# Effectiveness of Google Lookout app on functional task performance in Low Vision patients with macular disease.

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## ABSTRACT

**Purpose:** To determine the influence of the Google Lookout smartphone application on enhancing the performance of functional vision; reading and medicine recognition in patients with macular disease.

**Methodology:** The comparative quasi-experimental study was a within-subject study carried out at the Low Vision Clinic, Superior University, between April and September 2025 following the Ethical Review Board approval. Since the same participants were measured in both of the conditions, within-subject design was used. Each participant used the app to complete a two-functional vision task, including short-text reading and medicine identification, in two different conditions, first without the app and secondly with the Google Lookout application. The Wilcoxon Signed Ranks Test with the level of significance of $p < 0.05$ was used in data analysis.

**Result:** Google Lookout was found to be helpful in enhancing the accuracy of reading and medicine-recognition tasks. The mean reading accuracy improved between 9.4 ±1.6(without app) and 13.1 ±1.2 (with app) ($p < 0.001$) and the performance of medicine-identification was also significantly improved ($p = 0.001$).

**Conclusion:** The Google Lookout app effectively enhances the accuracy of reading and medicine-recognition tasks in patients with macular disease, supporting its role as a supplementary low-vision rehabilitation tool.

**Keywords:** Macular Disease, Low Vision, Google Lookout, Artificial Intelligence, Functional Vision, Reading Accuracy, Medicine Identification, Assistive Technology.

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## INTRODUCTION

Vision is considered the most crucial of the five human senses, essential for daily activities such as reading, learning, driving, watching TV, and recognizing faces. It enables individuals to navigate and interact with their surroundings confidently. When vision is impaired, autonomy and quality of life decline . Macular diseases are of special interest in ocular diseases as they cause damage to the central retina that provides detailed vision, which makes it hard to do anything requiring precision, even though they can see large objects and interact with their environment.

Macular diseases are considered as one of the major causes of an irreversible loss of central vision in the world, approaching 8.7 percent of the global population , and the functional impact of the problem would include the appearance of central scotomas, decreased contrast recognition, and distorted vision, consequently leading to slower reading rates, face recognition problems, and difficulties in matching medications or labeling products. In response, people tend to put in a non-foveal retinal area- fixation, which is actually less accurate and fatiguing. Such an adaptation may make people less productive in their day-to-day activities and result in frustration and reliance.

The goal of low-vision rehabilitation (LVR) is to maximize residual vision and restore functional autonomy among the patients. The conventional tools (optical magnifiers, telescopes and video magnifiers) as well as other non-optical strategies (enhanced lighting and high contrast materials) can support certain visual tasks but are not effective with dynamic activities in the real world (object or medicine recognition). Video magnifiers are very good when it comes to stationary reading but they are very expensive, bulky, and less convenient when it comes to locations of everyday use.These tools are also inadequate to those who experience problems with other reading methods such as seeing products or identifying medicine containers as a result it elevates the desire to have portable, inexpensive, and more versatile assistive technology. In the recent developments in artificial intelligence (AI) and computer vision (CV), the technology of assistive technology among the visually impaired has undergone a revolution. And in contrast to conventional optical tools, AI-powered applications on smartphones operate on images in real-time with the help of inbuilt cameras . Among them is the ability to read, recognise faces and objects, and describe scenes through voice feedback, which facet of multisensory experience is substituting lost central vision in Google Lookout. It is an AI and CV(computer vision)based app created by Google and allows auditory descriptions of the environment and functions in various modes, such as Short Text, Document, Explore, Food Label, and Currency to assist users in bringing independence into their daily activities.

Although the research on AI-based assistive applications is doing well, the vast majority of the studies involved participants who had mixed visual impairments, so little evidence was provided in relation to macular disease. Since patients with macular have peripheral but no central vision, the other way that they interact with such tools is different than that of a peripherally-damaged patient. It is, therefore, important to evaluate the effectiveness of Google Lookout in this particular population. This research seeks to determine the effects of Google Lookout on reading and medication identification forms with regards to accuracy and time as a functional outcome measures of improvement in people with macular disease.

## METHODOLOGY

A quasi-experimental within-subject observational study was conducted after approval from the Institutional Ethical Review Board. The study was carried out at the Low Vision Clinic, Superior University, from April 2025 to September 2025.Sample size was calculated using the formula:N=(Zcrit+Zpower/ES)^2where Zcrit=1.96 for a 5% level of significance(two tailed), Zpower=0.84 for 80% power of test, and the

estimated effect size (ES) was 0.5. Sample size was calculated 36 individuals.Each individual was tested twice without and with the Google Lookout app to test the level of functional tasks performance. The tasks involved reading printed text and medicine labels recognition, in which it was recorded that the accuracy and time of each condition was taken.The sampling was done using convenient sampling. Patients that had low vision due to macular diseases were also used in the research. Participants who had any other ocular or systemic pathology affecting the vision were excluded. All participants provided written informed consent prior to inclusion.All data were inputted into and analyzed with SPSS version 25. All variables were computed using descriptive statistics.The Wilcoxon Signed-Ranks Test was used in order to compare performance with and without the app. The p-value<0.05 was found to be statistically significant.

## RESULTS

This study involves the analysis of data from 36 participants with clinically diagnosed macular disease who performed two functional vision tasks under different testing conditions—without and with the Google Lookout application. The analysis focuses on comparisons of task accuracy and time taken between both conditions using the Wilcoxon Signed Ranks Test, and the findings are presented comprehensively for each performance parameter.

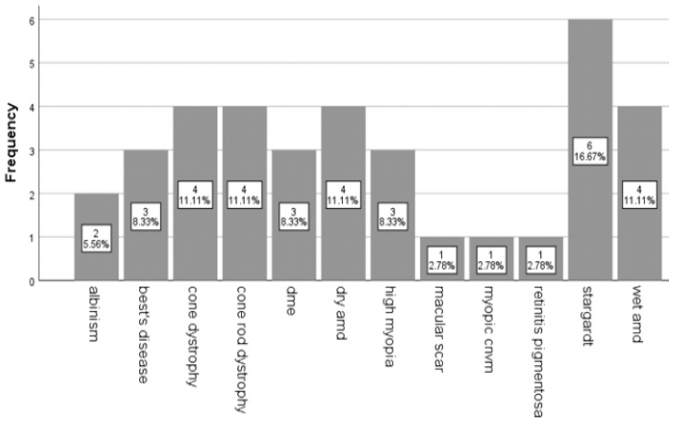
Reading Task: The accuracy was significantly increased, although the time spent in reading increased with the usage of the app. The average accuracy of reading improved with the use of the app as compared to when there was no app, 9.4 ±1.6 vs 13.1 ± 1.2, which was statistically significant ($p < 0.001$). This is to suggest that the Google lookout application facilitated the participants to read the printed text more accurately although it took slightly more time to process the audio feedback.

Medicine Identification Task: Similarly, accuracy for the medicine identification task improved significantly when using the app ($p = 0.001$).The improvement shows how the app can be useful in improving functional vision performance in patients with macular disease.

The following table presents the combined descriptive and inferential statistics for all performance variables evaluated with and without the use of the Google Lookout application.

| Variable | N | Mean (With App) | SD (With App) | Mean (Without App) | SD (Without App) | p-value (Wilcoxon) |
|---|---|---|---|---|---|---|
| Reading time | 36 | 28.6 | 6.66 | 18.64 | 2.98 | 0 |
| Accuracy | 36 | 13.1 | 1.2 | 9.39 | 1.61 | 0 |
| Medicine identification | 36 | 20.9 | 3.14 | 18.46 | 2.31 | 0.001 |
| Identify correct | 36 | 1.06 | 0.23 | 1.42 | 0.5 | 0.002 |
| Accuracy percentage | 36 | 82.1 | 7.49 | 58.68 | 10.05 | 0 |
| Reading rate | 36 | 29.8 | 10.3 | 30.94 | 6.96 | 0.239 |

Histogram showing frequency distribution of participants according to type of macular disease is below:




## DISCUSSION

In the current study, a total of 36 participants diagnosed with different macular pathologies, including Stargardt disease, juvenile macular degeneration, macular scar and others, were evaluated to determine the effectiveness of the Google Lookout application in enhancing functional vision and visual independence. Each participant was assessed for reading and medicine recognition tasks under two conditions:with and

without the Google Lookout app, following a short 10-minute training session app use and voice output.

The research conducted by Senjam in 2021 investigated the utilization of assistive technology on smartphones by individuals with visual impairment in India and demonstrated that 78 % of visually impaired participants experienced enhanced independence through smartphone-based assistive technologies, with an average text-recognition accuracy of 89 % (±6.2 %). Their study also revealed that task completion time increased modestly by 2.7 seconds ($p < 0.05$), emphasizing a trade-off between speed and accuracy,a pattern consistent with the present study .The present research concurs because Google Lookout users were far more accurate when reading and identifying medicine, and provided evidence that portable AI devices supply less dependency on optical equipment. The two articles narrow the gap of accessibility to smartphone-driven solutions, particularly in situations where finances are limited and magnifiers or visual aids are not affordable.

A research conducted by Pundlik in 2023,reported text recognition accuracy between 82 % and 95 % using AI-based OCR platforms and a 43 % reduction in reading errors compared with optical magnifiers ($p < 0.001$). Although their users required approximately 20–35 % longer to complete tasks, overall functional accuracy and satisfaction improved significantly ($p < 0.01$). Likewise, the participants in the current research also showed significant accuracy improvement as reading and medicine recognition using Google Lookout. This trend is similar where it is emphasized that AI-assisted apps focus on the accuracy and understanding rather than speed as it may imply that a bit of extended interaction has a positive impact on the task stability and increases user trust.

A research conducted by Spina in 2025, who studied the question of medicine identification by deep-learning systems, where such trends can be noticed. They experimented with a machine that they shot more than 90 -percent accuracy in controlled light conditions but dropped when experimenters hand-wrote labels, when the contrast was low, or when the graphics were curvy –. Their multilingual deep-learning algorithm scored 90.6 ±4.1% on mean recognition accuracy in optimal lighting, but scored 77.2 ±6.5%in suboptimal light ($p < 0.001$). Curved or handwritten labels were especially low in recognition rates with a performance under 70%.The two articles indicate that the largest impediments to OCR success are still visual noise, curved labels, and bad contrast, so indeed there is much work to do to refine the algorithms and introduce more data to cope with the reality variation.

A study done by Udayakumar in 2025 experimented with AI-powered smart glasses based on OCR and object recognition . The study find a 91 % ± 4.8 % accuracy in text recognition using AI-powered smart vision glasses versus 63 % ± 9.1 % with magnifiers ($p < 0.001$). Although mean task completion time increased by approximately 2.7 seconds ($p < 0.05$), participants reported an 87 % satisfaction rate.This is consistent with the current results, as the participants took a little longer time with Google Lookout but had significantly higher success rate of reading and identifying medicine. Both articles confirm that auditory feedback and AI-based interpretation increase the precision of the task as well as user confidence even at the cost of insignificant time loss.

A study by Choi and Chlebek in 2023 discovered that 73 percent of visually impaired adults had difficulties with non-native English voice-output and 64 percent reported delays in commands longer than 1.5 s, which slowed the speed of tasks ($p < 0.05$), even as many of them rated the apps useful in independent living (81 percent). These results are in line with the current research, where Urdu speakers took more time to complete the tasks because of language processing delay in Google Lookout and were more accurate but still were less satisfied than monolinguals.

The Google Lookout program is all central, and work-detailed whereas a study by Bleau in 2025

was about navigation, an activity that is dependent on wide-field spatial awareness that is generally fine in macular disease.They discovered by way of a sequence of navigation and close-up recognition activities that large spatial orientation navigation accuracy rates were high (91% ±3.8 %), but a decline to smaller values (67%± of 5.1%) occurred when trying to recognize using simple questions like product label reading or identification of small household objects. The mean time to complete the detailed tasks identifying objects was 26.7± 4.5 s, which is almost twice less than larger object orientation tasks ($p < 0.01$). Nonetheless, the satisfaction rates of users were always higher than 80, and people felt that they became more independent and safe.

Tran in 2023 have researched the low-vision rehabilitation programs and their impact on the speed of reading and day-to-day functioning of patients with age-related macular degeneration. The study compared 17 clinical trials on 1,028 subjects that had age-related macular degeneration to determine the impact of low-vision rehabilitation on the quality of life and reading performance. The combination of outcomes showed an average of 28.4 ± 7.2 words per minute improvement of reading after organized rehabilitation programs.They discovered that organized interventions increase life every day although the condition of vision does not change significantly. That is in line with current study, the person will be able to become more independent with intelligent tools such as AI, even though your visual acuity will remain the same.

According to research conducted by Gupta in 2024 designed and tested an assistive system called VisMed, a smartphone-based system that was used in identifying these medications and reading the labels in people whose eyesight is low. The system has reported an average recognition rate of 89.6% ± 4.2 that found the name of the medication and dosage instructions accurate in 82% of correct recognition (in normal lighting) in their experimental validation of 60 drug packages. In low light, however, the recognition rate went down to 73 % and 68% when the labels were written by hand or curved ($p < 0.05$). Time to complete an average number of tasks with the use of the app was 28.4 ± 7.1 s compared to 22.3 ± 6.5 s with manual reading, a statistically significant time difference ($p = 0.032$) but a 34% increase in accuracy with the aid of the app. These results are consistent with the results of the current research, in which the individuals were significantly more accurate in recognizing medicine when relying on the Google Lookout application.

There are limitations associated with this study. The sample size was also small and those recruited practiced variability in severity levels of the macular disease, thus it is possible that this affected the performance of the tasks. Output in the Urdu language and lack of recognition in the local currencies lowered the regional utility. Also, a single testing session was performed, along with no long-term follow-up to determine how well adaptation takes place and with which benefits in the long term. To improve on the current study, it is recommended that future studies with bigger and more varied samples, longer training durations, and longitudinal performance analysis to establish how AI-based assistive systems like Google Lookout would affect the quality of life and functional vision of patients with macular disease.

## CONCLUSION

It is concluded from the results of this study that Google Lookout application shows great enhancement of the visual performance and task accuracy in macular disease patients especially with reading and medicine recognition. It ensures an increased level of independence over traditional magnifiers. AI-powered applications such as Lookout may be used as useful supplements in the rehabilitation of low-vision. To maximize the utility, future research ought to use bigger, more varied samples and real life-situations. Incorporation of such apps and traditional aids can also be productive in accelerating speed and accuracy.

**Conflict Of Interest:** None to declare

**Ethical Approval:** The study was approved by the Institutional Review Board / Ethical Review Board Reference No. SU/IRB/FAHS/25/D-1239 dated 15.03.2025, Superior University Lahore.

**Authors' Contributions:**

Ramsha Azam: Concept, Design, Literature research, Data acquisition, Data analysis, Manuscript preparation, Manuscript editing,

Mahfar Khan: Literature research, Data acquisition, Data analysis, Statistical analysis, Manuscript review.

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