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Climate and Rhegmatogenous Retinal Detachment: A Comprehensive Review and Future Research Guidelines

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Purpose: Does weather affect the rate of developing rhegmatogenous retinal detachment (RRD)? This comprehensive review investigates the findings of the most recent studies on the relationship between RRD and climatic or seasonal factors.

Methods: An extensive search across PubMed, Embase, and Google Scholar databases resulted in 112 initial results, from which 18 studies published between 1980 and 2024 were selected. The selection criteria were based on the studies' relevance to our topic. We analyzed their methodology, geographic scope, and key findings. Data extraction encompassed study design, sample size, sex ratio, incidence rates, results, and identified limitations.

Results: Eight studies found no statistically significant relationship between seasonal variations and the incidence of RRD. Conversely, seven studies reported an increased incidence of RRD during the summer months. Additionally, secondary analyses of factors, such as ambient temperature, atmospheric pressure, and daylight hours, showed varied and sometimes conflicting results. A summary of common limitations and biases was synthesized into a table, providing guidelines for future research exploring this topic.

Conclusion: This comprehensive review highlights the complex interaction between environmental factors and RRD incidence. The conflicting results across different studies suggest a need for further research in this area. Future studies should address the identified limitations and biases to provide a clearer understanding of the relationship between climate and RRD. By utilizing the guidelines from our review, future research could aim to minimize confounding factors and improve the robustness of their findings. Understanding these interactions can be used to develop preventive strategies and enhance clinical practices to reduce the burden of RRD.

Keywords: rhegmatogenous retinal detachment (RRD), climate, seasonality, temperature

Introduction

Rhegmatogenous retinal detachment (RRD) represents one of the most common yet critical emergencies in ophthalmology, posing a significant threat to vision if not promptly and effectively treated. Historically, the prevalence of RRD in the United States (US) is estimated to range from 8.0 to 18 cases per 100,000 individuals.[1–3] RRD is characterized by the detachment of the neurosensory layer from the underlying retinal pigment epithelium (RPE). This detachment occurs due to the presence of one or more retinal breaks or tears, through which vitreous fluid passes and accumulates in the subretinal space, leading to the physical separation of the neurosensory retina from the RPE. This separation disrupts the metabolic exchange between these two layers, essential for retinal photoreceptor function, leading to visual impairment.[4,5] The urgency of addressing RRD lies in its potential to cause irreversible blindness in the affected eye if left untreated.[5] Due to its potentially insidious yet severe damage to vision, the risks factors, and correlations of RRD have been meticulously explored. Clinicians and scientists have been making ongoing efforts to improve clinical outcomes and, more importantly, to prevent such cases from occurring in the first place.

However, the multifactorial nature of RRD complicates these efforts significantly. It encompasses several well-established risk factors that contribute to its development. These include ocular trauma, often resulting from sports

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activities, and complications following cataract surgery.[6–8] Other significant risk factors extend to myopia, age, genetic predispositions, and previous ocular conditions, which can all weaken the retinal structure and predispose individuals to retinal tears and detachment.[9–13] Despite the known risk factors, the influence of ambient temperature on RRD incidence has emerged as a subject of scientific inquiry.

There are several hypotheses describing the plausible biological mechanisms of seasonal variations influencing the occurrence of RRD[14–19] (See Figure 1). One such hypothesis is temperature fluctuations affecting the vitreous body's consistency, potentially leading to increased vitreous liquefaction during warmer periods. This process can accelerate posterior vitreous detachment (PVD), a primary precursor to RRD.[14,15] Another hypothesis is that UV light induced free radical injury to the vitreous as a cause of cascade downstream effect. Furthermore, seasonal changes in intraocular pressure, influenced by eye temperature variations, could contribute.[16] Additionally, a decrease in sub-retinal cortisol levels has been proposed as another mechanism increasing the risk of retinal tears.[17]

Although there is no clear consensus on the mechanism of the meteorological impact on RRD, in recent decades, this relationship has been explored across various geographic regions. As a result, there is a plethora of studies with varying methodologies and conclusions. A notable attempt to synthesize these findings was made by Qassim et al in 2016, reviewing some of the existing literature up to that point.[20] Their work summarized key findings and highlighted the impact of ambient temperature on RRD, yet acknowledged the conflicting conclusions of these studies. To the authors' best knowledge, there has not been a recent comprehensive review since their study.

Since the publication of Qassim et al's review, numerous new studies incorporating data from previously unassessed geographic areas have emerged, warranting a new evidence synthesis using the most recent findings.[20] This study aims to bridge the gap by including the latest research and exploring key findings of studies conducted in the interim. This involves examining whether certain times of the year are associated with higher rates of RRD due to factors, such as changes in ambient temperature, variations in outdoor activity levels, or other seasonal behaviors that may affect the risk of ocular traumas. The analysis will also consider how these seasonal patterns might vary across different climates and geographical regions, reflecting the complex interplay between environmental factors and the pathophysiology of RRD. Furthermore, this study will discuss the broader implications of understanding seasonal variations in RRD occurrence and provide suggestions for future research to fill in the gap of data yet to be explored.

Understanding the seasonal patterns of RRD can offer valuable insights into preventive strategies and inform clinical practice, potentially reducing the incidence of this vision-threatening condition. By advancing knowledge in this area, physicians can better educate patients at risk and develop targeted preventive measures, ultimately aiming to reduce the burden of RRD on individuals and healthcare systems. The comprehensive literature search proposed above is a timely and essential update for advancing our understanding of RRD. By reviewing and synthesizing the latest findings, this study will contribute significantly to this evolving topic of scientific inquiry.

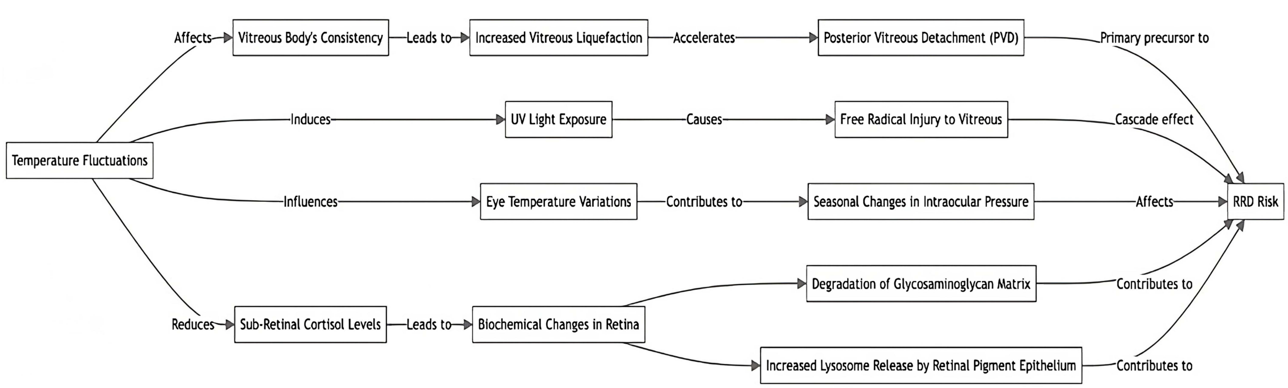

Figure 1 Plausible Mechanisms of Seasonal Influence on Rhegmatogenous Retinal Detachment (RRD) Risk.

Methods

Search Strategy

The electronic databases PubMed, Embase, and Google Scholar were searched in April 2024 to identify potentially relevant articles. The main search terms used were "Rhegmatogenous Retinal Detachment" and "Climate." Related terms for "Rhegmatogenous Retinal Detachment" included "Retinal Detachment", while "Climate" was associated with related terms, such as "Meteorological", "Occurrence", "Seasonal", "Seasonality", "Temperature", and "Variation." The main search terms were combined using the Boolean operator "AND", and the related search terms were combined using "OR."

Inclusion and Exclusion Criteria

The inclusion criteria of this study were the following: (1) articles written in English or translated in English, (2) articles published in peer-reviewed journals, (3) articles related to the relationship between rhegmatogenous retinal detachment and climate, (4) articles published between 1980 and 2024. Studies that did not meet these criteria were excluded. In addition, reviews, meta-analyses, abstracts-only studies, animal studies and those conducted in-vitro were excluded from this review.

Study Selection

Upon identifying the articles that met these criteria, publication abstracts were screened for relevance to our study aim.

Data Abstraction

Sample size, geographic locations, study duration, and key findings were considered when screening abstracts. If found to be relevant, researchers read the full texts thoroughly and collected relevant data points in a data extraction matrix created by the research team. A graphic depicting this literature search and article selection process is outlined in Figure 2 and flow chart diagram (Figure 3).

Results

Results of Study Selection

Eighteen articles were ultimately included in this study. Studies were ultimately selected for inclusion based on their relevance, study design, and specific geographic locations. The data points collected for the data extraction matrix

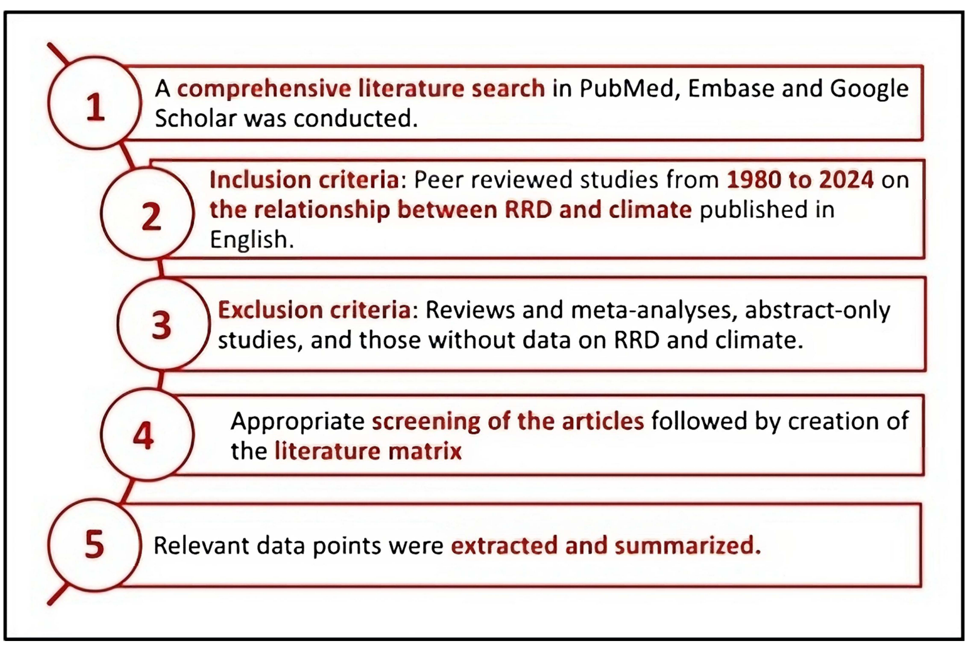

Figure 2 Flow diagram of the publication search and selection process.

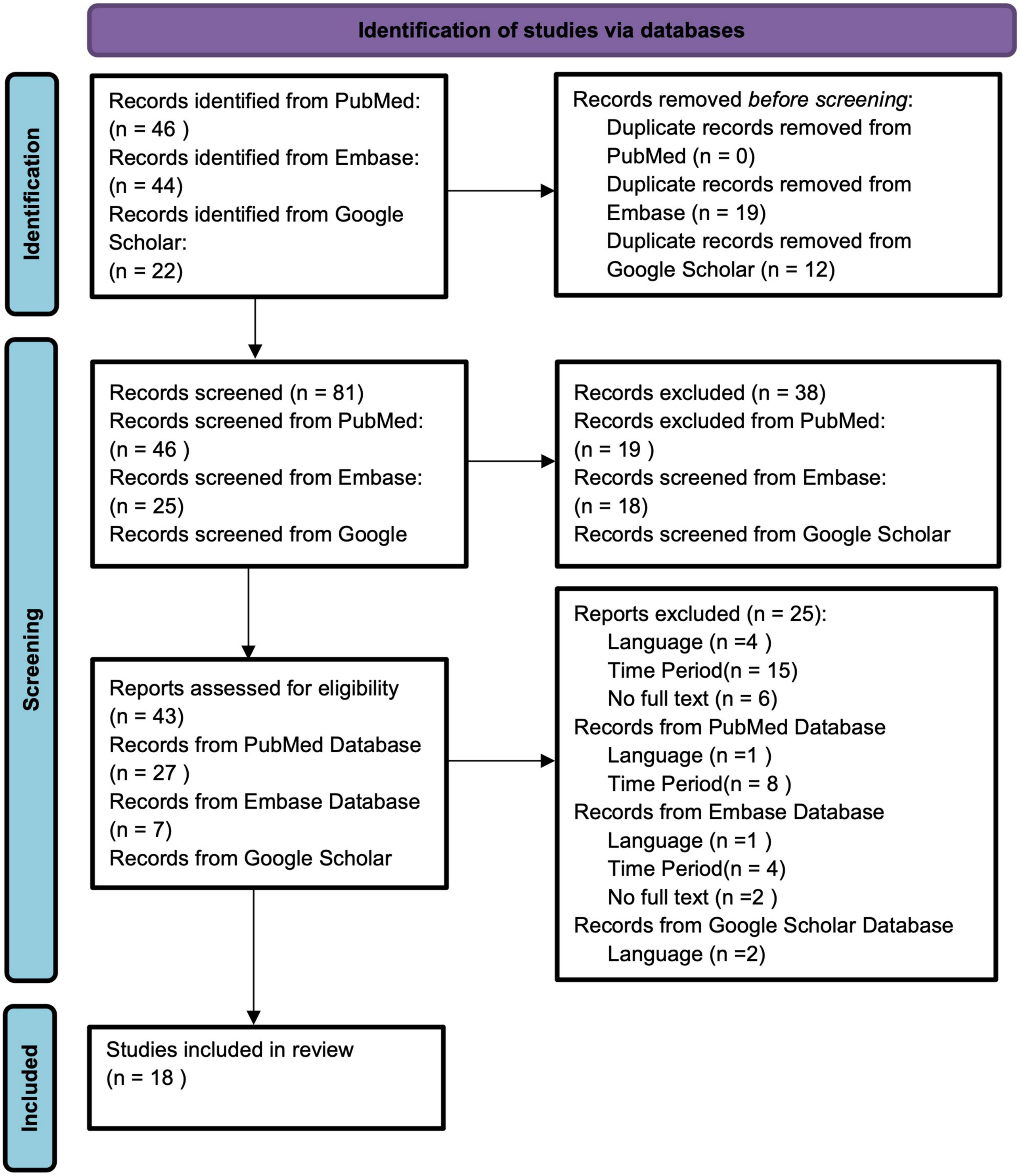

Figure 3 Flow diagram of the screening and selection process.

consisted of year of publication, data collection window, location (country/city), sample size, sex ratio (M:F), defined incidence rate, and key findings, specifically seasonal incidence rate and found association, if any. This data can be visualized in Table 1.[9,21–33]

Table 1 Table Summarizing Data Extraction & Key Findings

Authors	Year of Pub	Data Collection Window	Location (City/ Country)	Sample Size	Sex Ratio (M:F)	Incidence Rate/Other Measures	Key Findings (Include Annual Incidence Rate)
Paavola et al[15]	1983	1975–1980	Oulu, Northern Finland & Novosibirsk, Russia	560	Oulu: 123:135 Novosibirsk: 160: 142	Not specified, presumed (cases/month)	• Novosibirsk: 43 Cases/month ○ Oulu: 23 Cases/month • Novosibirsk & Oulu: ○ Summer Months (June–July)
Laatikainen et al[21]	1985	1978–1981	Helsinki, Finland	301	151:159	1. Annual incidence per 100,000 of RRD in population 2. Cases/month	• The 4-year cumulative number of cases varied from 28 to 39 per month (July–October) • Late Summer-Early Autumn (July–October)
Ghisolfi et al[17]	1986	1974–1983	Pavia, Northern Italy	363	170:193	Case number/period	• 108 cases/trimester • Summer Months (July, August, September)
Törnquist et al[22]	1987	1971–1981	Orebro, Sweden	590	275:315	1. Annual incidence per 100,00 of RRD in population 2. Cases/month	None
Al Samarrai[23]	1990	1981–1987	Kuwait City, Kuwait	266 eyes (259 patients)	Not specified	Cases/month	• 32 cases/month—November, • 28 cases/month—December, • 29 cases/month—January & February • Winter Months
Ivanisević et al[24]	2002	1988–1999	Split, Croatia	307 eyes (299 patients)	Not specified	Cases/season	None
Li et al[9]	2003	1999–2000	Beijing and nearby suburbs, People's Republic of China	519	296:223	Annual incidence rate (number of new patients divided by target population counts)	None
Mansour et al[25]	2009	1993–2006	Beirut, Lebanon	211	158:53	Cases/month	• 62 cases—Spring & 57 cases—Summer • Warm seasons (spring and summer)

(*Continued*)

Table 1 (Continued).

Authors	Year of Pub	Data Collection Window	Location (City/ Country)	Sample Size	Sex Ratio (M:F)	Incidence Rate/Other Measures	Key Findings (Include Annual Incidence Rate)
Lin et al[19]	2011	1999–2009	Taiwan	23,718	14,415:9303	Proportion of monthly admissions for RD as a fraction of Taiwan's total population	• The mean of monthly RD incidence rates/100,000 population for the trimester is around 0.1 • August through October (summer and early autumn)
Prabhu and Raju[16]	2016	2012–2014	Kerala, India	76	57:19	Cases/season	• 29 cases in trimester • Summer months* (March, April, May)
Auger et al[26]	2017	2006–2013	Quebec, Canada	14,302	8411:5891	Cases/period**	None
Manners et al[27]	2017	2000–2013	Western Australia	4376	2790:1586	Cases/period***	None
Torrado et al[28]	2019	2008–2014	Pontevedra, north-western Spain	256	Not specified	Cases/month	1. 25 cases/month—June & 25 cases/month—July 2. End of spring and Summer (June-July)
Edröl et al[29]	2019	2011–2018	Eastern Black Sea Region, Turkey	276	159:117	Cases/period	None
Choo et al[30]	2021	2014–2017	Korea	39,410 cases (32,088 patients)	17777:14311	Cases/month	• 3,495 cases/month • Spring (March)
Iida et al[31]	2021	2015–2019	Kashiwa, Japan	571 eyes (543 patients)	358:185	1. Eyes per month 2. Eyes per season	None
Ghezala et al[32]	2021	2010–2016	France	101 085	61,662:39423	Average monthly age-standardised and sex-standardised national RRD hospital incidence rate	• 2.03 ± 0.12 per 100000 population —June • 1.99 ± 0.17 per 100000 population —July • Summer months (June–July)
Saraf et al[33]	2022	2014–2018	USA	237 646	140,939:95,398	Cases/100,000	None

Notes: * Seasons were defined as follows: Summer—March–May, Monsoon—June–August, Autumn—September–November, and Winter—December–February. ** Period is defined as number of days with maximum daily temperature ≥30 °C in the preceding week. ***Period is defined as seasons. The seasons were classified as follows: winter—December, January and February; Spring—March, April and May; Summer—June, July and August and Autumn—September, October and November.

Characteristics of Included Studies

Geographic Scope

This review analyzed 18 studies, revealing a predominant focus on the regional or city-level impact of RD and its seasonal variations. Notably, only four studies—by Ghezala et al, Saraf et al, Choo et al, and Lin et al—expanded their scope to encompass entire countries.[19,30,32,33]

Geographic distribution of the included studies spans several continents: Asia (5, 28%), Europe (4, 22%), and Scandinavia & Northern Europe (3, 17%); the remaining 33% consist of North America (2), the Middle East (2), Eurasia (1), and Australia (1), showcasing a diverse range of environmental contexts.

Study Design

Among the included studies, nine were retrospective chart reviews, the most common design. Paavola et al and Törnquist et al, respectively, identified their studies as a comparative study and a population-based series.[15,22] Recent trends show a preference for nationwide models, as demonstrated by Ghezala et al, Lin et al, and Saraf et al, all utilizing some sort of nationwide database designs.[19,32,33] Auger et al introduced a multicenter case-crossover study, while Manners et al performed a whole-population retrospective observational study.[26,27] Notably, only one study, by Li et al, employed a prospective approach, conducting a population-based incidence study to assess incidence rates and associations.[9]

Patient Demographic

The analysis of patient demographics revealed a general trend in age distribution, with most studies reporting a mean age between 50 and 60 years, which is expected considering the pathophysiology of RD. An outlier was noted in the study by Al Samarrai, which reported a mean age of 41.1 years in Kuwait—the lowest among the studies reviewed.[23] Regarding gender distribution, males were more frequently associated with RD in 11 studies. This male predominance contrasts with findings from the 1980s, where every study, except for the one conducted in the Novosibirsk region by Paavola et al identified females as the demographic more likely to develop RD.[15] The remaining three studies did not report sex ratios in their results.

Incidence Estimate

In the reviewed studies, the prevalent approach for estimating the incidence of RRD involved quantifying the number of cases within specified time intervals, including months, trimesters, seasons, or other predetermined periods. On the contrary, a minority of studies—namely those conducted by Ghezala et al, Lin et al, and Li et al—adopted a method of calculating incidence rates as the proportion of cases relative to the sample size against a broader population metric.[9,19,32]

Seasonality Findings of Included Studies

In the evaluation of the 18 selected studies, seven identified a statistically significant correlation of RRD incidence during the summer, with some noting overlapping periods extending into spring and fall, as detailed in Table 1. Remarkably, only one study, by Choo et al, discovered a statistically significant association specifically in spring, in the month of March.[30] Similarly, the research conducted by Al Samarrai highlighted a significant association during the winter[23] Unique in its approach, the study by Prabhu & Raju designated the summer season as spanning March through May, within which they found a significant association.[16] Conversely, eight studies reported no significant association between weather conditions and the incidence of RRD.

Additional Findings of Included Studies

Some of the included studies explored beyond primary objectives and set a range of secondary aims, notably investigating the potential impact of meteorological factors—such as ambient temperature, atmospheric pressure, daylight hours, humidity, and precipitation—on the incidence of RRD. However, these studies presented conflicting results regarding the association between RRD incidence and these environmental variables. For example, Ghisolfi et al identified a positive correlation between light flux and RRD incidence, suggesting that increased exposure to light could elevate the risk of RRD.[17] Contrarily, Choo et al observed a bimodal distribution of RRD incidence in relation to daylight hours, indicating peaks during specific times of the year.[30] Meanwhile, Al Samarrai reported an inverse relationship, with lower RRD incidence associated with longer daylight hours, highlighting the complex and conflicting nature of these relationships.[23] However, one meteorological factor has been observed to have an inverse relationship with RRD incidence: atmospheric pressure. Lin et al and Iida et al have found that low atmospheric pressure was associated with increased cases of RRD.[19,31]

Despite the varied findings on meteorological influences, several studies affirmed well-established risk factors for RRD. High myopia and advanced age were consistently linked with an increased risk of developing RRD, echoing findings from earlier pathophysiological research (insert citations). An interesting association was reported by Choo et al, who found that patients with atopic dermatitis exhibited the highest prevalence of RRD during the summer and the lowest during the fall—a pattern that diverges from the general population trend reported in their study, which typically peaks in spring.[30]

This exploration of secondary study objectives underscores the intricate interplay between environmental factors and RRD incidence. As of yet, no single meteorological factor has emerged as a consistently significant predictor across multiple studies, suggesting the need for further research to unravel these complex associations and potentially integrate environmental considerations into RRD risk assessment and prevention strategies.

Discussion

The primary objective of this study was to identify the relationship between RRD and climate or other seasonal factors by performing a comprehensive analysis of relevant literature. This study provides additional insight into the current state of knowledge by including a detailed investigation of more recent studies. By providing this insight into the relationship between RRD and climate, novel and improved interventions may be developed to specifically cater to RRD patients with relevant risk factors.

Seasonality and RRD

The major significant finding of this project relates to the significance of the relationship between climate and RRD incidence. Since the study conducted by Qassim et al, there have been eight additional studies conducted on a global scale regarding the intersection of RRD and climate, which is double the amount of literature included in the previous review.[20] While it was previously found that the predominant season associated with RRD was the summer, our analysis found no statistically significant association between season and RRD incidence. Yet, due to the limited studies available for evaluation and the closeness of significant vs non-significant results, it is apparent that more studies must be conducted in order to more accurately assess this relationship.

Another important consideration for the findings is the seasonality of PVD. It could be argued that seasonality of PVD is a major finding as the majority of RRD cases are preceded by PVD.[34] Such a study was conducted by Rahman et al based on 567 cases of RRD over a 2 years period. They found a highly significant correlation between weekly average temperatures and the incidence of PVD.[35] In the studies included in this review, all of them acknowledged PVD as a risk factor and consideration for development of RRD; however, only Saraf et al looked at PVD cases as a separate variable.[33] The findings did not show any significant increase with any season. Future studies could focus on PVD as a separate variable to assess the seasonality of RRD due to the clear temporal and pathophysiological relationship between these two conditions.

Other Findings

In addition to the relationship between season and RRD incidence, many of the included studies also reaffirmed known risk factors for RRD, including myopia and advanced age. Such associations are not novel as the pathophysiologic pathway is known to connect the risk factors with RRD development. In particular, myopic eyes, specifically at a high stage, have an increased posterior segment volume, which creates traction of the vitreous gel on the retina.[13] Increased axial length of the eye further increases the risk of PVD and subsequent RRD. Aging affects RRD likely via progressive age-related degeneration of vitreous and as a general consequence of PVD. Finally, the male sex appears to be associated with an increased risk of RRD, as seen in all but one study included in this review. One theoretical explanation for this phenomenon is that males typically have longer ocular axial length.[36]

However, this finding may be due to a physiological or even behavioral pattern as well, requiring additional research.

Other significant findings regarding the relationship between meteorological factors such as light flux and daylight hours and RRD incidence varied among studies. One factor, atmospheric pressure, was found to have a negative correlation with the incidence of RRD.[19,31] While several studies found statistically significant associations between meteorological parameters and RRD incidence, conflicting data among the few studies present create a challenge to establishing any clear consensus.

State of Prevention Guidelines and Interventions

Current research has identified that although RRD is unpreventable, there are certain steps that are recommended to lower individuals' risks. It is advised for individuals to ensure compliance with regular eye exam recommendations, especially in individuals with nearsightedness, as myopia is a major risk factor for RRD.[37–40] Furthermore, current recommendations advise that maintenance of overall health and well-being as well as utilization of ocular safety equipment when participating in risky activities.[40,41] However, the most important risk factor in developing RRD still appears to be related to age.[42] Therefore, the measures mentioned above are even more important to follow for patients over the age of 50 years old.

However, there are minimal preventative interventional strategies currently in place due to the sudden and typically unpreventable nature of RRD, especially in populations where climate may predispose them to RRD. Interventions for RRD are primarily aimed at treating RRD efficiently after the onset, with treatment options including scleral buckle, vitrectomy, or laser photocoagulation.[5,43,44] Many studies propose that improving patient education in at-risk individuals, especially children, may be the most valuable intervention in reducing RRD occurrence and burden.[45–47] Developing and refining interventions such as improving patient education accessibility on an individualized or community-level basis, as well as continuing research regarding optimal treatment techniques, may improve patient outcomes in RRD, especially in geographic regions that may be exceptionally vulnerable due to climate-based risk factors.

Biases and Limitations

Study Design

The studies conducted so far on this topic have been predominantly of retrospective chart review style. In fact, only one study conducted a prospective study. Although there are disadvantages with retrospective design, it is a common choice due to its relatively inexpensive cost and ease. Regardless of the study design, there are several biases that must be considered by studies to provide stronger correlations. The list of such biases/limitations is presented in Table 2.

One particularly common limitation of studies in this review was the insufficient approach to account for population fluctuations and seasonal changes in patient numbers. It is not uncommon for patients to travel more during different months and seasons. Patients can also refer to other sites of care, if the study conducted does not include all of the major points of care in their location. Additionally, variation in physician availability is another factor that may impact the number of patients seen per month. Due to these reasons, studies could account for this significant confounding factor in either of the two ways:

A. Conducting a study in a location that is served only by one site or multiple sites that are included in the chart review while also accounting for changes in population number.
B. Estimating the number of overall patients seen for ophthalmological issues in the site/multiple sites and calculating corresponding incidence rate of RRD among this population.

Another limitation that was observed in the included studies is the lack of data to exclude non-rhegmatogenous cases of RD. This serves particular importance as ocular trauma is a risk factor for developing traumatic RD and also RRD.[48–53] Considering that any population is more likely to engage in sport activities or other forms of recreation during mild and

Table 2 Table Summarizing Common Limitations

Authors	Summary of Limitations
Paavola et al[15]	• All types of RD considered including idiopathic retinal detachment and traumatic RD • No incidence ratio account for changes in population
Laatikainen et al[21]	• No significant limitations
Ghisolfi et al[17]	• Single site —could lose patients presenting to other points of care • No incidence ratio account for changes in population
Törnquist et al[22]	• No significant limitations
Al Samarrai[23]	• All types of RD considered • No incidence ratio account for changes in population
Ivanisević et al[24]	• No significant limitations
Li et al[9]	• No significant limitations
Mansour et al[25]	• Single site—could lose patients presenting to other points of care • No incidence ratio account for changes in population • Study design accounts for warm seasons (April until September) and the cold season (October–March); however, no assessment of individual months of the seasons*
Lin et al[19]	• All types of RD considered* • Nationwide study—large variation in temperature between regions
Prabhu and Raju[16]	• No incidence ratio account for changes in population
Auger et al[26]	• No significant limitations
Manners et al[27]	• All types of RD considered* • Statewide study—large variation in temperature between regions
Torrado et al[28]	• No significant limitations
Edröl et al[29]	• Single site—could lose patients presenting to other points of care* • No incidence ratio account for changes in population
Choo et al[30]	• Included re-detachment cases* • Nationwide study—large variation in temperature between regions
Iida et al[31]	• Included re-detachment cases • No incidence ratio account for changes in population • Single site —could lose patients presenting to other points of care
Ghezala et al[32]	• No significant limitations • Nationwide/regional study—large variation in temperature in the same region
Saraf et al[33]	• Data collection relies on billing codes to assess seasonality— findings likely biased toward office-based care* • Nationwide study—large variation in temperature between regions

warm weather, traumatic RD cases could cause a rise in seasonal incidence of RD without clear association with the meteorological factors.

Geographic Area and Weather

An important consideration for limitations is the area where the study aims to find associations. Although it is certainly beneficial to collect data from various geographical locations, one interesting pattern was seen in this review: there are only two studies conducted in extreme weather conditions, *Törnquist* et al and *Al Samarrai*. Most studies included in the review report data from locations with mild temperatures. The importance of this observation lies behind the hypothesis of these studies. If seasonal association between ambient temperature and incidence of RRD is present, it must display a stronger association with weather conditions that display extreme temperature. In other words, if a study is done in a hot climate, it would be logical to expect a stronger case for incidence of RRD in summer while if the climate is in extreme cold range, it would be expected that such association would fade. Additionally, such study location would likely limit the impact of recreational changes that occur in warm weather increasing risk of ocular trauma. In our review, only one study, Al Samarrai was conducted in a hot climate that can be considered as extreme weather. However, there were several limitations decreasing the strength of findings of this study. On the other end of the weather spectrum, Törnquist et al considered data from subarctic climate, which found no significant associations with weather and RRD.

Another important consideration is the scope of studies. In this review, there are four studies that consider nationwide data and one study that considers Western Australia as a state. The limitation of such study lies in the significance of the climatic range seen in these countries. Ghezala et al did include a regional breakdown of the incidence of RRD to account for this; however, as an overall design including nationwide data is a potential bias due to unpredicted changes in climate in different regions of the country or even within the regions.

Future Directions

This comprehensive review involved 18 studies ranging from 1975 to 2018. Additional studies are needed to further examine the relationship between season and RRD incidence. An important factor to consider for future research is the climate in their specific geographic area. In this review, there is only one study, Al Samarrai, that collected data from a location with extreme heat and relatively mild winter. More studies could be done in extreme weather conditions to find a stronger association of incidence of RRD with ambient temperature or season. Additionally, more studies should be done in areas with large temperature fluctuations between seasons in order to explore the impact of weather variations on incidence of RRD.

In addition to season, future studies can also investigate the relationship between RRD incidence and other specific variables such as light flux, temperature, atmospheric pressure, humidity, precipitation, and other weather conditions. It is possible that these variables have varying effects on the incidence of RRD. These are potential confounding variables when analyzing the impact of climate and RRD, thus it is essential to investigate these factors separately to determine the most accurate assessment of risk factors for RRD.

Finally, future studies should include multi-institutional studies within a specific geographic area in order to limit confounding variables. The studies that were included varied greatly in climate, so it is difficult to pinpoint exactly what weather conditions influence the incidence of RRD. As multi-institutional studies are costly and difficult to conduct, one possible direction employed by studies in our review is incidence estimation to account for possible patient loss to other care points in the geographic area. In our review, the studies that did utilize such methods successfully limited confounding factors associated with such study design. Therefore, more studies could utilize this approach and provide a better estimation of the actual incidence of RRD.

Conclusion

This comprehensive review examines the relationship between seasonality and the incidence of RRD. A total of 18 primary studies were reviewed from a wide variety of geographic regions. While several included studies found a significant correlation between summer and RRD incidence, the results varied and overall there was no significant relationship between seasonality and RRD incidence. This could possibly be due to the lack of studies done in areas with extreme seasonal temperature fluctuations, one of the proposed hypotheses for seasonal RRD. Additionally, individual meteorological parameters such as UV index may play a role in RRD incidence independent from season, so it is critical to control for this as well as other confounding factors when examining the relationship between seasonality and RRD incidence. Since RRD is a critical ophthalmic emergency with detrimental effects if left untreated, it is crucial to continue to investigate and collect data on meteorological risk factors in order to protect patients living in potentially at risk climates.

Disclosure

The authors report no conflicts of interest in this work.

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