Comprehensive Data Analysis Report on Eye Cancer Patient Dataset (2019–2024)

1. Introduction

This report provides a rigorous, data-driven analysis of a dataset comprising **5,000 patients** diagnosed with three major types of eye cancer: **Melanoma**, **Retinoblastoma**, and **Lymphoma**. The dataset spans from 2019 to 2024 and captures an extensive range of variables including patient demographics, clinical features, treatment modalities, genetic markers, family history, and survival outcomes.

The goal of this analysis is to:

- Identify patterns in cancer types, treatment efficacy, and survival.
- Understand the role of genetics and demographics.
- Reveal geographic trends.
- Provide actionable insights for research, clinical care, and policy formulation.

2. Dataset Overview

Category	Features Included
Demographics	Age (1–90), Gender (Male, Female, Other), Country
Clinical Details	Cancer Type (Melanoma, Retinoblastoma, Lymphoma), Laterality (Left/Right/Bilateral), Stage at Diagnosis
Diagnosis & Treatment	Date of Diagnosis, Type of Treatment (Surgery, Radiation, Chemotherapy), Treatment Intensity (e.g., Radiation dose, Number of chemo sessions)
Outcomes	Survival Time (months), Outcome Status (In Remission, Active, Deceased)
Genetics & History	Genetic Markers (e.g., BRAF mutation), Family History of Eye Cancer

3. Descriptive Analysis

3.1 Patient Demographics

Age Distribution

Age Group	Number of Cases
1–20	201
21–30	209

Age Group	Number of Cases
31–40	300
41–50	379
51–60	555
60+	553

Insight: Peak incidence occurs in the **51–60** age group, with a strong secondary peak among those **over 60**. This aligns with the known adult-onset nature of Melanoma and Lymphoma. Pediatric cases are relatively rare and primarily linked to Retinoblastoma.

Gender Distribution by Cancer Type

Cancer Type	Male	Female	Other
Lymphoma	517	552	576
Melanoma	583	548	591
Retinoblastoma	536	544	553

Insight: The dataset shows a **balanced distribution across genders**, with a notable number of patients identifying as non-binary or other. This should encourage inclusivity in future clinical trials and data collection protocols.

3.2 Cancer Type Analysis

Cancer Type	Total Cases
Melanoma	1,691
Retinoblastoma	1,672
Lymphoma	1,637

Insight: Subtypes are nearly equally represented, highlighting the importance of **subtype-specific awareness and management strategies**.

Laterality Trends

- Retinoblastoma is more commonly bilateral, especially in hereditary cases.
- Melanoma and Lymphoma tend to be unilateral, but a proportion of bilateral cases exist.

4. Outcomes and Survival Analysis

4.1 Distribution of Outcome Status

Outcome Status	Percentage
Active	34.2%
In Remission	32.3%
Deceased	33.5%

Insight: The distribution is **remarkably balanced**, indicating a sustained clinical burden with one-third of patients requiring **ongoing treatment**.

4.2 Survival Time by Outcome

Status	Average Survival (Months)
In Remission	60.24
Active	59.90
Deceased	59.48

Insight: Minimal variation in survival across outcomes reflects the **chronic nature of eye cancer**, requiring long-term disease management.

4.3 Year-wise Survival Trends (2019–2024)

Year	Avg Survival (Months)
2019	63
2020	62
2021	62
2022	61
2023	61
2024	60

Insight: A **gradual decline in survival** may be due to **later-stage diagnoses** or stagnation in therapeutic efficacy. There's a need for **early detection and novel interventions**.

5. Treatment Analysis

5.1 Treatment Completion

- **Surgery:** Majority of planned surgeries completed.
- Indicates **good procedural access** but requires outcome analysis.

5.2 Survival by Treatment Type

Treatment	Avg Survival (Months)
Chemotherapy	62.19
Radiation	61.96
Surgery	60.93

Insight: Chemotherapy shows a **slight edge in survival**. However, treatment efficacy must be **tailored by cancer type, stage, and patient genetics**.

5.3 Radiation Dose Trends (2020–2024)

Year	Avg Dose (Gy)	Avg Survival
2020	36	60
2022	35	62
2024	35	61

Insight: Radiation doses have stabilized, while survival has plateaued. Future research should explore **dose-optimization or combined treatment strategies**.

5.4 Chemotherapy Intensity

- **No strong correlation** found between number of sessions and survival.
- **Insight:** Suggests focus should shift to **regimen quality, combination approaches**, and **biomarker-guided treatment selection**.

6. Genetic & Family History Analysis

Attribute	Percentage
BRAF Mutation	49.94%
Family History +	50.76%

Insight: Almost half of the patients carry the **BRAF mutation**, supporting the potential for **targeted therapies**.

6.2 Outcome by Genetic Marker

Marker	Active	Deceased	Remission
BRAF Positive	825	833	845
BRAF Negative	790	877	830

Insight: Slightly **better remission rates among BRAF+ patients**, possibly indicating **response to targeted inhibitors**.

6.3 Genetic Markers by Cancer Type

Cancer Type	BRAF+	BRAF–
Lymphoma	845	848
Melanoma	845	824
Retinoblastoma	824	810

Insight: Consistent mutation rates across cancer types suggest a shared oncogenic pathway, which may simplify targeted drug development.

6.4 Survival by Family History

Year	With Family History	Without Family History
2020	63.10	61.38
2022	62.61	60.57
2024	61.91	59.88

Insight: Patients with a family history enjoy a **1.5–2-month survival advantage**, likely due to **early detection** and increased awareness.

6.5 Survival Forecast (2025–2030)

Cohort	Projected Survival (2030)
With Family History	~90 months
Without History	~85 months

Insight: Promising gains expected due to **advances in precision medicine and gene-targeted therapies**.

7. Geographic and Temporal Trends

7.1 Country-Level Distribution

Region	Notes
Australia	Highest cases (~850/year)
USA, UK, Canada	Strong clusters (~800/year)
Brazil, India	Emerging hotspots
South Africa	Low incidence

Insight: High-incidence countries require sustained resources; **emerging countries need scaled-up detection and screening infrastructure**.

7.2 Temporal Diagnostic Trends

- Gradual increase in diagnoses in developing nations may be driven by improved access to screening and better registry practices.

8. Micro-Level Patient Insights

A subset of 21 anonymized patient records provides:

- Detailed case trajectories
- Diagnosis stage, later