MANUSCRIPT

FACTORS INFLUENCING THE VISUAL ACUITY OF NIGHT SHIFT WORKERS (A STUDY ON GORONTALO POST JOURNALISTS)

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Background: The purpose of this study was to predict factors and find the dominant factor that influence the visual acuity of workers in Gorontalo Post

Method: this was an analytic survey method with cross-sectional study approach. The population of this study involved 37 people with 28 people taken as the samples.The criteria for sampling were those who do not wear glasses and actively working at night shift. The data were collected using lux meter for light intensity variable, visual acuity was measured using the Snellenchart and the age, work tenure, and night shift length was used as a guideline for an interview.

Results: The results of the bivariate analysis showed that the correlation test for variables, work tenure, light intensity and working time were 0.502> 0.25, 0.085 <0.25 and 0.502> 0.25 toward workers' visual acuity. The results of the multivariate test show that the three independent variables can explain the dependent variable of 16.5% with the regression equation: Y = 0.533+ 0.333 X1 + 0.150 X2 - 0.192X3. The most influencing independent variable towards the dependent variable is the light intensity factor indicated by the beta value of 0.353, the work tenure of 0.159 and the length of working time is - 0.203.

Conclusion: It is predicted that there is an effect of light intensity, work tenure, and working time toward visual acuity of night shift workers. It is expected that workers pay more attention to physical health, especially visual comfort when doing work that lasts long enough.

Keywords : Visual Acuity, Light Intencity, Night Shift Workers, Work Environment, Eye Fatigue

1. Introduction

Human needs lighting to visually recognize objects in which the organs that influence vision are eyes and central vision nerves. Light intensity, either high or low intensity, influences the eyestrain and eye nerve strain. For workers, the working environment influencesproduct quality. Lighting is one of the physical factors in the workplace. Bad lighting can cause eyestrain and in turn, lack of work efficiency, mental tiredness, pain complaints and even work-related accidents(1).Bad lighting intensity is one of the physical factors in the work environment that can reduce visual acuity. Visual acuity is influenced by several factors such as 1) size of the object; 2) brightness or level of light in the field which depends on the lighting and the optical reflection or surface; 3) length of observation time; 4) level of contrast that is the degree of brightness differences between the object and its surrounding (2). The healthiness of the eyes is an important requirement to increase the quality of human resources in order to increase the quality of life of the society, which in turn, to achieve smart, productive, independent, and prosperous Indonesian human resources. Lack of light intensity has made the iris muscle force the pupil to see objects and when this is done continuously for a long time will cause the reduction of visual acuity(3).Visual acuity is defined as an eye ability to see an object clearly and is highly dependent on the eye accommodating ability. Visual acuityis influenced by changes of target angle speed, vibration, luminance, contrast, tracking of the head and eyes movement, reaction time, learning factor, and fatigue(4). Reduction of visual acuitycan also occur due to aging.

Initial study in the Redaction Unit at Gorontalo Post Newspaper agency reveals that workers in average journalists/workers work at night time, as in day time they hunt the news to be published daily in this newspaper, and their nighttime work shift starts from 04.00 pm to 01.00 am, hence, they work under artificial lighting which yet complies with the standard regulates by Kepmenkes No. 1405 of 2002, where it stipulates that lighting for routine workers at night time shift should be 300 Lux. Observation using Lux Meter, reveals that the light intensity in the redaction room of Gorontalo Post was only 133 Lux.Therefore, the lighting does need attention as it influences the eye fatigue and causes eyes nerve strain, thus, accelerate the reduction of visual acuity. The absolute sleep time of shift workers, including night workers, is longer than that of non-shift workers; however, it is associated with health problems such as drowsiness and persistent fatigue during work(5). Night

workers are awake for about 20 h, and weekly workers are awake for 15 h (6). This is becausenighttime sleepers are less likely to sleep in the daytime, and theeffects of the bio-cycle reduce the time spent sleeping(7).

2. Material and Methods

2.1 Participants and Study Sample

The population in this study is 37 people who work in the redaction room (newsroom) in Gorontalo Post agency. Sampling technique is purposive sampling with the criteria ofworkers who do not wear glasses, discipline, and active in their jobs each working hour in their night shift, thus, 28 samples are obtained(8).

2.2 Measures

The independent variables in this study were age, light intensity (X1), work tenure (X2), length of working time (X3) and, while the dependent variable is the visual acuity of workers.As lighting system used in the workroom is general lighting, which lights are attached in the attic of the workroom, thus light is equally spread, then, the light intensity is measured using three spots of measurement. Measurement spot is determined based on the horizontal crosscutting spot of the length and width of the room each 5-meter distance and 1 meter above the floor. A lux meter Kris Bow type KW06-sne291 is used to measure the intensity of light in the workroom. The light received by the photocell will produce a current that can move the pointer at the meter level; this number indicates the intensity of illumination. The stronger the illumination intensity, the greater the number indicated by the pointer level meter.Work tenure is defined as <5 years and ≥ 5 years. The length of working time is defined as <6 hours and ≥ 6 years. To measure the visual acuity of the respondents, Snellen chart tests were used which are commonly used in Indonesia. Respondents were asked to stand at a distance of 6 meters from the Snellen chart, close one eye using their hands, then start reading from the top row to the bottom, until they are no longer able to read the letters on the line. If the respondent could read the letters of the 8th line, the sight is optimal (visual acuity 20/20). The visual acuity is measured

based on a percentage with the following criteria: normal visual acuity if the percentage is 95%-75%, a low vision if 60% - 10% (9).

2.3 Statistical Analysis

A multiple regression analysis based on a linear model is used to investigate which variable is more dominant to influence visual acuity. Statistical analysis in this study is used to test a multiplelinear regression model by considering that the data from the dependent variable are numeric data. Following the fulfillment of assumption used in multiple linear regression, thus, univariate, bivariate, and multivariate analysis is used to describe the characteristic of respondents based on age, work tenure, light intensity, length of the work shift, and visual acuity. Bivariate analysis is to select correlation between the dependent variable (visual acuity) and independent variables (work tenure, light intensity, and length of work shift in the workroom), while multivariate analysis is used to obtain the regression model to determine factors that significantly influence the complaint on visual acuity. The descriptionof the characteristics of the respondents uses univariate analysis test. In order to test the correlation, bivariate and multivariate tests between variables are administered. The statistical package used by researchers for the analysis is IBM's SPSS version 23.

3. Results

Univariate analysis result toward 28-night shift workers shows that there are ninerespondents (29.0%) whose visual acuity isnormal and 19 respondents (61.3%) whose visual acuity isa low vision. Thisis influenced by the insufficient light intensity in the workroom, where the light intensity is less than 300 lux (low lighting). In addition, there are also workers who have been working for more than six years,and in addition to the aging factor, these people also have more than one extra hour from the scheduled work shift. This study shows that age factor does not significantly influence the complaint on visual acuity as respondents average age is 25 years old or still in their productive age. Workers who have been working for less than five years are 16 respondents while 12 respondents who have been working for five years or more. This difference in work tenure is due to the Gorontalo Post Newspaper agency has been developing. Hence, they become selective in recruiting workers. Thus, the number of workers is limited. Level of light intensity in the redaction room of Gorontalo Post, the

highest is 320 lux,and the lowest is only 133 lux. There are 19 workers who work under insufficient light intensity as their desks are located in non-strategic location (spot 2 and 3) whose light intensity is 170 and 130 lux. Meanwhile, there are only nine workers who work under appropriate light intensity as their desks are positioned within a strategic location, spot 1, where the light intensity is 320 lux.

The result of bivariate analysis for correlation of work tenure has the correlation value of 0.502 > 0.25, light intensity 0.085 < 0.25 and length of work shift has the correlation value of 0.502 > 0.25. Therefore, it is evident that work tenure and length of work shift variables can be ignored from multivariate modeling. Nevertheless, as substantially the work tenure variable and the length of work shift are important factors to influence visual acuity, those variables are still included in the multivariate analysis(10).

Further, to create a multivariate model, a multivariate analysis is simultaneously carried out. From the data, it is obtained that the value of R square is 0.165, which means that all three independent variables are able to describe the visual acuity variable by 16.5%, whereas the rest can be described by other variables. The analysis of the output shows a residual value with the mean of 0.000 and deviation standard of 0.4346, as seen in Table 1 below.

Table 1 Simultaneous multivariate analysis

Entered Variables	R	R Square	Adjusted R Square	Std. The error of the Estimate	Durbin-Watson
Work tenure, lighting intensity, length of work shift	0.406	0.165	0.61	0.46	1.807

In table 1, the obtained Durbin Watson coefficient is 1.807 and categorized in interval value between -2 and +2. This means that the independence assumption is fulfilled. In the Figure 1, the distribution area is equally distributed around the zero dots, it can be said that the variance is homogenous in each X value. The data which are distributed around the diagonal line and follow the direction of the diagonal line, and the formed diagram is like that of a bell, then the regression model met the normality assumption as presented in Figure 1 below.

Figure 1 Histogram Graphic of Normality Assumption

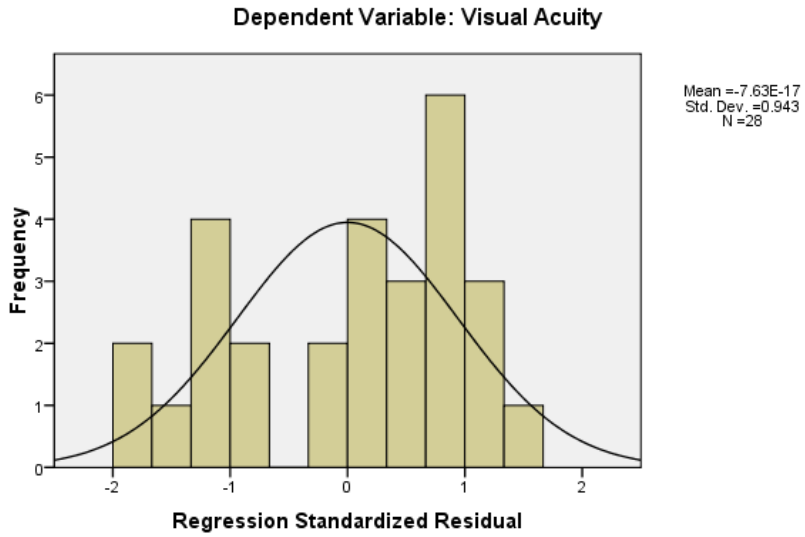
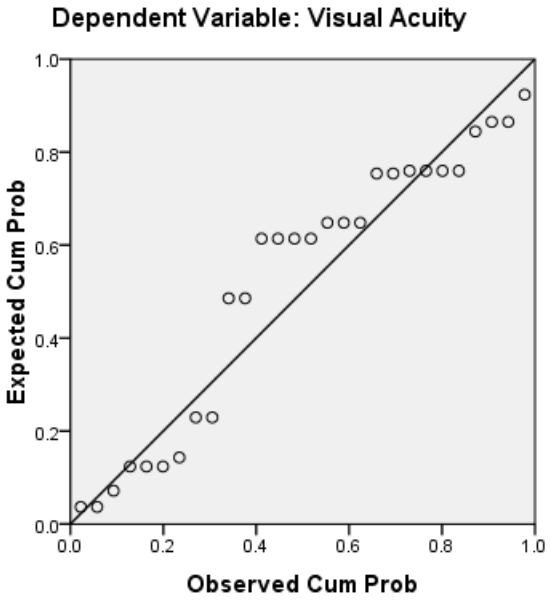


Figure 2 Normal P Plot Graphic for Normality Assumption



The analysis results show a residual number with a mean of 0.000 with a standard deviation of 0.4346, as presented in Table 2 below. Thus the existence assumption is fulfilled.

Table 2 Regression Coefficient of Each Variable

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	0.3417	1.0167	0.6786	0.19314	28
Residual	-0.82500	0.65833	0.00000	0.43461	28
Std. Predicted Value	-1.744	1.751	0.000	1.000	28
Std. Residual	-1.790	1.428	0.000	0.943	28

By considering a regression model were able to explain 16.5% variation of the dependent variable and fulfillment of assumptions, the regression line equation is obtained as follows:

Visual acuity = 0.533 + 0.333 light intensity + 0.150 work tenure – 0.192 length of working time.

This means that the constant of 0.533 states that if there is no increase in the value of the variable light intensity, work tenure and working time, the value of visual acuity is 0.533. Each addition of 1 score of work tenure value and lighting intensity in the workspace, it will give a score of 0.333 and 0.150 on visual acuity after the work tenure and working time are controlled. For workers who carry out tasks during working hours, the vision level will decrease by 0.19% after the intensity variable and work tenure are controlled. To find out which variable has the most influence in determining the dependent variable can be seen from the large beta value for intensity 0.353, work tenure of 0.159, length of working time - 0.203, it can be concluded that the variable light intensity has the greatest influence (dominant) on visual acuity. The coefficient of regression equation is shown in Table 3 below:

Table 3. Coefficient of Regression Equation

Model		Unstandardized Coefficients	
		B	Std. Error
1	(Constant)	.533	.171
	lighting intensity	.333	.177
	work tenure	.150	.179
	working time	-.192	.180

4. Discussion

Descriptive analysis result toward 28 respondents in redaction room shows that on average their age is 25 years old. The age range is 20-39 years old and is a productive age range (11). There are 78.6 % of workers who work at nighttime and have work tenure of 5 years or more, and 21.4% ofworkers have been working for less than five years. The length of their work, which more than five years suggest that they have adapted toward their working condition. This is as suggested with the regression model, were each one score increase in work tenure will increase their visual acuity by 0.333 in correlation with their working experience.

However, the aging factor also causes a reductionin visual acuity. Aging has caused eye lenses to gradually lose its elasticity and made it hard to see close distance objects. Aging has made the distance to the closer spot longer. Around the age of 40-50 years old, there will be a significant change;the object will appear blurry,and fatigue will easily come when working on a closer object(12).Lighting intensity in this study is a dominant factor that influences complaint on visual acuity. According to the measurement in each measurement spots, lighting intensity in two spots, spot number 2 and 3, do not meet the lighting standard. This is due to the type and quality of light that is unsuitable with the type of work being done in the room. Length of working time for the night shift workers is six hours from 6.00 pm to 00.00 am. When the news is plenty to be printed, then the workers should work extra hours. This condition has caused their visual acuity to decline.

Based on the data analysis, visual acuity declines by 0.19% when workers work fully for 6 hours. This work is implemented so they can fulfill their daily needs. Visual acuity is the ability of the visual system to differentiate various objects (13). Optimal visual can be achieved when there are a complete visual nerve, healthy eyes structure and appropriate ability of the eyes to focus (14).

5. Conclusion

The objective of this study is to predict factors that influence visual acuity complaint of the workers of Gorontalo Post newspaper redaction and to determine dominant factors that influence visual acuity complaint. To find out those factors, the analysis is carried out by involving independent variables such as age, lighting intensity, work tenure, and length of the work shift.

Through univariate, bivariate, and multivariate tests toward independent and dependent variables, it is obtained that there are three variables that can describe the visual acuity complaint of the respondents by 16.5% whereas the rest can be described by other variables outside the study. Lighting intensity that is suitable for this type of journalism work is $\geq$ 300 lux, whereas the findings show that lighting intensity in the workroom is yet to meet this standard. Hence, it made eyestrain and causes the decline of visual acuity of the workers. In certain conditions, workers work for more than 6 hours under this lighting which caused fatigue,especially in the eye. All workers age is under 40 years old. Thus, the age factor does not influence the visual acuity complaint. This was due to their age is

categorized as a productive age,and they are able to work maximally. Out of 28 workers, there are 22 workers who havea workingtenure of≥ 5 years; hence, their eyes have adjusted to this nighttime working condition.

Limitation in this study is that there are variables, which predicted to influence the eyestrain considering the significance value of the studied variables is low.

Conflict of Interest

The author has no conflict of interest with regard to the material presented in this paper.

References

1. Suma'mur. Higiene Perusahaan dan Kesehatan Kerja (Hiperkes). Jakarta: Sagung Seto; 2009.
2. Budiyono H. Bahan Kuliah Instrumentasi. Program Pascasarjana Ilmu Kesehatan Kerja. Yogyakarta: Universitas Gadjah Mada; 2008.
3. Haeny N. Analisis Faktor Resiko Keluhan Subjektif Kelelahan Mata Pada Radar Controller Di PT Angkasa Pura II (Persero) Cabang Utama Bandara Soekarno-Hatta. Universitas Indonesia; 2009.
4. Wijaya AR, Sukandari N. Efek Vibrasi Terhadap Ketajaman Visual Manusia dalam Human Display Interface. In: Proceeding Seminar Nasional Ergonomi. Surabaya: Guna Widya; 2010.
5. Fallis W, Diana E, Marie P. Napping During Night Shift: Practices, Preferences, and Perceptions of Critical Care and Emergency Department Nurses. Crit Care Nurse. 2011;31(2):1–11.
6. Kim J. The Relationship Between Frequency of Injuries and Workplace Environment in Korea: Focus on Shift Work and Workplace Environmental Factors. Saf Health Work. 2018;9:421–6.
7. Åkerstedt T. Shift Work and Disturbed Sleep/Wakefulness. Occup Med. 2003;53(2):89–94.
8. Sugiyono. Statistika Untuk Penelitian. Bandung: Alfabeta; 2012.
9. Ilyas S. Ilmu Perawatan Mata. Jakarta: Sagung Seto; 2009.
10. Riyanto A. Penerapan Analisis Multivariat dalam Penelitian Kesehatan. Yogyakarta: Nuha Medika; 2012.
11. Indonesian Law on Employment/UU No. 13. Indonesia; 2003.
12. Natalegawa A. Geriatrik Oftalmologi dalam Bunga Rampai Ilmu Kedokteran. Bandung; 1982.

13. Anderson DM. Dorland's Illustrated Medical Dictionary. 31st ed. Saunders/Elsevier. Philadephia, PA; 2007.
14. Riordan-Eva P, Witcher J. Vaughan & Asbury's General Ophtalmology. 17th ed. New York: McGraw-Hill Companies; 2008.

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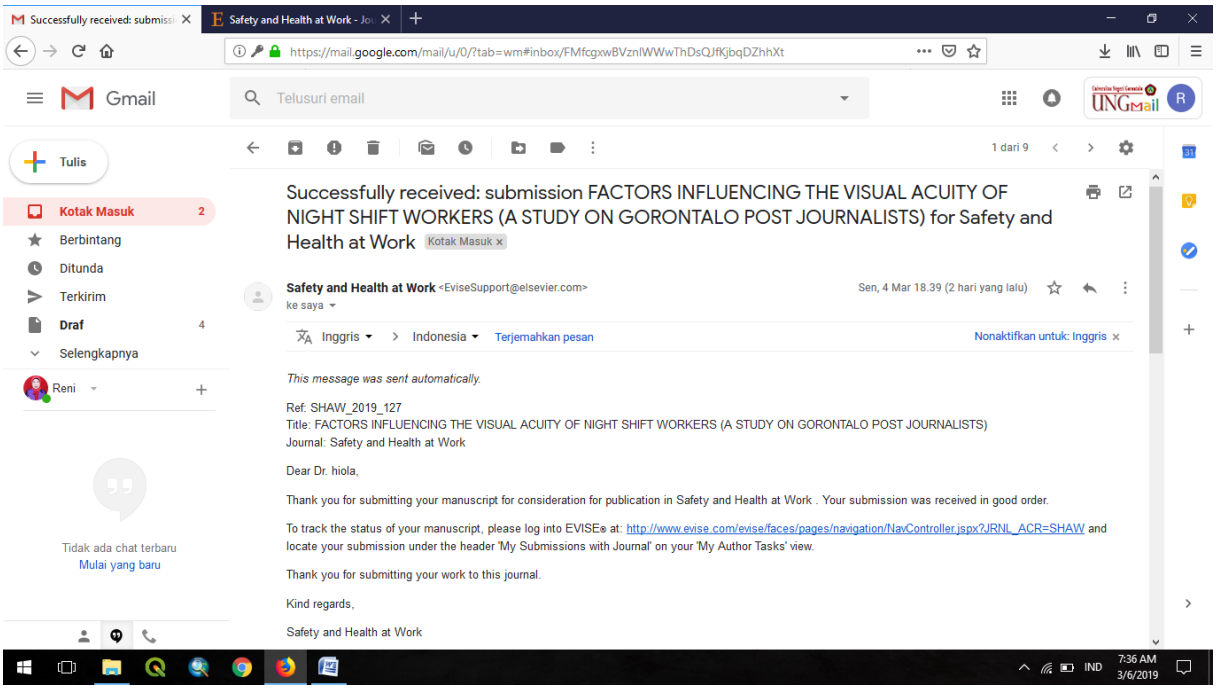

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Abstract

Background: The purpose of this study was to predict factors and find the dominant factor that influence the visual acuity of workers in Gorontalo Post Method: this was an analytic survey method with cross-sectional study approach. The population of this study involved 37 people with 28 people taken as the samples. The criteria for sampling were those who do not wear glasses and actively working at night shift. The data were collected using lux meter for light intensity variable, visual acuity was measured using the Snellen chart and the age, work tenure, and night shift length was used as a guideline for an interview. Results: The results of the bivariate analysis showed that the correlation test for variables, work tenure, light intensity and working time were 0.502> 0.25, 0.085 <0.25 and 0.502> 0.25 toward workers' visual acuity. The results of the multivariate test show that the three independent variables can explain the dependent variable of 16.5% with the regression equation: Y = 0.533+ 0.333 X1 + 0.150 X2 - 0.192X3. The most influencing independent variable towards the dependent variable is the light intensity factor indicated by the beta value of 0.353, the work tenure of 0.159 and the length of working time is - 0.203. Conclusion: It is predicted that there is an effect of light intensity, work tenure, and working time toward visual acuity of night shift workers. It is expected that workers pay more attention to physical health, especially visual comfort when doing work that lasts long enough.

Taxonomy

Occupational Safety, Safety Management

Keywords

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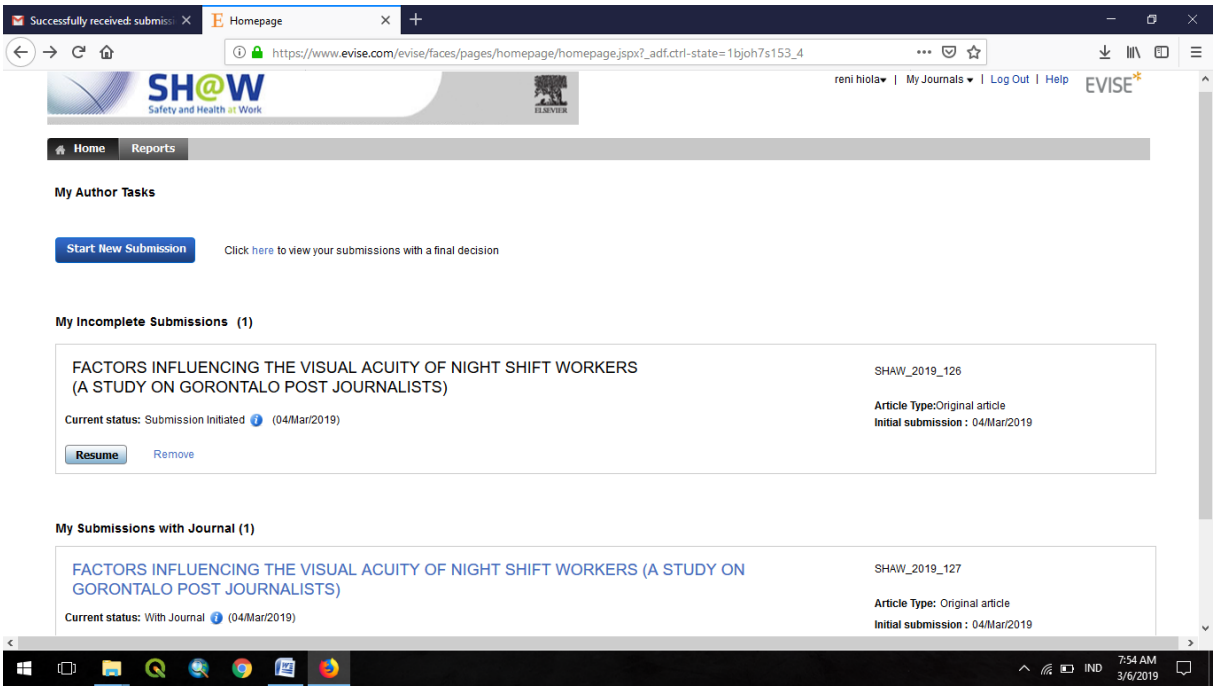
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