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EFFECTS OF DAILY DISPOSABLE VS EXTENDED WEAR CONTACT LENS ON EYE HEALTH

Original Research

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ABSTRACT

Background: Vision and eye health are essential for quality of life, impacting education, employment, and daily activities. Vision impairment remains a major public health concern, affecting 596 million individuals worldwide, including 43 million who are blind. The burden is disproportionately higher in low- and middle-income countries, where access to affordable interventions remains limited. Contact lenses serve as an alternative to spectacles, with daily disposable and extended wear lenses being widely used. While daily disposable lenses minimize contamination risk due to their single-use nature, extended wear lenses, made from oxygen-permeable materials, can be worn continuously for up to 30 days, potentially increasing ocular health risks.

Objective: To evaluate the impact of daily disposable and extended wear contact lenses on ocular health by comparing the prevalence of dryness, redness, swelling, and tear film stability between users of both lens types.

Methods: A cross-sectional study was conducted at Eye2Eye Optometrists, Lahore, with a sample size of 74 participants, divided equally between daily disposable and extended wear lens users. Participants were aged 17 to 23 years and were regular contact lens users for refractive correction. Those with pre-existing ocular or systemic conditions or occasional lens wearers were excluded. Data were collected through questionnaires assessing ocular symptoms and clinical evaluations using slit lamp examination, Schirmer's test, and tear breakup time. Statistical analysis was performed using SPSS version 26, with a p-value <0.05 considered significant.

Results: Extended wear users reported significantly higher ocular symptoms, including dryness (81.1% vs. 32.4%, p=0.00), redness (51.4% vs. 13.5%, p=0.00), swelling (16.2% vs. 2.7%, p=0.03), and blurry vision (13.5% vs. 2.7%, p=0.04). Schirmer's test showed reduced tear production in extended wear users (56.8% had <10mm in 5 minutes vs. 21.6% in daily disposable users, p=0.00). Tear breakup time was also significantly lower in extended wear users, with abnormal values in 54.1% for the right eye and 56.8% for the left eye compared to 27% and 24.3% in daily disposable users (p=0.01, p=0.00). Slit lamp examination revealed higher rates of corneal opacity (62.2% vs. 21.6%, p=0.00) and conjunctivitis (43.2% vs. 16.2%, p=0.00) in extended wear users.

Conclusion: Extended wear contact lenses were associated with a higher prevalence of ocular surface complications, including increased dryness, redness, and corneal abnormalities, compared to daily disposable lenses. The findings highlight the need for careful selection of contact lenses and adherence to recommended wear schedules to minimize ocular health risks.

Keywords: Blepharitis, contact lenses, conjunctivitis, corneal opacity, dry eye syndrome, myopia, visual acuity.

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INTRODUCTION

The health and functionality of the human eye play a fundamental role in overall well-being, affecting various aspects of life, including education, employment, and social participation. However, access to quality eye care remains a significant challenge for many populations worldwide, leading to a high prevalence of vision impairment and blindness. In 2020, an estimated 596 million individuals globally were affected by distance vision impairment, with 43 million cases of blindness. Additionally, around 510 million individuals suffered from uncorrected near vision impairment due to the absence of corrective measures such as reading glasses. Notably, the burden of visual impairment disproportionately affects individuals in low- and middle-income countries (LMICs), with nearly 90% of cases occurring in these regions. If current trends continue, projections indicate that by 2050, approximately 895 million people will have distance vision impairment, including 61 million individuals who will experience blindness (1-3). These statistics highlight the urgent need for effective interventions to protect and maintain eye health. The introduction of contact lenses revolutionized vision correction, offering an alternative to traditional eyeglasses and enabling millions of individuals to achieve clearer vision. Initially conceptualized by Leonardo da Vinci in 1508, contact lenses evolved into a clinical application in the late 19th century. Early models consisted of rigid glass shells, which were difficult to manufacture and uncomfortable for wearers. However, significant advancements in optical materials, particularly the development of optically transparent polymers in the 1940s, paved the way for improved comfort and practicality (4). Today, contact lenses are widely used for vision correction, therapeutic purposes, and cosmetic enhancement. Among the various types available, daily disposable and extended wear contact lenses are particularly popular due to their convenience and potential benefits (5). Despite their advantages, the duration of contact lens use has critical implications for ocular health, with extended use being associated with various complications (6).

Daily disposable contact lenses are designed for single-use applications, providing a fresh, sterile lens each day, which minimizes the risk of contamination and associated ocular complications. In contrast, extended wear lenses are made from advanced, highly oxygen-permeable materials that allow for continuous wear over extended periods, sometimes up to 30 days. While both lens types offer unique benefits, they also pose distinct challenges to eye health, particularly concerning ocular surface integrity, infection risk, and tear film stability (7). The composition of contact lens materials and the cleaning solutions used further influence ocular health outcomes. Many lens care solutions contain preservatives such as thimerosal and chlorhexidine, which can induce allergic reactions in susceptible individuals, manifesting as ocular discomfort, conjunctival hyperemia, and corneal staining. Approximately 40–60% of individuals with a history of allergies experience ocular symptoms related to contact lens use, necessitating discontinuation or frequent application of anti-allergic eye drops (8-9). Environmental factors such as exposure to smoke, pollutants, and allergens can exacerbate these symptoms, leading to discomfort and compromised lens tolerance (10). Tear film stability is a crucial determinant of eye health and comfort in contact lens wearers. The tear film serves multiple functions, including lubrication, protection, and nutrient supply to the ocular surface. Assessments such as the Schirmer's test and tear breakup time (TBUT) are commonly used to evaluate tear film stability. Patients diagnosed with aqueous tear deficiency typically exhibit a Schirmer's test score of less than 10 mm, indicating insufficient tear production. Blinking plays a vital role in tear film distribution across the cornea and conjunctiva, and prolonged intervals without blinking can result in tear film breakup, leading to ocular dryness and discomfort. Individuals with an inherently unstable tear film are more prone to developing symptoms of dry eye disease, which can impact visual clarity and overall lens tolerance (11-12). Furthermore, contact lenses, by virtue of their continuous interaction with the ocular surface, can contribute to vision disturbances such as blurred vision, irritation, and photophobia. Visual acuity testing remains the standard approach for assessing vision quality and detecting subtle changes in ocular function. The process involves the transmission of visual signals from the retina to the brain via the visual pathway, where photoreceptor cells convert light into electrical signals for interpretation (13).

Given the widespread use of contact lenses and the potential risks associated with prolonged wear, it is imperative to evaluate the comparative effects of daily disposable and extended wear lenses on eye health. This study aims to assess the ocular implications of these two lens types, focusing on parameters such as infection risk, tear film stability, allergic reactions, and overall visual function. By addressing this research gap, the findings will contribute to a deeper understanding of optimal contact lens use, guiding recommendations for safer and more effective vision correction strategies.

METHODS

This cross-sectional study was conducted to evaluate the ocular health implications of daily disposable and extended wear contact lenses among regular contact lens users. The study was carried out at Eye2Eye Optometrists, an optical setup in Lahore, following ethical approval from the Superior University Ethical Committee. A total of 74 participants were recruited using a non-probability sampling technique. The sample size was determined using the formula $n = z^2 \times p \times (1-p) / e^2$, ensuring adequate statistical power for comparison between the two groups. Participants included individuals aged 17 to 23 years who regularly used contact lenses for refractive correction and voluntarily agreed to participate in the study. Exclusion criteria included individuals below 17 years of age, those who used contact

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lenses occasionally, and those with pre-existing ocular or systemic conditions that could confound the study outcomes. Participants were categorized into two groups: daily disposable contact lens users and extended wear contact lens users. Data collection involved a structured questionnaire designed to assess symptoms related to dry eyes, conjunctival hyperemia, tear film quality, and visual disturbances. In addition to subjective assessments, an ophthalmic evaluation was conducted using a slit lamp biomicroscope to identify any abnormalities in the lids, conjunctiva, and cornea. Objective tests, including the Schirmer's test and tear breakup time (TBUT), were performed to assess tear production and tear film stability, respectively. These tests provided quantitative measures of dry eye syndrome and ocular surface integrity, aiding in a comprehensive evaluation of the impact of contact lens wear on eye health.

All participants were informed about the purpose of the study, and written consent was obtained before their inclusion. Confidentiality and adherence to ethical research standards were maintained throughout the study. Data analysis was performed using SPSS version 26. Descriptive statistics, including frequencies and percentages, were used to present qualitative data, while quantitative variables were expressed as mean and standard deviation. Comparisons between the two groups were conducted using cross-tabulation analysis, and a p-value of <0.05 was considered statistically significant.

RESULTS

The study included 74 participants, with 37 individuals in each group of daily disposable and extended wear contact lens users. The mean age in the daily disposable lens group was 19.10±1.94 years, while in the extended wear lens group, it was 19.72±2.44 years. The duration of contact lens wear significantly differed between the groups, with daily disposable users reporting an average of 4.94±1.88 days, whereas extended wear users had a mean duration of 8.91±3.34 months. Gender distribution indicated a higher proportion of female participants in both groups, with 75.7% in the daily disposable group and 82.0% in the extended wear group. A significant difference was observed in ocular discomfort parameters between the two groups. Dry eye symptoms were reported by 32.4% of daily disposable lens users, compared to 81.1% of extended wear lens users (p=0.00). Redness was present in 13.5% of daily disposable lens users and in 51.4% of extended wear users (p=0.00). Blurry vision was significantly more common in extended wear users (13.5%) than in daily disposable users (2.7%) (p=0.04). Swelling was also more prevalent among extended wear users (16.2%) compared to daily disposable users (2.7%) (p=0.03).

Slit lamp examination findings revealed a significantly higher prevalence of eyelid abnormalities in extended wear lens users. In the right eye, normal eyelids were observed in 29.7% of daily disposable users and only 2.7% of extended wear users (p=0.02). Left eye examination showed a similar trend, with 37.8% of daily disposable users having normal eyelids compared to 8.1% in extended wear users (p=0.01). Trichiasis was more common in extended wear users (24.3% right eye, 18.9% left eye) than in daily disposable users (13.5% right eye, 13.5% left eye), though not statistically significant. Madarosis was significantly higher in extended wear users (32.4% right eye, 37.8% left eye) compared to daily disposable users (10.8% right eye, 10.8% left eye) (p=0.01, p=0.00, respectively). Blepharitis was also more frequent in extended wear users (18.9% right eye, 18.9% left eye) compared to daily disposable users (2.7% right eye, 8.1% left eye) (p=0.00, p=0.22, respectively). Conjunctivitis was significantly more prevalent in extended wear users, affecting 43.2% in the right eye and 54.1% in the left eye, compared to 16.2% and 29.7% in daily disposable users, respectively (p=0.00, p=0.02). Corneal abnormalities were also significantly different between the groups. Corneal opacity was found in 62.2% of daily disposable users' right eyes and 48.6% of left eyes, compared to 21.6% and 18.9% in extended wear users (p=0.00 for both). Keratitis, corneal edema, neovascularization, and infiltrates were more frequent in extended wear users, though not all reached statistical significance.

Tear film stability and tear production were assessed using Schirmer's test and tear breakup time (TBUT). Schirmer's test results showed that normal tear production (>10mm in 5 minutes) was significantly higher in daily disposable users (78.4% right eye, 40.5% left eye) compared to extended wear users (43.2% right eye, 40.5% left eye) (p=0.00, p=1.00). Abnormal tear production (<10mm in 5 minutes) was significantly more prevalent in extended wear users (56.8% right eye, 59.5% left eye) than in daily disposable users (21.6% right eye, 59.5% left eye) (p=0.00, p=1.00). TBUT results indicated that normal tear film stability was significantly higher in daily disposable users (73.0% right eye, 75.7% left eye) compared to extended wear users (45.9% right eye, 43.2% left eye) (p=0.01, p=0.00). Abnormal TBUT was more frequent in extended wear users (54.1% right eye, 56.8% left eye) than in daily disposable users (27.0% right eye, 24.3% left eye) (p=0.01, p=0.00).

Table: Demographic Characteristics, Contact Lens Wear Duration, and Gender Distribution

Parameter	Daily Disposable Lenses Group (Mean±S.D) / n (%)	Extended Wear Lenses Group (Mean±S.D) / n (%)
Age (years)	19.10±1.94	19.72±2.44
Duration of Wear Lenses	4.94±1.88 (Days)	8.91±3.34 (Months)

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Male	9 (24.3%)	6 (18.0%)
Female	28 (75.7%)	31 (82.0%)
Total	37 (100%)	37 (100%)

Table: Comparison of Daily Wear vs. Extended Wear Conditions

Condition	**Daily Wear N (%age)**	**Extended Wear N (%age)**	**Total (N)**	**P-Value**
Dryness	12 (32.4)	30 (81.1)	37	0.00
Redness	5 (13.5)	19 (51.4)	37	0.00
Blurry Vision	1 (2.7)	5 (13.5)	37	0.04
Swelling	1 (2.7)	6 (16.2)	37	0.03

Table: Comparison of SLE of right and left eye

Condition	**Daily Disposable Lenses (n=37)**	**Extended Wear Lenses (n=37)**	**p-value**
Right Eye Lid			
Normal	11 (29.7%)	1 (2.7%)	0.02
Swelling	6 (16.2%)	8 (21.6%)	0.58
Redness	5 (13.5%)	8 (21.6%)	0.39
Blepharitis	5 (13.5%)	6 (16.2%)	0.86
Swelling + Redness	6 (16.2%)	7 (18.9%)	0.78
All of the Above	4 (10.8%)	7 (18.9%)	0.38
Left Eye Lid			
Normal	14 (37.8%)	3 (8.1%)	0.01
Swelling	6 (16.2%)	8 (21.6%)	0.58
Redness	4 (10.8%)	6 (16.2%)	0.66
Blepharitis	6 (16.2%)	8 (21.6%)	0.58
Swelling + Redness	4 (10.8%)	5 (13.5%)	0.78
All of the Above	3 (8.1%)	7 (18.9%)	0.38
eye lashes			
Right Eye Lashes			
Normal	27 (73.0%)	9 (24.3%)	0.00
Trichiasis	5 (13.5%)	9 (24.3%)	0.16
Madarosis	4 (10.8%)	12 (32.4%)	0.01
Blepharitis	1 (2.7%)	7 (18.9%)	0.00
Left Eye Lashes			

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Normal	25 (67.6%)	9 (24.3%)	0.00
Trichiasis	5 (13.5%)	7 (18.9%)	0.71
Madarosis	4 (10.8%)	14 (37.8%)	0.00
Blepharitis	3 (8.1%)	7 (18.9%)	0.22
Conjunctivitis			
Right Eye Conjunctivitis			
Present	6 (16.2%)	16 (43.2%)	0.00
Absent	31 (83.8%)	21 (56.8%)	0.00
Left Eye Conjunctivitis			
Present	11 (29.7%)	20 (54.1%)	0.02
Absent	26 (70.3%)	17 (45.9%)	0.02
Cornea			
Right Eye Cornea			
Opacity	23 (62.2%)	8 (21.6%)	0.00
Keratitis	5 (13.5%)	6 (16.2%)	0.86
Edema	3 (8.1%)	7 (18.9%)	0.19
Neovascularization	2 (5.4%)	5 (13.5%)	0.26
Infiltrate	2 (5.4%)	5 (13.5%)	0.26
All of the Above	2 (5.4%)	6 (16.2%)	0.18
Left Eye Cornea			
Opacity	18 (48.6%)	7 (18.9%)	0.00
Keratitis	8 (21.6%)	6 (16.2%)	0.5
Edema	4 (10.8%)	7 (18.9%)	0.34
Neovascularization	3 (8.1%)	8 (21.6%)	0.09
Infiltrate	2 (5.4%)	6 (16.2%)	0.08
All of the Above	2 (5.4%)	3 (8.1%)	0.60

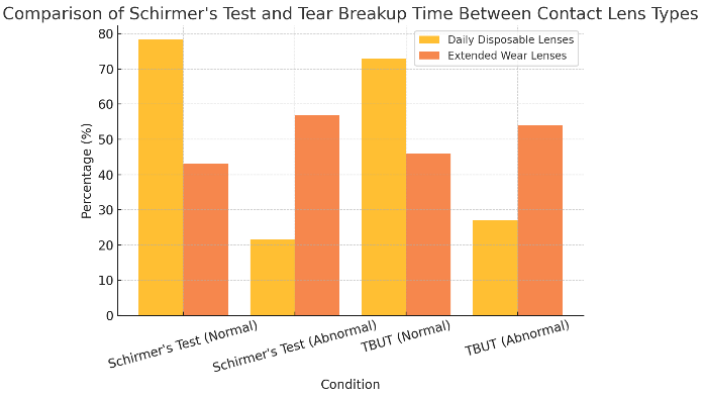
Table: Comparison of Schirmer's Test and Tear Breakup Time Between Daily Disposable and Extended Wear Contact Lenses

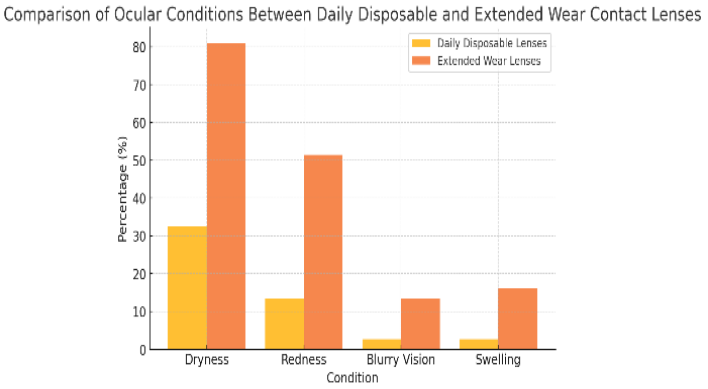
Condition	**Daily Disposable Lenses Group (n=37)**	**Extended Wear Lenses Group (n=37)**	**p-value**
Schirmer's Examination			
Right Eye (>10mm in 5 min)	29 (78.4%)	16 (43.2%)	0.00
Right Eye (<10mm in 5 min)	8 (21.6%)	21 (56.8%)	0.00
Left Eye (>10mm in 5 min)	15 (40.5%)	15 (40.5%)	1
Left Eye (<10mm in 5 min)	22 (59.5)	22 (59.5)	1
Tear Breakup Time			
Right Eye (Normal)	27 (73%)	17 (45.9%)	0.01

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Right Eye (Abnormal)	10 (27%)	20 (54.1%)	0.01
Left Eye (Normal)	28 (75.7%)	16 (43.2%)	0.00
Left Eye (Abnormal)	9 (24.3%)	21 (56.8%)	0.00





DISCUSSION

The study findings demonstrated notable differences in ocular health outcomes between daily disposable contact lens users and extended wear lens users. Participants using extended wear lenses exhibited a significantly higher prevalence of ocular complaints, including pain, redness, dryness, and visual disturbances. Eye dryness was reported by 81.1% of extended wear users compared to only 32.4% of daily disposable users. Similarly, ocular redness was observed in 51.4% of extended wear users, whereas only 13.5% of daily disposable wearers reported this issue. Blurry vision was also more frequently reported among extended wear users, affecting 13.5% compared to 2.7% of daily disposable users. These findings emphasize the potential benefits of daily disposable lenses in reducing ocular surface irritation and discomfort, likely due to their frequent replacement, which minimizes deposit formation and bacterial contamination. Tear film stability, as measured by tear breakup time, was also significantly better in daily disposable users, with 73% exhibiting normal tear breakup times compared to 45.9% of extended wear users. This suggests that daily disposable lenses contribute to maintaining tear film integrity, reducing the risk of dry eye symptoms (14,15). The findings regarding eye dryness align with previous research, indicating that daily disposable lenses are associated with greater comfort and reduced ocular irritation. Studies have established that frequent lens replacement lowers bacterial deposition and accumulation of surface debris, reducing tear film disruption and improving overall lens tolerance. The higher incidence of ocular redness in extended wear users is consistent with literature suggesting that prolonged lens use increases mechanical irritation and reduces oxygen permeability, leading to conjunctival hyperemia and corneal hypoxia. Studies evaluating the effects of overnight contact lens wear have similarly reported that extended wear increases the risk of hypoxic stress, mechanical abrasion, and subsequent ocular redness. The present findings reinforce these observations, as more than half of extended wear users experienced redness, whereas this issue was significantly less common among daily disposable users (16,17).

Extended wear lenses were also associated with a greater prevalence of visual disturbances, including blurry vision. Previous studies have linked prolonged contact lens wear to corneal hypoxia and transient corneal edema, both of which can contribute to visual disturbances. Research examining the impact of continuous lens wear has indicated that overnight use may induce corneal swelling, leading to fluctuating visual acuity. The increased frequency of ocular neovascularization observed among extended wear users further supports the notion that chronic hypoxia is a key factor contributing to ocular surface changes. Prior meta-analyses on contact lens wear and corneal health have consistently reported that extended wear lenses pose a greater risk for corneal neovascularization due to sustained oxygen deprivation (18). The findings also indicated a higher prevalence of eyelid irritation and swelling among extended wear users, which can be attributed to prolonged mechanical interaction between the lens and the ocular surface. Research evaluating the effects of extended contact lens wear has demonstrated that continuous lens use may trigger inflammatory responses due to increased friction and reduced tear film stability. This can lead to eyelid irritation, blepharitis, and swelling, as observed in the present study. The mechanical stress exerted by extended wear lenses on the ocular surface may also explain the increased prevalence of eyelid abnormalities, including trichiasis and madarosis, in this group (19,20).

While this study provides valuable insights into the effects of different contact lens modalities on ocular health, certain limitations must be acknowledged. The relatively small sample size may limit the generalizability of the findings to a broader population. The reliance on self-reported symptoms introduces the potential for recall bias, and subjective assessments may not fully capture the severity of ocular discomfort. The use of a single measurement tool for tear film evaluation, rather than incorporating advanced diagnostic

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techniques, may also have constrained the depth of the analysis. Additionally, the study was conducted at a single center, limiting its applicability to diverse populations with varying environmental and lifestyle factors (20). Future research should consider larger, multi-center studies to enhance the generalizability of findings. Incorporating a broader range of diagnostic techniques, including anterior segment optical coherence tomography and in vivo confocal microscopy, could provide more precise assessments of corneal and conjunctival health. A longitudinal study design with extended follow-up periods may offer deeper insights into the long-term effects of different contact lens modalities. Additionally, the inclusion of microbial assessments could further clarify the role of bacterial contamination in the development of ocular complications. Enhancing participant follow-up procedures and integrating advanced statistical models could also strengthen the reliability of future findings (18-20).

Despite these limitations, the study highlights the potential advantages of daily disposable contact lenses in reducing ocular surface complications, improving tear film stability, and minimizing the risk of mechanical irritation. The findings emphasize the need for careful consideration of contact lens selection, particularly for individuals prone to dry eye symptoms and ocular irritation. Clinicians should educate patients on the risks associated with prolonged contact lens wear and encourage adherence to recommended replacement schedules to optimize ocular health outcomes.

CONCLUSION

The findings of this study highlight that daily disposable contact lenses offer superior comfort and are associated with fewer ocular complications compared to extended wear lenses. Daily disposable lenses were found to be more effective in reducing symptoms of dryness, redness, and visual disturbances while also promoting better tear film stability. By minimizing bacterial deposition and mechanical irritation, these lenses contribute to maintaining long-term ocular health, making them a preferable option for individuals seeking both comfort and safety in vision correction. The study underscores the importance of selecting appropriate lens modalities based on individual needs and reinforces the need for adherence to recommended wear schedules to prevent contact lens-related complications.

AUTHOR CONTRIBUTIONS

Author	Contribution
Rabia Akram	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Sarmad Siddique	Methodology, Investigation, Data Curation, Writing - Review & Editing
Ubaidullah Jan	Investigation, Data Curation, Formal Analysis, Software
Sobia yousif	Software, Validation, Writing - Original Draft
Aleeza Naeem	Formal Analysis, Writing - Review & Editing
Ghashia Gul	Writing - Review & Editing, Assistance with Data Curation
Ayesha Saleem	Writing - Review & Editing, Assistance with Data Curation

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