]. In pathology, all the changes that happen in cells and tissues during the phase of disease are studied. Those changes can be structural or functional. These changes are studied usually to have all information about the recognition of disease, to know the exact reason that causes the death, and to know all the reasons. This procedure also discloses the whole mechanism and also the aftereffects of that particular disease. The evolution of Telepathology is from video microscopy which can also be known as television microscopy[6]. This research was performed in the early time of the 1950s about video microscopy in which most of the research was about biological sciences in which investigation led up to basic diagnostic tools in the field of telemedicine clinical usage. Its origin can be detected by the introduction of easily understanding studies that are all about the importance of color and all other tools that are related to images that lead towards the diagnosis of diseases and a long chain of studies by which a connection can be understood that is found between virtual slide and microscopy diagnosis[7]. All that evidence which is all about the ease of Telepathology and all that knowledge that is related to information technology has been compiled for several years. Several studies that are all about evidence have put a great focus on intermediate consequences. This indication is usually given by comparison that is represented between Telepathology and light microscopy which is traditional[8]. The objective of providing and bringing improvements in screenings that are all about eye urgency in all those areas that are far away and in those places where the setting is very poor in Brazil is to provide validity in the field of tele ophthalmology mobile systems. The availability of this system provides this opportunity to observe the condition of a patient who belongs to a remote area and then provide a decision that is all about the condition of the case. If the expert suggests that the situation is alarming, then he is sent to the nearby hospitals for further detailed treatment[9]. This phenomenon can be understood by the following example, in which two ophthalmologists are involved in the urgent study of patients. One of them is involved in the examination of patients belonging to remote areas. And the other one is examining the patients in the hospital. After the comparison of the working of both experts, one comes to the point that the results are 81.94%. The level of sensitivity was 92.85%. The level of accuracy was 85% with the predictive value in negative terms is 96.72%. In this whole procedure, a process of analysis of time was also involved. We can come to know to this point that each patient requires 8.6 minutes when patients are consulted remotely[10]. It is the first case when a cell phone screen was used to analyze the urgent situation of ocular situations. On behalf of these results, the systems can differentiate between those situations that are extremely urgent and all those situations also which are not urgent. This technology also provides an alternative method to provide services for those areas which are not developed. In this technique of screening, the most beneficial result is the analysis of all urgent situations along with their level of sensitivity. It also predicts the negative value of this complete phenomenon[11]. Ronald S. Weinstein, M.D., an academic pathologist, coined the term "telepathology" in 1986. Weinstein highlighted the processes necessary to set up remote pathology diagnostic services in an editorial for a medical magazine. He and his team published the first scientific paper on robotic telepathology. Weinstein also obtained the first US patents for robotic telepathology systems and telepathology diagnostic networks. Many people regard Weinstein to be the "father of telepathology". In 1989, Eide and Nordrum launched Norway's first viable clinical telepathology service, which is still in operation today.

Thousands of patients in North America, Europe, and Asia have benefited from clinical telepathology services of various types. Telepathology has been effectively employed to a wide range of applications, including remote rendering of histopathology tissue diagnosis. Although digital pathology imaging, including virtual microscopy, is the preferred technology for telepathology services in industrialised countries, several underdeveloped countries continue to use analogue telepathology imaging for patient treatment.

Research Objective

The main objective of this research is to see the results which show that it is a very powerful technique, and its main purpose is to effectiveness in all those areas where resources are extremely deficient, and to provide facilities to their citizens. The study examines the impact of telepathology on diagnostic efficiency in remote parts of Brazil. The study article is divided into five particular sections. The first segment demonstrates the introduction section, which includes the research purpose. The second component describes a literature review, while the third piece describes research methodology, including tools and approaches. The fourth section describes the results and their categorization. Similarly, the final section summarised the whole research study and recommendations about telepathology and diagnostic efficiency.

LITERATURE REVIEW

Researchers claim that information technology provides immense benefits to the health sector. to provide efficient health services to patients the use of telemedicine is preferred in every health sector. During any geographical as well as social health circumstances people are provided with medical aid using telemedicine[12]. Studies explain that different health centers perform different medical procedures. the tele pathology is the most advanced technology-based medical procedure performed in medical centers. This technology-based program provides health services to the patients[13]. scholars suggest that development and advancement in technology have led to the improvement in medical services and treatments. The majority of medical procedures have been revolutionized because of modern technology. Various ophthalmological institutes use telemedicine to provide medical treatment to the patient. the use of telepathology as a diagnostic tool is increasing in developing countries. The telepathology technique helps in solving the health problems created due to socioeconomic factors. by solving socio-economic issues this technology provides numerous treatment opportunities to the diseased patient[14]. scholars predict that using telediagnostic technology in laboratories for treatment proves greatly effective. The diagnostic approach uses information technology to improve its performance during a medical treatment procedure. the deep knowledge and information regarding the presence of cancer cells in the body are provided by the use of a diagnostic technology-based approach[15]. Research studies reveal that most maternal-fetal medication is developed using telemedicine. The quality and effectiveness of medicines developed through telemedicine are enhanced.

In developing as well as developed countries telemedicine is required for most diagnostic purposes[16]. Also, telemedicine helps in predicting which medicine is suitable for a particular ailment. in medical practices, telemedicine use is widely preferred to find out the effectiveness of medicine against disease. telemedicine use increased during the COVID-19 pandemic because of the benefits telemedicine

provides to patients. The ability of telemedicine to effectively perform its function is enhanced by using AI in the development of telemedicine [17]. studies show that services provided by pathology labs hold diagnostic importance. The information related to oncology becomes more accessible through diagnostic pathology labs. However, in low-income countries, the services provided by pathology diagnostic labs are lacking due to inefficiency of these labs. To improve the working performance, these labs are equipped with medical devices that work using information technology [18]. the WHO claims that telemedicine provides great services to patients and health care systems. These services and their criteria vary from country to country. like in low-income countries the services provided by telemedicine are poor while in high-income countries telemedicine is efficiently developed to provide advantageous services to the medical sectors [19]. studies explain that pathologists can observe different types of samples in pathology labs using the technology-based diagnostic approach. mobile devices are used in labs that increase the overall working efficiency of lab devices to predict cancer oncology [20]. Studies provide evidence that health systems in low-income countries are poorly managed which affects the performance of medical procedures. the health system in low-income countries is so poor that cancer cell identification in these health areas is a big and difficult task. Diagnostic tests in low-income countries are very difficult to perform. in such countries, cytopathology-based diagnostic tests are famous for carrying out cancerous cell analysis [21]. Studies predict that a lot of infectious diseases are prevalent in low income countries. these diseases prevalence affects the social economic condition of LMICs. to manage the prevalence rate of non-communicable disease in LMIC the use of DHT is acceptable. DHT is effective technology based system that provides promising application in suppression the spread of infectious diseases [22]. scholar studies shows that digitalization of health sectors is essential for maintaining the accuracy of data store in these sectors. the digital health systems are developed using technology software that upgrades the functioning of medical systems. During any pandemic situation the digitalized health systems are used prominently. The patients are provided with equal health opportunities using a digital health system [23]. studies elaborate that communication between doctors and patients has become easier using teleconsultation. This technology-based approach makes communication possible over long geographical areas. a doctor and

patient can communicate anywhere around the globe using teleconsultation-based technology. In Brazil and other countries the use of this technology has encouraging outcomes [24]. Studies explain that doctors and patients are not mentally at the same level and therefore the interaction between them is one of the complex interactions. to understand a patient doctor and the patient need to make mutual efforts. This mutual understanding between the patient and doctor allows the doctor to better understand the patient's condition and to treat him [25]. studies suggest that the occurrence of cancer in low-income countries is higher. The detection of cancer-like serious diseases in these countries is possible using digital health facilities. A digitalized health system is a more advanced health care system than a non-digitalized system. digitalized health care interventions are provided in different countries to make the patient recovery after disease faster [26]. Also, the patients visiting the dentist are given teledentistry-related treatment. technology-based approaches are used in teledentistry for getting oral information related to patients. Most dentists prefer to use tele dentistry approach in comparison to direct assessment tests for studying the oral health of patients [27]. studies show that in low-income countries, thoracic pathological diagnostic tests are formed to understand the diseases related to the lungs and thoracic cavity. Any disease condition related to thoracic is identified using the diagnostic procedures [28]. maintaining public health is the utmost duty of all the health sectors working around the globe. the health problems people face related to oral health are treated by the professionals of dentistry. most advanced dental services are provided in developed countries and not in developing countries because dental treatments are often expensive. the dental health services are difficult to provide in LMIC [29]. studies predicts that a lot of medical advancement have seen in telemedicine sector. the popularity of telemedicine around world is because of the use of technological based system in these platforms. accessible and convenient medical services are provided to the patients getting treatment services from telemedicine institutes. patients that gets treatment from telemedicine related centers are more satisfied the patients receiving treatment from other health sectors [30]. scholars studies explain that virtual consultation is provided to patient living in remote areas using the services of tele medications. timely treatment is provided to patient using the diagnostic concept of tele medication [31] (Fig 1).



FIGURE 1: Telepathology

Methodology

The research study determines the Impact of Telepathology on Diagnostic Efficiency in Remote areas of Brazil. The research paper based on primary data analysis for determine the analysis develop different questions related to telepathology and diagnostic efficiency. For measuring the research used SPSS software and generate result included descriptive statistic, correlation analysis, also that explain the chi square values, and parameters analysis between them. The research study also explained the control chart related to variables. according to the research Telepathology system (TPSs) benefits many sub-areas of pathology such as histopathology, oral pathology and oral medicine. These sub areas include the research and treatment of cellular disease and gum diseases. Pathologists faced many types of disease ranges from simple/ cyst to severe infection such as cancer. Pathologist gets benefits with the help of information system that aid them in accurate diagnostic preparation in quick time. The Santa Catarina State Integrated Telemedicine and Telehealth System (STT/SC) functioning in Brazil since from 2005 providing the services in the areas of telepathology and telemedicines. It is presented as web application and serves more than 7.2 million people regarding the service of various fields. Cancer is the one of serious challenges for

public health and it is considered the cause of increasing fatality worldwide. In many countries, cancer causes early death at the age of 70. The increase in cancer cases can be due to the transition of demographic and epidemiology factors. It was estimated that in Brazil, the new number of cancer cases will be 704, 400 from the year 2023-2025.

In Brazil, the first society named as Brazilian Society of Pathology (SBP) was the first advised people about cancer diagnosis during mid-time. Telepathology uses the artificial intelligence in cancer analysis enables remote discussions to reduce the travel time of patients and also reduce the risk of contamination. Telepathology and AI are considered promising tools to reduce the time delay for providing accurate results and improve the field of health care. This technology provides quick, accurate results and reduces the time of social distancing and burdening of the health care system. However, it is also important to secure the patient's information, have proper regulations and responsibly use this technology. With the advancement and investment, telepathology-based technologies are expected to grow more quickly and efficiently to improve the health care system. Cancer diagnosis is an important analysis of pathology lab, with the help of telepathology cancer diagnosis and treatment can be optimized worldwide.

Descriptive Statistics

Table 1: Result of Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Telepathology 1	50	1.00	3.00	1.4800	.61412
Telepathology 2	50	1.00	2.00	1.3600	.48487
Telepathology 3	50	1.00	3.00	1.4400	.57711
Diagnostic Efficiency 1	50	1.00	3.00	1.5600	.61146
Diagnostic Efficiency 2	50	1.00	3.00	1.5800	.64175
Diagnostic Efficiency 3	50	1.00	3.00	1.5000	.64681
Valid N (listwise)	50				

The above result of table 1 is the descriptive statistical analysis result, which shows the lowest value, maximum value, mean rate, and standard deviation rate. The telepathology 1, 2, and 3 factors are considered independent variables, and the mean values of 1.4800, 1.3600, and 1.4400 indicate a positive average rate, with standard

deviation values of 61%, 48%, and 57% deviating from the mean. The diagnostic efficiency 1, 2, and 3 are considered dependent variables, and their mean rates are 1.5600, 1.5800, and 1.5000, respectively, with standard deviation rates of 64% and 61%. Table -1 reveals that the total lowest and maximum values are 1.00 and 3.00, respectively (Fig 2).

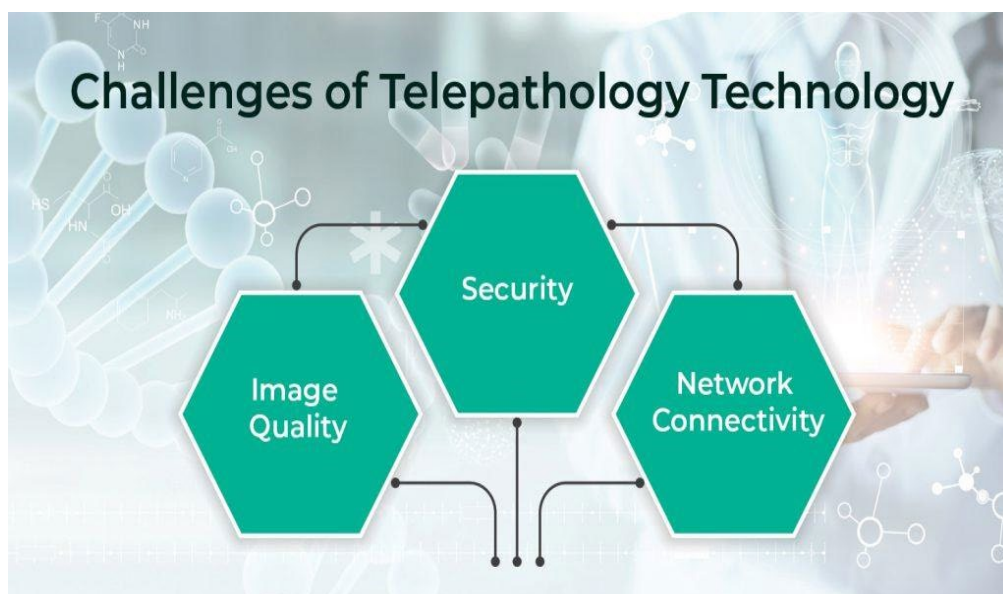


Figure 2: Challenges of Telepathology Technology

There are three challenges of telepathology technology first is images quality second one is security and third is network connectivity. These challenges link between them.

Classification of Telepathy

Static Telepathology

The most basic sort of telepathology is static. The images are first pre-selected, and the sender pathologist digitises a sample image. These images are then transmitted to a distant telepathologist via email or Internet services. One of the enticing characteristics of static telepathology is the low setup costs because no special software is required to see the images; all that is needed is a microscope, camera, and Internet. However, there are several drawbacks, such as the risk of missing a potential diagnostic region with a glass slide, a loss of clarity at low-power magnification, a lack of focus in a still image, and an inaccurate field selection by the submitting pathologist. Although this is a less efficient technique, there have been cases where glass slide and telepathology diagnoses agreed by up to 95%-100%.

Dynamic Telepathology (or real-time)

The dynamic telepathology technology is ideal for frozen-section telepathology and unmanned regions. Microscopic slide images are

delivered to the recipient in real time via live telecommunication. The deployment of a remote robotic microscope enables receivers to change both the magnification and slide. However, this complicated equipment is both costly and difficult to maintain. It includes a charge-coupled device video camera, high-resolution video displays, proprietary software, and specialised, high-performance hardware (computer).

Aside from that, it needs a consistent, high-bandwidth telecommunications connection between the transmitter and the recipient. Dynamic telepathology has changed the field, with a stated 99%-100% agreement between telepathology and light microscopy diagnosis.

Hybrid Telepathology

Hybrid telepathology, or nonrobotic real-time telepathology, combines static and dynamic technologies. They get the benefits of both systems. This method involves automatically stitching together a sequence of photographs using software before compressing them into a single file. Once the dynamic telepathology session begins, these images are sent, which expedites the recipient's consultation process by minimising the time required to operate the robotic microscope. This strategy is beneficial for providing quick consultations and increasing patient care.

Table 2: Result of Correlations

		Correlations					
		Telepathology 1	Telepathology 2	Telepathology 3	Diagnostic Efficiency 1	Diagnostic Efficiency 2	Diagnostic Efficiency 3
Telepathology 1	Pearson Correlation	1	.093	-.032	.139	.367**	-.051
	Sig. (2-tailed)		.520	.824	.335	.009	.723
	N	50	50	50	50	50	50
Telepathology 2	Pearson Correlation	.093	1	.006	.132	.168	.130
	Sig. (2-tailed)	.520		.968	.360	.244	.368
	N	50	50	50	50	50	50
Telepathology 3	Pearson Correlation	-.032	.006	1	-.192	-.152	-.383**
	Sig. (2-tailed)	.824	.968		.182	.292	.006
	N	50	50	50	50	50	50
Diagnostic Efficiency 1	Pearson Correlation	.139	.132	-.192	1	.196	.206
	Sig. (2-tailed)	.335	.360	.182		.174	.150
	N	50	50	50	50	50	50
Diagnostic Efficiency 2	Pearson Correlation	.367**	.168	-.152	.196	1	.025
	Sig. (2-tailed)	.009	.244	.292	.174		.865
	N	50	50	50	50	50	50
Diagnostic Efficiency 3	Pearson Correlation	-.051	.130	-.383**	.206	.025	1
	Sig. (2-tailed)	.723	.368	.006	.150	.865	
	N	50	50	50	50	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

The above result of table 2 describe that correlation coefficient analysis in between telepathology and diagnostic efficiency. Result describes that Pearson Correlation, significant level and number of observations related to them. overall result shows some positive and some negative relation between telepathology and diagnostic. The diagnostic efficiency 1 shows that Pearson correlation rate is 0.139, 0.132, -0.192, 0.196 and 0.206 its shows that positive correlation rate the significant level is 33%, 36%, 18%, 17% also that 15% significantly level with telepathology. Similarly, the diagnostic efficiency 2 also demonstrate that 36%, 16%, 15%, 19%, 2% correlation level. Similarly, the diagnostic efficiency 3 describe that 72%, 36%, 6%, 15%, 86% significant level. According to the result overall number of observations is 50. Telepathology makes it probable to deliver pictures to pathologists and experts at any place globally to have the precise and quick analysis. This process emerged as a new field during the

academic time of COVID-19 when people were not able to move from place to place. With the help of this technology, patients easily send images and other data and information without experiencing the long travel distance. Telepathology is used in many ways for cancer diagnosis such as screening, second opinion, quick and accurate service and getting in touch with specialized pathologists. Telepathology with the addition of AI analyzes a large number of data quickly and accurately. For instance, AI addition to telepathology detects large amounts of data rapidly and precisely. This technology diagnoses the early stage of cancer and benign stage and analyzes the difference between benign and malignant stage cancer. It also helps in the classification of cancer subtypes and choosing of modified treatments for cancer cure. In this way patient will get treatment on proper time to get rid of the diseases and improve his health. The result of table 3 demonstrate that test statistical analysis result

describes chi square values and significant value of each variables included dependent and independent. The chi square value of telepathology 1,2 and 3 its chi square value is 20.440, 3.920 and 23.680 shows that positive chi square rate. The diagnostic efficiency 1,2 and 3

these are representing that chi square value is 17.080, 14.920 and 18.760 it describes positive chi square rates. The above result describe overall significant value is 0.000 shows 100% significant level between them.

Test Statistic

Table 3: Result of Test Statistic

	Telepathology 1	Telepathology 2	Telepathology 3	Diagnostic Efficiency 1	Diagnostic Efficiency 2	Diagnostic Efficiency 3
Chi-Square	20.440 ^a	3.920 ^b	23.680 ^a	17.080 ^a	14.920 ^a	18.760 ^a
df	2	1	2	2	2	2
Asymp. Sig.	.000	.048	.000	.000	.001	.000

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 16.7.
b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 25.0.

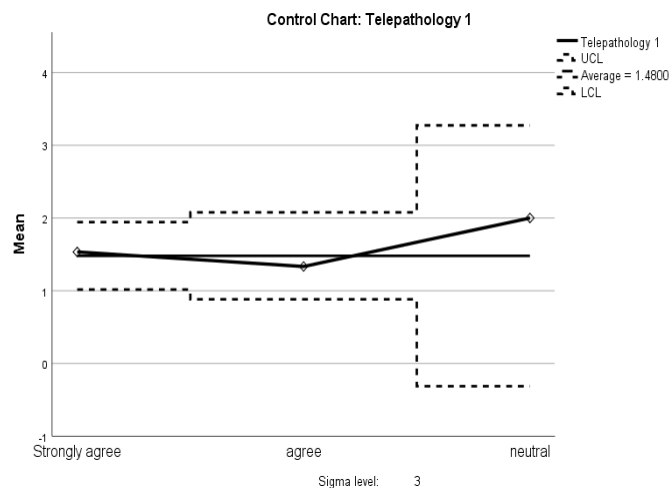


Figure 3: Control Chart

The above graph figure 3 demonstrates the control chart related to telepathology the vertical side shows mean value its start from 0 and end at 4 points. The horizontal side describe the strongly agree, agree

and neutral level. According to the result its average value is 1.4800 shows positive average rate related to them. the above lines represent that control link between dependent and independent.

Bayesian Estimates of Coefficients

Table 4: Result of Bayesian Estimates of Coefficients

Parameter	Bayesian Estimates of Coefficients			95% Credible Interval	
	Mode	Mean	Variance	Lower Bound	Upper Bound
Diagnostic Efficiency 1 = Strongly agree	1.400	1.400	.016	1.150	1.650
Diagnostic Efficiency 1 = agree	1.545	1.545	.018	1.279	1.812
Diagnostic Efficiency 1 = neutral	1.667	1.667	.134	.945	2.388

a. Dependent Variable: Telepathology 1
b. Model: Diagnostic Efficiency 1
c. Assume standard reference priors.

The above result of table 4 represents that estimation analysis related to the different parameters result demonstrate that mode level, mean value, variance level, lower bound and upper bound of each parameter. The first parameter is diagnostic efficacy 1= strongly agree its mode rate is 1.400, the mean value is 1.400 also that the variance rate is 0.016 shows that 16% variance level between them. the lower bound and upper bound level is 1.150 and 1.650 its present that positive rates related to 95% credible interval. Similarly, the second parameter is diagnostic efficiency 1=agree its variance rate is 0.018 its shows that 18% variance level the 95% credible level is 1.279 and 1.812 respectively. Third parameter is diagnostic efficiency 1= neutral the result describes that mode value is 1.667 the mean rate is 1.667 the variance rate is 0.134 also that upper and lower bound level is 0.945 and 2.388 respectively shows positive interval level between them.

Conclusion

Telepathology is seeing rapid technology advancements across the world. Telepathology and digital pathology have evolved from an intriguing concept to a useful tool in clinical and research pathology. The ultimate objective of pathology practice, regardless of the methodologies or equipment utilized, is to diagnose lesions more precisely and quickly. Thus, incorporating telepathology and digital pathology into routine diagnostics would transform pathologists' lifestyles from microscope to computer screen. The research study based on primary data analysis for determine the result used SPSS software and run results. Currently, a pathologist manually prepared a patient's report with the help of collected data under light microscope before submitting it to the system. Often, for the complex cases a

second option is required by the professionals located in different region that required the sending of specimen via email for further analysis. This method is slow and faces many challenges in severe and complex cases. External methods increase risk of loss of specimen and increase response time. Overall research concluded direct and significant link between them. To reduce these problems faced by

STT/SC, TPS had been discovered which enable the pathologists to access the digitized specimen sample of patient's directly from system using the software such as slide scanner. Thus, this method replaces the light microscope method and enables pathologists to focus on specific case. Yet, this method does not support the specialist discussion regarding the case.

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