

COMPARATIVE STUDY OF TIME EFFICIENCY BETWEEN MANUAL AND SEMI-AUTOMATIC DISPENSING METHODS IN OPTICS

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ABSTRACT

Technological developments in the optical field have driven changes in dispensing methods from manual to semi-automatic systems to improve service efficiency. The semi-automatic method is expected to speed up the dispensing process, reduce patient waiting time, and increase productivity without reducing the quality of results. However, the effectiveness of both methods is still influenced by various factors, such as the type of equipment, operator skills, and service conditions, so it cannot be concluded which method is the most efficient. The purpose of this study was to compare the time efficiency of manual and semi-automatic systems. This study used a comparative analytical quantitative study with a cross-sectional design. The study population was the entire eyeglass dispensing process carried out at the optical center where the study was conducted. Sampling was carried out using a purposive sampling technique of 60 people, consisting of 30 people in the manual group and 30 people in the semi-automatic group. Data collection used observation. Data analysis used the Mann-Whitney test. The results showed that the average total dispensing time using the manual method was 431.83 seconds, while the semi-automatic method was 624.57 seconds, so the manual method had a shorter completion time. The Mann-Whitney test results showed a significant difference between the manual and semi-automatic dispensing methods ($p < 0.001$). Based on the results, it can be concluded that the manual dispensing method is more time-efficient than the semi-automatic method.

Keywords: Time Efficiency, Dispensing Method, Manual, Semi-Automatic.

INTRODUCTION

Optical dispensing services is series of technical and clinical processes in prepare, adjust, and deliver tool help vision to patient. This process covers a number of stages important like verification recipe, selection lens, cutting lenses, mounting on frames, up to adjustment end in patients. Efficiency in the dispensing process to become aspect important Because related direct with quality service, satisfaction patients, as well as productivity power optics. The more efficient a dispensing process, then the more fast patient get tool help vision without reduce quality results (American Optometric Association., 2022).

Optical dispensing is component important in correct abnormalities refraction. Precise and accurate optical dispensing measurements are essential in evaluate need vision, determining lens parameters, and ensuring correct optimal vision (Maseedupalli, 2024). Examination vision and implementation proper and correct optical dispensing procedures important For comfort vision users glasses. Measurement eyeglass frame fit with face users who do not appropriate, because can cause discomfort vision such as asthenopia, vision blurred, and sick head (Husna et al., 2018).

Need glasses will increase from time to time Because prevalence to abnormalities refraction the more tall Good Because disease eye and Because factors other. Because of that That skill in know product glasses and techniques offer to consumers are in great demand For increase excellent service in the optical world (Chin, 2020).

Optics is facilities that provide service inspection eye examination refraction, as well as glasses corrective and service lens contact (Pratiwi, 2023). Optics always make an effort For increase quality election glasses and updates in a way Keep going continuously with

objective For interesting customers and win competition. As well as optics can get quality product selected glasses consumer can fix what is needed so that in the end can increase satisfaction customer (Pradipta et al., 2023).

Along with development technology in the field optics, the dispensing method has experienced change from manual system towards semi-automatic system. Manual methods rely on skills technician in a way full in every process stages, while semi- automatic method utilise tool help machine like an automatic lens edger For increase speed and accuracy work. Use technology This expected can reduce time workmanship as well as increase consistency results. However, the implementation semi- automatic methods also require investment costs and training source Power man (Djarmika, 2025).

Efficiency time be one of indicator important in evaluate performance something dispensing method. Longer processing time short No only increase productivity, but can also reduce time Wait patients and improve satisfaction service. In context service health, efficiency time is part from quality patient - oriented services. Therefore that 's important For measure and compare efficiency time between manual and semi- automatic methods in a way objective (Rosita et al., 2021).

With Thus, optical dispensing is a complex and multidimensional process that involves aspect technical, clinical, and service. The success of this process is largely determined by the accuracy of every stages, competencies technicians, as well as support technology used in the process of being worked on. Therefore that, evaluation towards the dispensing process becomes very important For ensure quality service still awake and fit with established standards.

More further, urgency he did study regarding optical dispensing, in particular related efficiency time, the more increase along with development technology and demands service increasing health high. Increase amount patient as well as need fast and quality service demand existence more dispensing methods efficient without reduce quality results. Until moment this, still there is variation in use manual and semi- automatic methods in various service optics, so that required research that is capable give proof empirical about the most effective and efficient method. Therefore that, research This become important For done as base in taking decision based on scientific data use increase quality optical dispensing services optimally.

Based on description mentioned, it is necessary study For know comparison efficiency time between manual and semi- automatic dispensing methods. Research results This expected can give clear picture about more methods efficient so that can become base in taking decisions on service optics. Some study relevant previous show that use system automatic or semi- automatic can increase efficiency of the dispensing process. Research by Pradata et al. (2019) entitled Effectiveness Implementation of Automated Dose Dispensing in Inpatient Wards House Sick General Tangerang Regency uses cross-sectional study method. Research results show that Automated Dose Dispensing (ADD) is more effective compared to manual dispensing with longer dispensing time fast (53.70 seconds) compared to 144.54 seconds) and higher number of dispensing errors low. Equation study the with study This lies in the discussion about comparison manual and automatic /semi- automatic methods in the dispensing process and efficiency time. However, research the performed on dispensing medication at home sick and add dispensing error variable, whereas study This carried out in the field optics and focus on efficiency dispensing process time.

Besides that, research by Wijayanto et al. (2025) entitled Implementation and Effectiveness Unit Dose Dispensing System in Increase Safety Patients at Home Sick use narrative review method. Research results show that Unit Dose Dispensing (UDD) system is capable of reduce medication errors, increase efficiency Work power health, as well as

increase safety patient. Equation study this with research that will be done lies in the discussion efficiency in the dispensing process. The difference is study the carried out on a home drug dispensing system Sick with focus safety patients, whereas study this focused on optical dispensing with comparison manual and semi- automatic methods based on efficiency time workmanship. With however, although study related dispensing efficiency has Lots carried out in the field pharmacy and home sick, research about efficiency dispensing time on service optics Still limited. Therefore that, research This expected can give contribution scientific in development better optical dispensing services effective and efficient

Study This aim For know comparison efficiency time between method manual and semi- automatic dispensing with measure dispensing process time for each method as well as compare efficiency time both of them. In theoretical, research This expected can give benefit for development knowledge optometry and management service health. In general practical, research This expected can add knowledge and experience researchers about efficiency service optics, to be reference scientific and teaching materials for institutions education in development knowledge optometry, as well as become material consideration for practitioners and owners optics in determine method more dispensing efficient. Besides that, the implementation more methods efficient expected can increase productivity power work, reduce time wait, and increase quality and satisfaction patient in service optics.

Dispensing is the process of preparing, mixing, and delivering tool or product optics to patient in accordance with recipe or needs that have been determined. In context optics, dispensing includes election lens, mounting lens to the frame, as well as adjustments to fit with condition users (Maseedupalli, 2024).

The manual dispensing method is a work process that is carried out in a way directly by power Work without help system automatic (Rosita et al., 2021). Entire stages, starting from measurement until installation lens, done manually so it really depends on skill and accuracy officer.

The manual dispensing method is a work process glasses that almost all over the stages done by manpower refractionist optics or optics use manual equipment with involvement very limited machines.

Method manual dispensing has a number of disadvantages, namely it is very dependent on the skills, experience and accuracy of the operator, has risk error more human high, consistency relative results more low, limited productivity Because depends on power humans, as well as potential cause operator fatigue that can lower concentration and improve risk error in the dispensing process.

The semi-modern (semi-automatic) dispensing method is method workmanship glasses that combine operator skills with help machine or semi- automatic equipment. In the method this, some stages like lens cutting (edging), measuring, or tracing the frame is assisted by the machine, while the verification process recipe, selection lenses, frame fitting, adjustments end, and inspection quality still done by manpower refractionist optics. With Thus, the semi-modern method does not fully replace the role of the operator, but functioning as tool help For increase accuracy and consistency results.

Method semi-modern dispensing has a number of shortcomings, namely need cost adequate investment and maintenance big, requires operator training for machines can used optimally, time preparations that sometimes longer, depending on conditions and performance machines, as well as No all over stages can done in a way automatic so that still need skills and competencies power refractionist optics.

Factors that influence efficiency time in the dispensing process covering skills and experience power work, availability tools, complexity work, as well as system work used.

Skilled and experienced workforce can finish work more fast and accurate, while modern tools can speed up the process and improve accuracy. Besides that, kind lens, level correction, form frame, as well as use Manual or semi- automatic methods also affect the length of the dispensing process.

METODE PENELITIAN

The type of research is quantitative with a cross-sectional approach. namely measurement variables done on one time For compare efficiency time between two dispensing methods, namely manual and semi- automatic (Machali, 2021). This design was chosen because it provides an objective picture of performance differences between methods without interfering with the variables being studied. The cross -sectional approach is widely used in health services research because it is time- and cost-efficient and can produce relevant data in a short time.

This research was conducted at Optik, which is an eye health service facility that provides refraction examination services and glasses dispensing. The time this research was carried out was in the month June 2026. The timing of the study was adjusted to the optical operational schedule so that the data collection process could run smoothly without disrupting patient services. The variables in this study include independent and dependent variables. The independent variable is the dispensing method used, namely manual and semi-automatic methods. The dependent variable in this study is time efficiency, which is measured based on the total time required to complete all stages of the dispensing process.

The population is the entire research subject who has certain characteristics according to the research objectives. In this study, the population is The population in this study is the entire eyeglass dispensing process carried out at the optical shop where the research is conducted, using both manual and semi-automatic dispensing methods.

The sample is a portion of the eyeglass dispensing process that was observed to measure the efficiency of its processing time, both in manual and semi-automatic methods. The sample in this study was 10 manual dispensing processes and 10 semi-automatic dispensing processes, so that the total sample was 20 dispensing processes. The sampling technique in this study used purposive sampling.

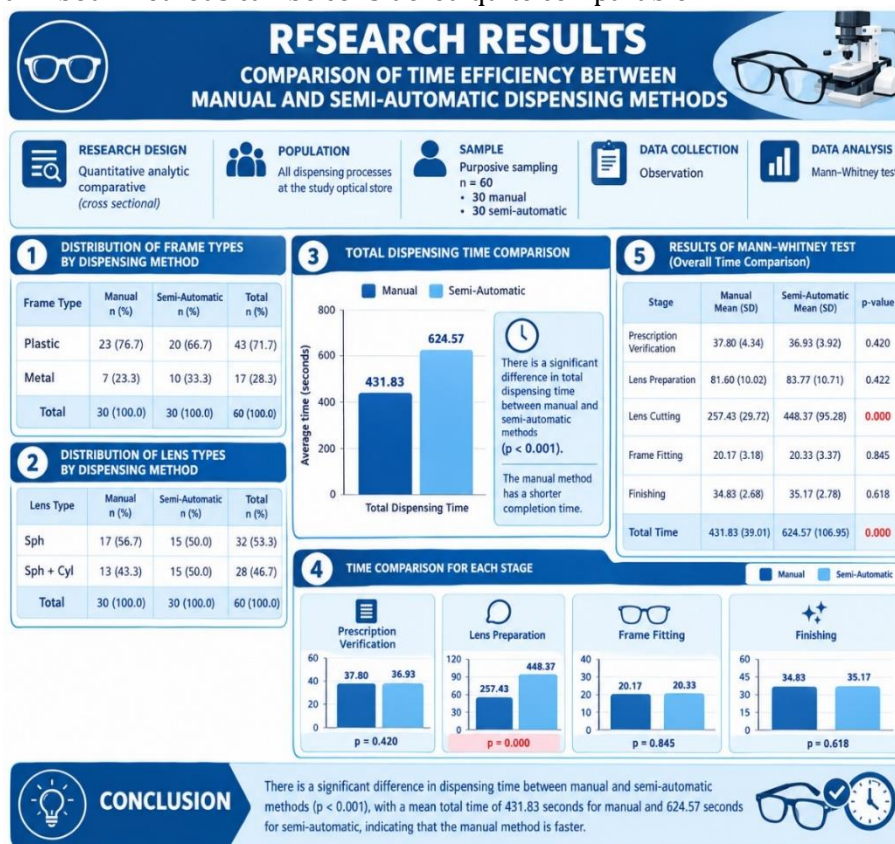
The operational definition of this research includes dispensing methods and time efficiency. Dispensing methods are defined as techniques used in the eyeglass processing process that are divided into manual and semi-automatic methods, with indicators of method type and use of machine tools, which are observed using observation sheets and categorized nominally into 0 = manual and 1 = semi-automatic. Time efficiency is defined as the total time required to complete all dispensing stages starting from prescription verification to the end of the process, which is measured using a stopwatch and observation sheets with a ratio scale in minutes. The time stages observed include prescription verification time, lens selection, lens cutting, frame fitting, and finishing. In addition, the time efficiency category is determined based on the total processing time and compared with the average or cut-off value, with fast, medium, and slow categories.

Data were collected through direct observation of the dispensing process at the research site. Data analysis was conducted to determine the description and differences in time efficiency between the manual and semi-automatic dispensing methods. The mean, median, and standard deviation values were used to describe the processing time for each method. Furthermore, differences in time efficiency were analyzed using an independent t-test if the data were normally distributed or the Mann-Whitney test if the data were not normally distributed. Test results were declared significant if the p-value <0.05, indicating a difference in time efficiency between the manual and semi-automatic dispensing methods.

RESEARCH METHODS

Results it is known that in the manual dispensing method group, the majority used plastic frames, namely 23 jobs (76.7%), while iron frames were used in 7 jobs (23.3%). In the semi-automatic dispensing method group, the use of plastic frames also dominated, with 20 jobs (66.7%), while iron frames were used in 10 jobs (33.3%). Overall, the most commonly used type of frame was plastic frames, with 43 jobs (71.7%), while iron frames were used in 17 jobs (28.3%).

Based on result, it is known that in the manual dispensing method group, the majority used spherical lenses (Sph) for 17 jobs (56.7%), while spherical cylindrical lenses (Sph + Cyl) for 13 jobs (43.3%). In the semi-automatic dispensing method group, the use of Sph and Sph + Cyl lenses was 15 jobs (50.0%) each. Overall, the most commonly used lens type was Sph for 32 jobs (53.3%), while Sph + Cyl for 28 jobs (46.7%). These results indicate that the distribution of lens types in both groups is relatively balanced so that the characteristics of the lenses used in both methods can be considered quite comparable.



Results it is known that the average prescription verification time in the manual method is 37.80 ± 4.34 seconds, while in the semi-automatic method it is 36.93 ± 3.92 seconds. The lens preparation stage has an average time of 81.60 ± 10.02 seconds in the manual method and 83.77 ± 10.71 seconds in the semi-automatic method. The most striking time difference is seen in the lens cutting stage, which is 257.43 ± 29.72 seconds in the manual method and 448.37 ± 95.28 seconds in the semi-automatic method. Meanwhile, the average frame fitting time is relatively the same, namely 20.17 ± 3.18 seconds in the manual method and 20.33 ± 3.37 seconds in the semi-automatic method. The finishing stage also showed an average time that was almost the same, namely 34.83 ± 2.68 seconds in the manual method and 35.17 ± 2.78 seconds in the semi-automatic method.

Based on the results of the normality test using Shapiro-Wilk, it was found that the variables of prescription verification, lens preparation, and frame fitting had a significance value of more than 0.05, so the data were normally distributed. Therefore, these three variables were analyzed using the Independent Sample t-test. Meanwhile, the variables of lens

cutting, finishing, and total dispensing time had one group with a significance value of less than 0.05, so the data were not normally distributed. Therefore, the analysis of differences was performed using the Mann-Whitney U Test.

The average total dispensing time for the manual method was 431.83 seconds, while the semi-automatic method was 624.57 seconds. The Mann-Whitney test results showed $p = 0.000$ (<0.05), so there was a significant difference between the two dispensing methods in terms of total processing time. These results indicate that there was a significant difference in total dispensing time between the manual and semi-automatic methods. The lower mean rank value for the manual method (15.75) compared to the semi-automatic method (45.25) indicates that the manual method had a significantly shorter or more efficient completion time than the semi-automatic method. Thus, the research hypothesis stating that there was a difference in time efficiency between the manual and semi-automatic dispensing methods was accepted.

The results showed that the average total dispensing time using the manual method was 431.83 seconds. The stage that required the longest time was lens cutting with an average of 257.43 seconds, while the prescription verification, lens preparation, frame fitting, and finishing stages required relatively shorter times. This indicates that the lens cutting process is the stage that most determines the length of dispensing time in the manual method.

In theory, the dispensing process in optics includes prescription verification, lens preparation, cutting or edging, lens fitting into the frame, and final inspection (finishing) (Syamsudin, 2026). In the manual method, most of these steps are carried out by operators using conventional equipment, so the speed of the process is greatly influenced by the operator's skills, experience, and accuracy. The lens cutting stage takes longer because the operator must precisely adjust the size and shape of the lens to the frame to ensure the results match the prescription (Normisbah, 2020).

The results of this study indicate that although the manual method relies on operator skill, the dispensing process can be completed in a relatively short time if the operator has sufficient experience and competence. This indicates that operator skill is a key factor influencing time efficiency in the manual method.

In the semi-automatic method, the average total dispensing time was 624.57 seconds. The lens cutting stage was also the longest, with an average of 448.37 seconds. This longer time compared to the manual method is thought to be influenced by the data input process, frame scanning, machine settings, and machine runtime during the cutting process. Nevertheless, the semi-automatic method has the potential to provide more consistent and precise results.

In theory, semi-automatic methods utilize machines for the lens cutting process, but they still require operator intervention during the preparation phase, parameter setting, frame shape scanning, lens mounting, and final product inspection. Therefore, even with technological assistance, processing time is influenced not only by machine speed but also by tool preparation time, calibration, and operator skill.

The results of this study indicate that the use of semi-automatic technology does not always result in shorter processing times. At the research site, the additional steps before the machine starts working resulted in a longer total dispensing time compared to the manual method. Nevertheless, the semi-automatic method still has advantages in terms of more consistent cutting results, higher precision, and the potential to reduce errors during the dispensing process. Therefore, the choice of dispensing method should consider not only time efficiency but also the quality of the results and the service needs of the optical shop.

Time Efficiency of Manual and Semi-Automatic Methods The discussion begins by interpreting the findings on each dispensing process indicator, namely prescription verification time, lens preparation time, lens cutting time, frame fitting time, and finishing time, then ends with a discussion of the total dispensing time as an illustration of the overall efficiency of the process. so that a comprehensive understanding is obtained regarding the influence of dispensing methods on the efficiency of service time in optical laboratories.

Discussion of Prescription Verification, The results of the study showed that the average prescription verification time in the manual dispensing method was 37.80 seconds, while the semi-automatic method was 36.93 seconds. The results of the Independent Sample t-test showed a p value = 0.420 ($p > 0.05$), so there was no significant difference between the two methods in the prescription verification stage. These findings indicate that the prescription verification process is still dominated by cognitive abilities and the accuracy of officers in checking patient identity, lens strength, lens type, and the suitability of the doctor's prescription with laboratory data. At this stage, the use of semi-automatic machines has not provided significant benefits because the machine does not replace the clinical decision-making process by refractionists or opticians.

The results of this study align with research on preloaded versus manual systems in ophthalmology procedures, which reported no significant difference in time at operator-dependent stages, while time savings primarily occurred in mechanical or instrument preparation stages. Therefore, it is understandable that increased efficiency in dispensing services does not necessarily occur at all stages of the work process but is more influenced by the characteristics of the activity being performed. Stages requiring professional validation remain dependent on the competence of the personnel.

Lens Preparation: The study results showed that the average lens preparation time for the manual method was 81.60 seconds, while for the semi-automatic method it was 83.77 seconds, with a p-value of 0.422, indicating no significant difference. Lens preparation includes identifying the lens type, checking the prescription specifications, selecting a blank lens, and initial adjustments before the edging process. All of these steps are still largely performed manually, even though the laboratory uses semi-automatic machines. Therefore, the use of machines has not been able to significantly speed up this stage.

Literature on the optical dispensing process explains that before the edging process is carried out, the operator must still perform frame tracing, lens marking, blocking, and prescription checking manually so that the work time in the initial stage is relatively unchanged between manual and semi-automatic methods. The results of this study indicate that the efficiency of a dispensing system is determined not only by the presence of the machine, but also by the proportion of work that still requires operator intervention.

Lens Cutting: The lens cutting stage was the only stage that showed a significant difference. The average cutting time for the manual method was 257.43 seconds, while the semi-automatic method was 448.37 seconds. The Mann-Whitney test showed a p-value < 0.001 , indicating a significant difference between the two methods. This difference indicates that the lens edging or cutting process is the stage most influenced by the working method used. Interestingly, in this study, the semi-automatic method actually took longer. This condition can be influenced by several factors, including the time required for machine calibration, parameter input, lens block installation, frame size adjustment, and waiting time while the machine is running. If the work volume is not high or the operator is not accustomed to using the machine, then this additional time can cause the total process to take longer than the manual method.

In theory, auto-edgers are designed to improve consistency of results, reduce manual intervention, and speed up the process under optimal operating conditions. However, these benefits are highly dependent on operator readiness, machine condition, and the complexity of the lens being processed.

This research finding differs from several international studies that report that automated systems can reduce processing time if workflows are well-integrated. Research on digital workflows and preloaded systems in ophthalmology shows that automation can save total time when all stages are digitized, not just a single process.

These differences in results indicate that the effectiveness of technology is heavily influenced by implementation in the field. Semi-automatic machines do not automatically increase efficiency without optimal operational standards and operator skills.

Frame Installation The average frame installation time for the manual method was 20.17 seconds, while for the semi-automatic method it was 20.33 seconds. The t-test results showed a p-value of 0.845, indicating no significant difference. The frame installation stage is a precision job that requires manual skill from the operator to ensure the lenses are properly installed without causing damage to the frame or lenses. Therefore, even though the cutting process uses a machine, the installation stage still relies heavily on the manual skills of the officer. These results are in accordance with the concept of optical dispensing which states that the fitting and mounting stages still require the operator's technical skills to ensure the quality of the final result and patient comfort.

Finishing: The finishing stage showed an average time of 34.83 seconds for the manual method and 35.17 seconds for the semi-automatic method. The Mann-Whitney test yielded a p-value of 0.618, indicating no significant difference. Finishing is the final inspection process, which includes lens cleaning, optical position checks, frame adjustments, and quality control before delivery to the patient. These stages are still performed manually, so the use of machines does not significantly impact the processing time.

Research on dispensing process optimization shows that the final inspection stage still requires validation by staff, so that more time reductions are achieved through workflow improvements than through replacing manual inspection activities.

Overall, the average total dispensing time for the manual method was 431.83 seconds, while the semi-automatic method was 624.57 seconds. The Mann-Whitney test showed a p-value <0.001, indicating a significant difference between the two methods. These results indicate that under laboratory conditions, the manual method actually provides a shorter completion time than the semi-automatic method. This finding is likely influenced by machine setup time, calibration processes, parameter settings, and operator experience in operating semi-automatic equipment. In other words, technology investment does not necessarily immediately result in increased efficiency without proper workflow integration, operator training, and machine maintenance.

These findings differ from several studies that show that automated systems can significantly reduce dispensing time after work processes have been standardized and all stages digitized. For example, research in hospitals has shown that automated dispensing can speed up dispensing time compared to manual systems when implemented comprehensively. Therefore, the results of this study imply that the success of implementing dispensing technology is determined not only by the availability of semi-automated machines, but also by human resource readiness, workflow efficiency, frequency of machine use, and operational standards implemented in the optical laboratory.

The results of this study differ from those of Pradata et al. (2019) who reported that Automated Dose Dispensing (ADD) was more effective than manual dispensing, with an average dispensing time of 53.70 seconds compared to 144.54 seconds, and had a lower dispensing error rate. The results of this study are also not entirely in line with the research of Wijayanto et al. (2025) who stated that the implementation of the Unit Dose Dispensing system can increase the work efficiency of healthcare workers while reducing medication errors.

The difference in the results of this study compared to previous studies is likely due to the characteristics of dispensing work in optical shops, which differ from hospital pharmacy services. In the lens dispensing process, the frame scanning, machine parameter settings, and cutting processes using semi-automatic tools require additional time, resulting in longer total completion times. Furthermore, operator experience, the type of machine used, and the workflow in the optical shop can also affect dispensing efficiency. Thus, although semi-automatic technology offers convenience and the potential for increased precision, under the conditions of this study, manual methods proved to be more efficient in terms of dispensing completion time.

CONCLUSION

Based on the results of the study on the relationship between contact lens use and the risk of visual impairment, it can be concluded that the use of contact lenses in the majority of respondents is in the good category, namely 38 respondents (51.4%), the sufficient category is 34 respondents (45.9%), and the poor category is 2 respondents (2.7%). The risk of visual impairment shows the low and high categories of 30 respondents (40.5) respectively, while the moderate category is 14 respondents (18.9%). The results of the Kendall's Tau-b test show a value of $\tau = 0.703$ with a p-value < 0.001 , which means there is a strong and significant relationship between contact lens use and the risk of visual impairment. Based on these results, contact lens users are advised to pay attention to cleanliness, how to use, care, lens lifespan, and to have regular eye examinations. Opticians and health workers are expected to increase education regarding the proper use and care of contact lenses through counseling and information media. For future researchers, it is recommended to use a wider sample size and coverage area and consider other factors, such as the duration and type of contact lens use, history of eye disease, treatment compliance, and use of digital devices, with a longitudinal or cohort research design to obtain more comprehensive results.

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