MASTER OF PUBLIC HEALTH

Johns Hopkins Bloomberg School of Public Health & IIHMR University

PRACTICUM REPORT

By

Dr. Arpana Goswami
Cohort-5
2017-19

Under the Guidance of

Dr. Tanjul Saxena
Associate Professor
IHMR University

Mr. Rajneesh Bhandari
Managing Director
NeuroEquilibrium Diagnostics Pvt. Ltd

2019

TO WHOMSOEVER IT MAY CONCERN

This is to certify that Dr. Arpana Goswami, student of Master of Public Health Program offered by IIHMR University, Jaipur in cooperation with Johns Hopkins Bloomberg School of Public Health, Baltimore has undergone Practicum Training at NeuroEquilibrium Diagnostics Pvt. Ltd. From 17/10/2018 to 31/12/2018.

The Candidate has successfully carried out the study designated to her during practicum training and her approach to the study has been sincere, scientific and analytical.

The Practicum Training is in fulfilment of the course requirements.

I wish her success in all his future endeavors.

Sd-

Dr. Tanjul Saxena

Practicum Advisor

CERTIFICATE BY SCHOLAR

This is to certify that the Practicum Project titled 'A Comprehensive analysis to evaluate, compare and determine the appropriateness of the vestibular diagnostic test', submitted by me, Dr. Arpana Goswami with Enrollment No. IIHMR-U/07/2017-2019/0026 with Hopkins ID A7FA5E under the supervision of Dr. Tanjul Saxena and Mr. Rajneesh Bhandari for award of Master of Public Health carried out during the period 17/10/2018 to 31/12/2018 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Dr. Arpana Goswami

MPH Cohort 2017-19

CERTIFICATE FROM THE ORGANIZATION

Neuro Equilibrium
Diagnostic Systems Pvt. Ltd.

140, Shri Gopal Nagar, Gopalpura Bypass Road, Jaipur 302015. E-mail : info@neuroequilibrium.in | www.neuroequilibrium.in

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Dr. Arpana Goswami,** student of Master of Public Health Program offered by IIHMR University, Jaipur in cooperation with Johns Hopkins Bloomberg School of Public Health, Baltimore has undergone Practicum Training at **NeuroEquilibrium Diagnostics Pvt. Ltd.** From 17th October 2018 to 31st December 2018.

During the practicum, she was exposed to various activities and had conducted normative studies of diagnostic equipment's to provide reference values for diagnosing the patients with vestibular disorders and determining the appropriateness of the test. The candidate had independently performed literature review on electronic databases along with data screening and analysis. She has also contributed to the preparation of the manuscript on the above research work. During this period, her conduct was good. We found her extremely inquisitive, hardworking and willing to put her best efforts to go in to the depth of the subject and understand it better.

The above research work was carried out under my direct supervision.

NeuroEquilibrium Diagnostic Systems Pvt. Ltd.

Rajneesh Bhandari
Managing Director
NeuroEquilibrium Diagnostics Pvt. Ltd.
Date: 06/03/2019

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THE ORGANIZATION

NeuroEquilibrium Diagnostics Pvt. Ltd., Jaipur

NeuroEquilibrium is pioneered with an aim to provide advanced and economical medical assistance to people suffering from vertigo and balance disorder conditions. It is making ground-breaking innovations in this field by developing indigenous vertigo diagnostic systems which operate on cutting-edge cloud technology. The international standards of operation and management of their vertigo speciality clinics provide hope to the innumerable people out there who are suffering from balance disorders. It is a chain of vertigo specialty clinics providing patient specific treatments for vertigo and other balance disorders like dizziness, light-headedness, unsteadiness, tendency to fall, difficulty in focusing during head movement etc. The Managing Director Mr. Rajneesh Bhandari is a Chemical Engineer from IIT Delhi. The company was established in March 2015.

The company's vision is to set up more than a hundred vertigo diagnosis and treatment clinics across India SE Asia, Middle East and Africa in collaboration with leading ENT and neurology clinics with an aim to address the needs of one million vertigo patients by 2022 and 5 million in the next 10 years.

PROJECT BRIEF

A comprehensive analysis to evaluate and compare the efficiency of the diagnostic tool for providing the reference values for the test procedures along with the sensitivity, specificity and the inter-rater test-retest reliability of the test to detect the vestibular disorders. Through this comparison we aim to establish a relationship between the reference values and various vestibular disorders thereby providing easy diagnosis.

ROLE

Role Title
Research Associate

Responsibilities

- Submitted proposals for research projects
- Conducted & coordinated activities of the related research project
- Conducted normative studies for two diagnostic equipment
- Collated data, performed statistical analysis
- Screened articles (title and abstract; full text)
- Prepared manuscript on the research done
- Report writing

Duration of Practicum
17/10/2018 – 31/12/2018 (65 Days)

Hours of Practicum
552 Hours

Faculty Advisor
Dr. Tanjul Saxena

Preceptor
Mr. Rajneesh Bhandari (Managing Director, NeuroEquilibrium Diagnostics Pvt. Ltd.)

LEARNING OUTCOMES

Analytical/Assessment Skills

- Collated data and statistically analysed the burden of vertigo and assessed vertigo related disability.
- Analysed the inter-rater test-retest reliability, specificity and sensitivity of the tests performed in diagnosing vertigo.

- Conducted normative studies for diagnostic instruments
- Determined ROC curve to show in a graphical way the connection between clinical sensitivity and specificity for possible cut-off for the diagnostic test and analysing the benefit of using the test
- Data extraction and synthesis using SPSS

Communication Skills

- Utilized learned skills to communicate effectively with all the stakeholders
- Developed a description of all the reports of various disorders explaining the procedure of the diagnostic tests

Several vestibular tests are into existence. The project aimed at designing an improved test which can be used efficiently in a clinical routine and is applicable as an office procedure. With a relatively easier technique, less discomfort to the patient and within a short time period, the test was able to screen the vestibular functions with a high sensitivity, specificity and accuracy. The newly developed testing algorithm was described and test results were reported in a large number of otologically healthy individuals with a wide range and in patients with vestibular disorders.

Fundamentally, through this project, a diagnostic testing procedure was developed to detect the patients with vestibular disorders thereby providing early diagnosis and rehabilitation exercises to aid in the recovery.

The authenticity of data was maintained throughout the project. After receiving the data, analysis was performed to find the normative. The values were cross checked before the data analysis. The project was completed without any delay within the stipulated time. Utmost care was taken not to introduce any kind of bias in the data set.

During the data collection, clear set of inclusion and exclusion criteria were formed. Also, for comparing the results with the established ones, a thorough literature review was done with the similar inclusion and exclusion criteria.

BACKGROUND

Dizziness and imbalance are amongst the most common complaints in older people, and are a growing public health concern since they put older people at a significantly higher risk of falling. They present with a prevalence of up to 50% all across the globe. Dizziness can manifest as vertigo (the illusion that you or your environment is spinning, tilting or moving), light headedness or imbalance. The degree to which dizziness impacts a person's life can vary from individual to individual; some patients find their dizziness to be a minor nuisance, while others are severely disabled by their symptoms and are unable to work, drive or socialize outside of the home.[1] Many symptoms of vestibular loss like imbalance with ambulation or unsteady vision (oscillopsia) are commonly seen in older adults.[2,3,4,5] The increased prevalence of vestibular loss in the older population has potentially substantial economic and societal consequences.[5,6]

Vestibular disorders causing vertigo have a lifetime prevalence of around 7.4 percent.[6] 80 percent of them consult for their vertigo which causes work interruptions; this amounts for an important cost to the society.[7] A report reviewing presentation to US emergency departments (EDs) from 1995 through 2004 indicated that vertigo and dizziness accounted for 2.5% of presentations.[8] The estimated number of 2011 US ED visits for dizziness or vertigo was 3.9 million.[9] Most of the vertigo related expenses are due to the unnecessary diagnostic measures and ineffective treatments.[7]

Although the presence of vertigo and dizziness in the aged is often chronic, their consequences are underestimated. They are important risk factors for postural instability, limitations in mobility and activities of daily life and restrictions of social

participation. By increasing postural instability and the propensity for falls, vertigo is also a major risk factor for injuries and fractures, thus contributing to the main avoidable reasons for disability, need for nursing care and, ultimately, death.[10]

Mild hearing loss is the most common disability worldwide. The incidence of hearing loss is 25% in people younger than 25 years, and it reaches 40% in persons older than 40 years. About 25% of the population report tinnitus. Vertigo, dizziness, tinnitus, and hearing loss are typically associated with inner-ear diseases as opposed to central nervous system (CNS) diseases.[11]

Even though vertigo and dizziness in the aged are theoretically consequential, their impact on the prevalence and burden of disability is still unknown. One major reason for this lack of attention might be that vertigo and dizziness in the aged are primarily seen as symptoms of other chronic conditions.[12]

Patients with uncompensated vestibular dysfunction find it difficult to maintain their gaze during the diagnostic testing procedure. This results in insufficient information to compensate head movement resulting in blurred vision.[13] The objective of the research was to come up with a testing procedure which does not interfere with the gaze and allows for a correct diagnosis. Appropriate diagnosis and treatment can significantly improve quality of life. Most causes of dizziness are benign, but early recognition of serious or life-threatening disease is important.[14]

One of the limitation of presently available vestibular testing is its inefficient means to correctly identify the patients with the deficits. Lack of quantifiable and scalable devices to measure the defect over several patient visits results in inaccuracy. Recent improvements like portal laser device and computer devices have still not been able to overcome the limitation due to visual distortion for laser beam along with delay in the presentation of stimuli.[15,16]

METHODOLOGY

A literature review followed by a study to find the normative reference value, specificity, sensitivity, accuracy and inter-rater test-retest reliability of the diagnostic testing procedure. A total of 110 participants were selected for the study of which only 94 were included based on the inclusion and exclusion criteria. 33 healthy participants were recruited by Neuroequilibrium. Informed consent was obtained from all the study participants. 61 patients included in the study had been selected from Vertigo and Ear Clinic, Jaipur. Participants with a previous history of vertigo were excluded from the study. Participants were also tested for contrast and colour blindness. In case if they were tested positive, these participants were excluded from the study. Other exclusion criteria was abnormal neurological, psychiatric or vision disorders. All participants were instructed not to take any kind of medication or alcohol 24 hours before the test. Each participant underwent vestibular examination including VNG for saccades (fixed and random), spontaneous nystagmus and smooth pursuit eye movements to rule out any central nervous system abnormalities. Caloric test was performed on all the study participants to detect horizontal semi-circular canal dysfunction. Participants with abnormal responses were excluded from the study.

STATISTICAL ANALYSIS

Descriptive statistics were performed on statistical software SPSS (IBM version 21) to calculate the sensitivity and specificity of the test and determine the inter-rater test-retest reliability intraclass correlation coefficients (ICC) at 95% confidence intervals. Consistency was tested for inter-rater reliability with a two-way random effect models. Cronbach's Alpha and Standard Error of the measurement was used to evaluate reliability for each ICC. Level of significance was set at alpha value of <0.05 for all the statistical calculations. ICC >0.75 represents excellent reliability whereas $0.4<ICC>0.74$ specifies fair to good reliability. Paired t test was conducted to test the two trials for each test and find the difference between the mean

ROC curve was determined to show in a graphical way the connection between clinical sensitivity and specificity for possible cut-off for the diagnostic test and analysing the benefit of using the test. Sensitivity was calculated as the ratio of true positive and sum of true positive and false negatives whereas specificity was calculated as ratio of true negative and sum of true negatives and false positives. Accuracy was calculated by dividing sum of true positives and true negatives by sum of true positives, true negatives, false positives and false negatives. Results were divided into true positives, true negatives, false positives and false negatives based on the normative derived at 95% Confidence interval. Healthy subjects are differentiated from patients by analysis of observed mean and confidence intervals at different test parameters.

RESULTS

The Cronbach's Alpha (CA) value was found to be 0.9 suggesting excellent reliability with a standard error mean (SEM) of 0.008 at the first testing and 0.006 at second. A testing showing accurate assessment of vestibular system. A CA value above 0.7 is considered to be ideal and the test is said to be reliable. The ICC was found to be statistically significant at an alpha value of less than 0.05 ($p<0.05$). Analysis of Variance (ANOVA) was conducted to examine the effect of vestibular status (normal vs. impaired). Also, paired t test was conducted to test the two trials for each test measure which showed the difference in the mean for the normal group and the participants with vestibular disorder to be statistically significant ($p<0.005$). Post-hoc testing using the Tukey HSD test revealed that the mean score for the normal subjects was not significantly higher than the other groups ($p<0.05$). The internal consistency along with test-retest reliability showed that this is a good measure for testing vestibular disorder.

The reference value for many tests is defined as "a threshold value between which the test results of a specified percentage (usually 95%) of apparently healthy individuals would

fall."[17] The normal reference range was calculated as mean ± 2SD. Using the reference value, the sensitivity of the testing procedure was found to be 64 percent. The specificity was calculated to be 96 percent. The accuracy of the test was seen to be 85 percent.

The above results showed that the testing procedure is reliable to measure vestibular disorders with high accuracy.

CHALLENGES FACED

The first and foremost different thing which I had come across was the work culture. The people around me had different experience and had certain expectations from me. My supervisor had given me a list of the work needed to be done during the practicum period. Initially, I had become quite apprehensive but later the work assigned to me helped me gain new skills and sharpen my existing skills. My supervisor helped me understand the minute details. This allowed me to complete my work to the best of my abilities.

LEARNING EXPERIENCE

The project allowed me to know about various effects vestibular defects and especially vertigo has on the overall well-being. It is one of the most neglected symptom of which care is taken only when it becomes severe. I got the opportunity to use my learned skills during the course and apply them in a manner which could bring a meaning to the project. It helped me to enhance my analytical and communication skills along with data presentation and report writing. Also, it gave me the exposure to interact with various stakeholders and share my views with them. Overall, it was a great learning experience which allowed me to have a practical exposure of the skills learned during the course.

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