

Cancer Date Analysis

TREATMENT AND SURVIVAL ANALYSIS

Justin Lee / 5th FEB 2025

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A G E N D A

- Project Overview
- Key Objectives
- Key Features
- Tech Stack
- End Users
- Key Data Columns
- Data Visualization & Analysis

KEY OBJECTIVES

Extract valuable insights through in-depth analysis of cancer datasets

Enhance data exploration, visualization, and interpretation skills

Provide data-driven recommendations for improving healthcare strategies

KEY FEATURES

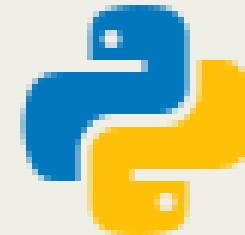
Import cancer datasets into a PostgreSQL database

Identify specific use cases and provide actionable insights

Perform data exploration and visualization

Compile comprehensive analysis reports

TECH STACK



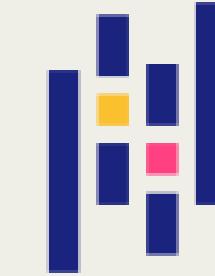
PYTHON



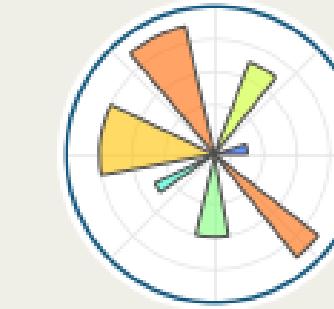
PostgreSQL



Jupyter
Notebook



pandas



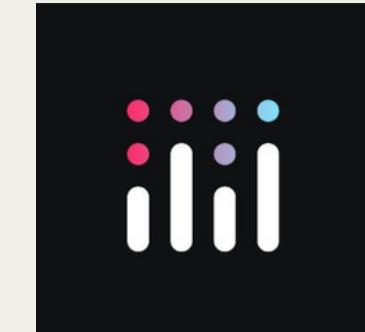
Matplotlib



Seaborn



Scikit-learn



Plotly

END USERS

- **Healthcare Professionals:** Optimize treatment regimens
- **Administrators:** Develop hospital and healthcare management strategies
- **Policy Makers:** Establish medical policies and patient care guidelines

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KEY OBJECTIVES

Core Variables (Existing Data)

Core Variables	Description
encore_patient_id	Unique patient identifier
merged_regimen_id	Treatment regimen ID (non-duplicate)
intent_of_treatment	Purpose of treatment (curative vs palliative)
date_decision_to_treat	Date of treatment decision
start_date_of_regimen	Treatment start date
mapped_regimen	Assigned treatment regimen
clinical_trial	Participation in clinical trials (Yes/No)
chemo_radiation	Chemotherapy/Radiation therapy indicator
benchmark_group	Comparison group
link_number	Internal linkage ID for hospitals or research institutions
patientid	Unique patient identifier
vitalstatus	Survival status
vitalstatusdate	Last updated survival status date
age	Patient's age
site_icd10_o2_3char	Cancer type (ICD-10 code)
stage_best	Cancer staging information
comorbidities_27_03	Comorbidities (pre-existing conditions)
seq_var	Genetic mutation information
follow_up_time	Time since treatment start

Computed Variables(New Data)

Computed Variables	Description
duration	Survival duration (calculated based on follow-up period)
event_mapped	Mortality indicator (1=Deceased, 0=Survived, -1=Unknown)
previous_regimen	Previous treatment regimen
modification_reason	Reason for treatment modification
standardized_regimen	Normalized regimen using clinical taxonomy

1. OVERALL TREATMENT SUCCESS ANALYSIS

[Chart Type]

- Bar Chart
- Stacked Bar Chart (Supplementary)

[Variables to Use]

- standardized_regimen (Treatment Regimen)
- event_mapped (Mortality status: 1 = death, 0 = survival, -1 = unknown)
- duration (Survival Duration)
- intent_of_treatment (Treatment Goal: Curative vs Palliative)
- clinical_trial (Clinical Trial Participation)

[Why This Chart is Needed]

- Compare success rates of different treatment regimens to identify the most optimal regimen.
- Analyze the difference between curative vs palliative treatments.
- Assess how participation in clinical trials impacts survival rates.
- Help hospitals and policymakers optimize treatment strategies.

[Key Insights]

- "Which treatment regimen currently used shows the highest survival rate?"
- "How does the success rate differ between curative and palliative treatments?"
- "How much does participation in clinical trials increase patient survival?"

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1. OVERALL TREATMENT SUCCESS ANALYSIS

Based on the results from the event_mapped column, it can be seen that the distribution of 'survival' and 'death' is well-balanced. However, certain treatments, such as "Chemotherapy::Chemo+T Trial," have an extremely small number of 'survival' cases – only 1 in this case. This issue arises when some treatments have very few 'survival' cases, while 'death' cases are more abundant, leading to a 100% success rate. This skewed outcome typically occurs with treatments where the 'survival' count is too low compared to the 'death' count.

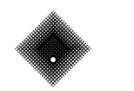
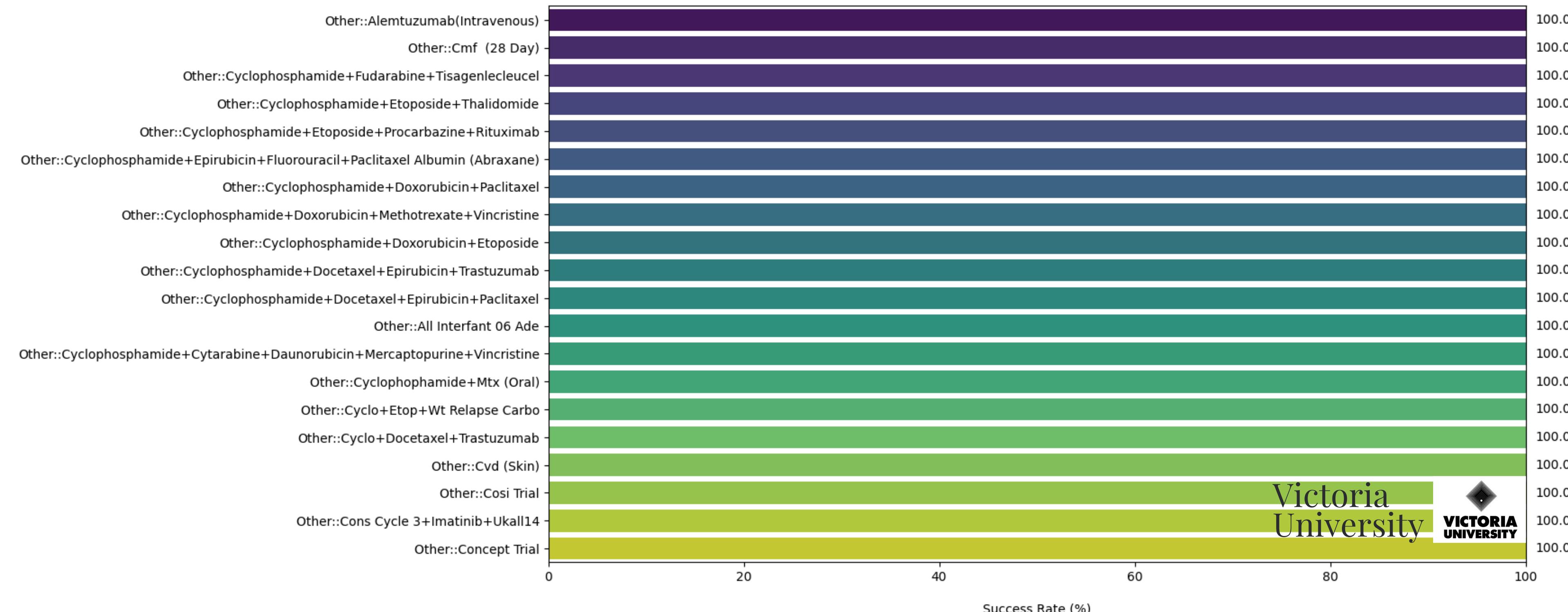
Block 1. Top 20 Treatment Success Rates

Block 2. Middle 20 Treatment Success Rates

Block 3. Bottom 20 Treatment Success Rates

1-1. TOP 20 TREATMENT SUCCESS RATES

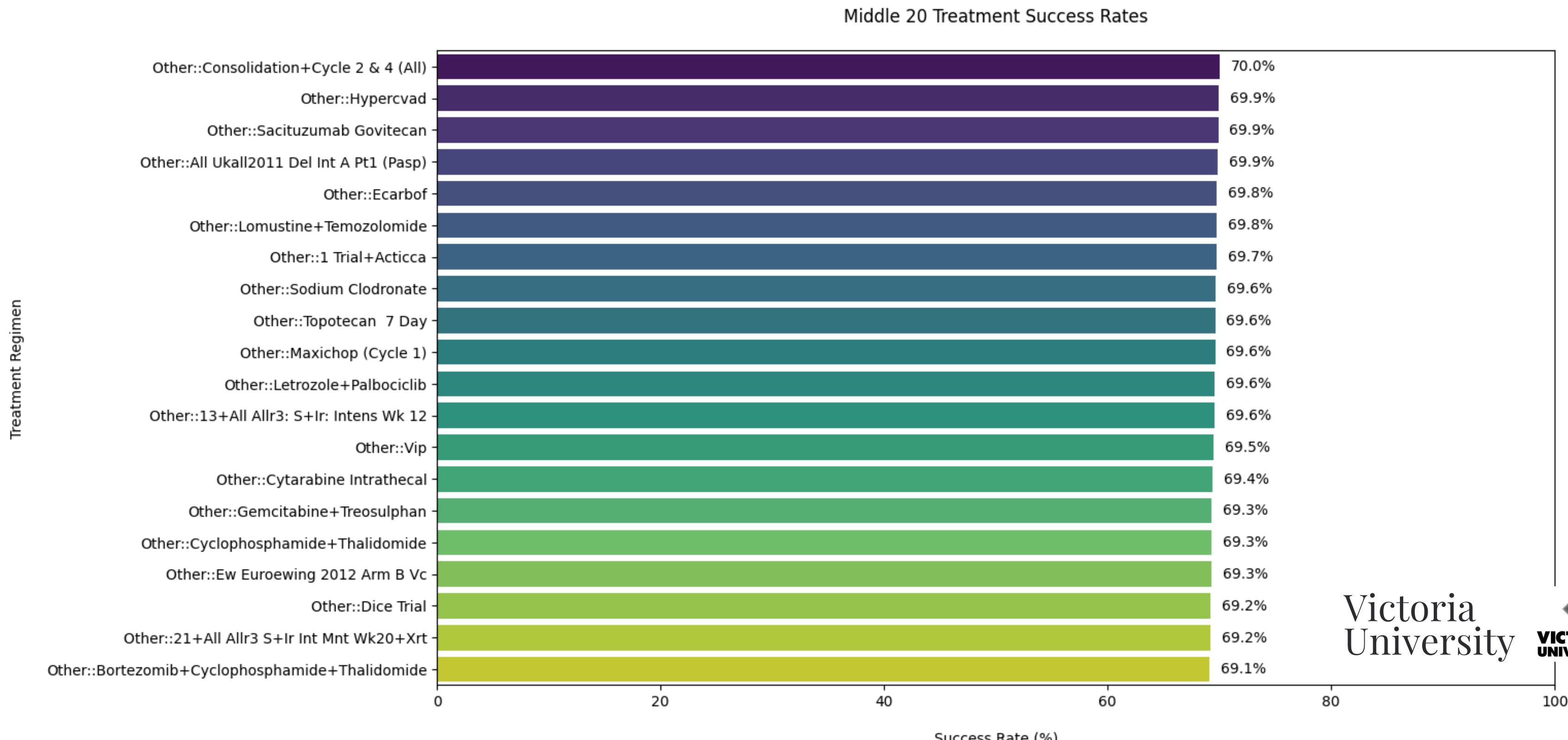
Top 20 Treatment Success Rates



1-1. TOP 20 TREATMENT SUCCESS RATES

The treatments in the Top 20 category show extremely high survival rates, with several reaching 100%. This indicates that these treatment regimens are very effective in achieving survival for the patients undergoing them. However, this also implies that the data for these treatments could be limited or heavily skewed towards 'survival' outcomes.

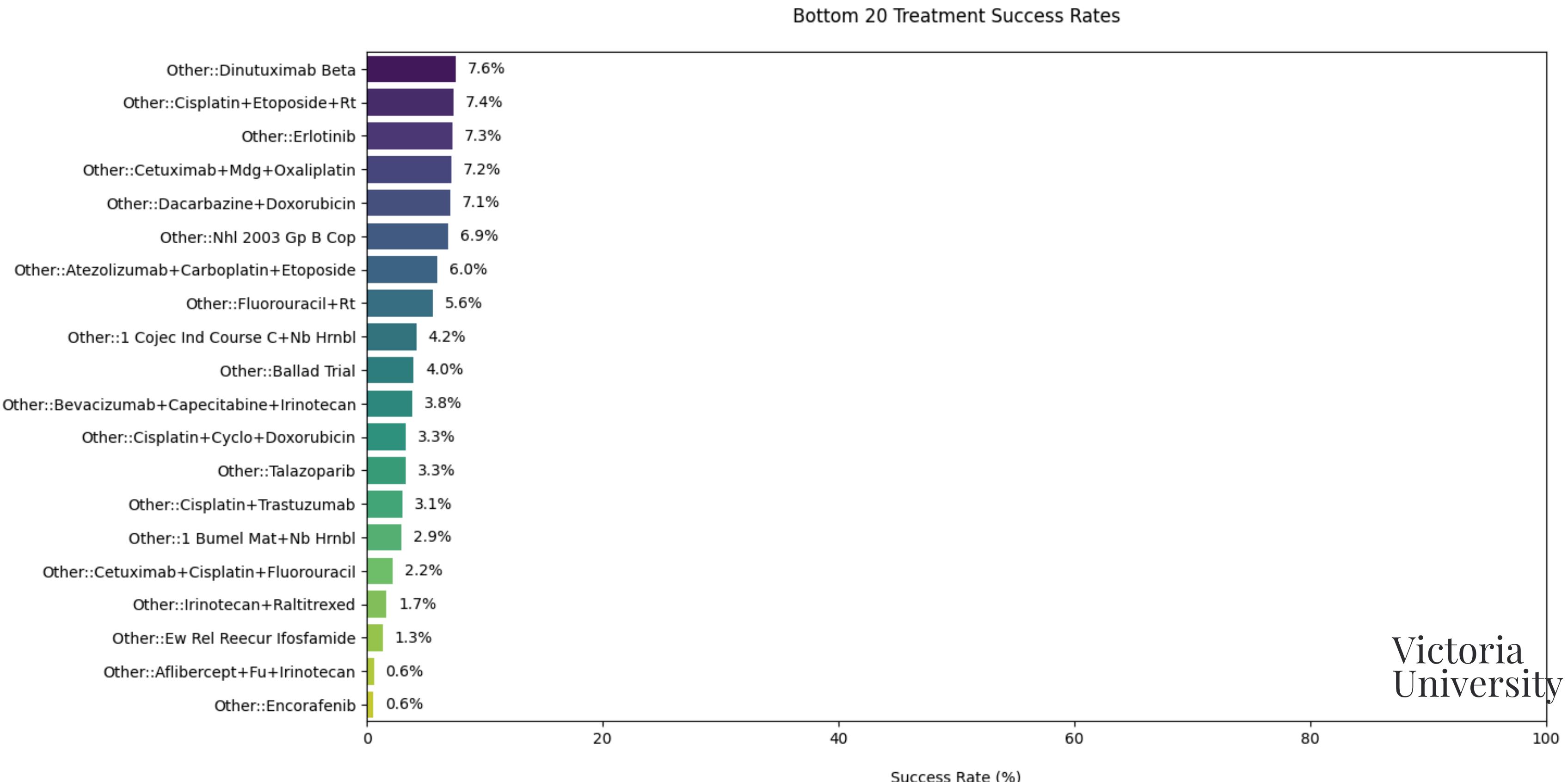
1 - 2. MIDDLE 20 TREATMENT SUCCESS RATES



1-2. MIDDLE 20 TREATMENT SUCCESS RATES

The Middle 20 treatments exhibit success rates ranging between 69% and 70%. These treatments are likely to be more commonly used and include a broader range of survival outcomes, including both positive and negative results. The difference in success rates highlights that while these treatments are still relatively effective, they may not perform as consistently as the top treatments.

1 - 3. BOTTOM 20 TREATMENT SUCCESS RATES



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1-3. BOTTOM 20 TREATMENT SUCCESS RATES

The Bottom 20 treatments have much lower success rates, ranging from 7% to 0.6%. These regimens are associated with significantly poorer survival outcomes. In particular, the low success rates for treatments like "Encorafenib" and "Afibercept" suggest that these treatments may not be the most effective options available.

Conclusions:

1. Effectiveness of Treatment Regimens: Some treatment regimens show excellent survival rates, especially in the Top 20 group. However, regimens with lower success rates should be reconsidered or modified to improve outcomes.
2. Consideration for Curative vs. Palliative Treatments: Based on the data, there may be a need to further analyze how curative treatments (aiming for full recovery) compare to palliative treatments (aiming to alleviate symptoms but not cure the illness). The effectiveness of palliative treatments could influence the decision-making process for patients with terminal conditions.
3. Clinical Trial Participation: The data suggests that clinical trial participation could be beneficial, as treatments used in clinical trials often result in improved outcomes. It is essential to continue monitoring how treatments from clinical trials compare to those not in trials to refine medical strategies and improve patient survival rates.
4. Recommendations for Hospitals and Policymakers:
 - Focus on expanding the use of highly effective treatments, especially those within the Top 20 group.
 - Investigate treatments in the Middle and Bottom 20 groups to understand their limitations and identify opportunities for improvement.
 - Encourage participation in clinical trials to explore innovative treatments and ensure that patients have access to the most promising options.

2 TREATMENT SUCCESS RATE BY CANCER TYPE

[Chart Type]

 Heatmap

[Variables to Use]

- site_icd10_o2_3char (Cancer Type)
- standardized_regimen (Treatment Regimen)
- event_mapped (Mortality status: 1 = death, 0 = survival, -1 = unknown)
- duration (Survival Duration)

[Why This Chart is Needed]

-  Identify suitable treatment regimens for specific cancer types.
-  Visually represent survival differences across cancer types for tailored treatment plans.
-  Assist hospitals and research institutions in studying effective treatments for specific cancers.

[Key Insights]

- "Does success rate differ across cancer types for the same treatment regimen?"
- "Could a treatment that works for one cancer type perform poorly for another?"

2 TREATMENT SUCCESS RATE BY CANCER TYPE

Currently, the heatmap is overcrowded, making it difficult to interpret key insights. By splitting the chart into multiple focused visualizations, we can enhance clarity, readability, and insight extraction.

📌 **Split the Heatmap by Treatment Regimen Groups**

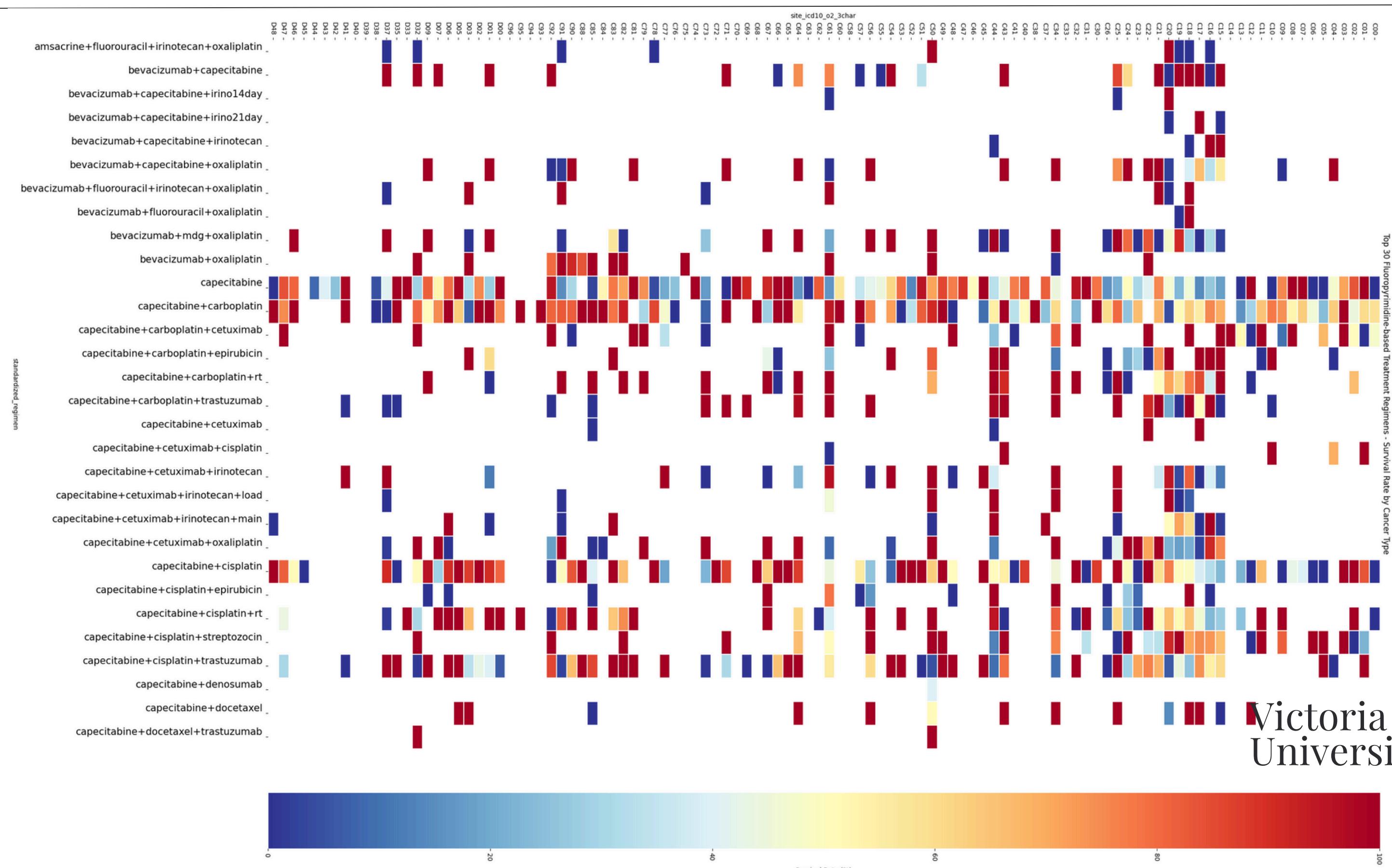
- Block 1. Top 30 Fluoropyrimidine-based Treatment Regimens
- Block 2. Top 30 Immunotherapy-based Treatment Regimens
- Block 3. Lymphoma Regimens Treatment Regimens
- Block 4. Hormonal Therapy Treatment Regimens
- Block 5. Targeted Therapy

📌 **Focus on the Top 10 Most Common Treatment Regimens**

📌 **Separate Heatmaps by Cancer Type**

- Block 1. Top 30 Treatment Regimens - Survival Rate by Lung Cancer
- Block 2. Top 30 Treatment Regimens - Survival Rate by Colorectal Cancer
- Block 3. Top 30 Treatment Regimens - Survival Rate by Breast Cancer
- Block 4. Top 30 Treatment Regimens - Survival Rate by Lymphoma & Leukemia

2-1-1 TOP 30 FLUOROPYRIMIDINE-BASED TREATMENT REGIMENS



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2-1-1 TOP 30 FLUOROPYRIMIDINE-BASED TREATMENT REGIMENS

Summary of the Fluoropyrimidine-based Treatment Regimens Heatmap

1 Wide Variation in Survival Rates Across Cancer Types

- Some treatment regimens show high survival rates (>80%) in specific cancer types but perform poorly (<40%) in others.
- This indicates that fluoropyrimidine-based regimens are highly cancer-type dependent.

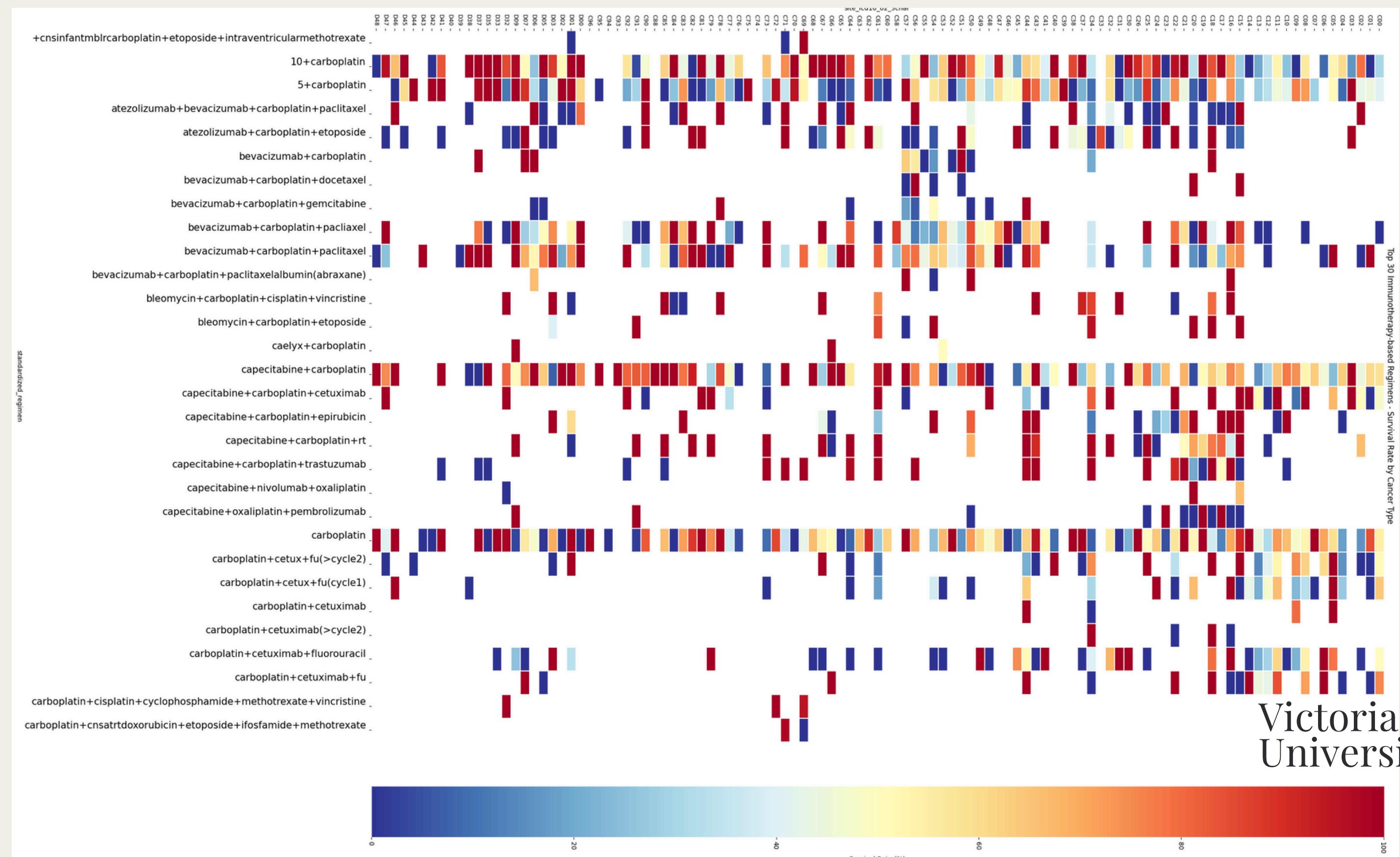
2 Certain Regimens Show Consistently High Survival Rates

- Treatments like Capecitabine + Oxaliplatin and Bevacizumab + Fluorouracil show strong results across multiple cancers.
- These could be considered more universally effective options within this regimen category.

3 Distinct Patterns for Gastrointestinal Cancers

- High survival rates are observed for colorectal and stomach cancers, aligning with the frequent use of fluoropyrimidine-based regimens in these cancers.
- However, their effectiveness in lung cancer and lymphomas is limited, suggesting a need for combination therapies.

2-1-2 TOP 30 IMMUNOTHERAPY-BASED TREATMENT REGIMENS



2-1-2 TOP 30 IMMUNOTHERAPY-BASED TREATMENT REGIMENS

Summary of the Immunotherapy-based Treatment Regimens Heatmap

1 Highly Effective for Certain Cancer Types

- Pembrolizumab + Carboplatin and Nivolumab + Ipilimumab show excellent survival rates (>80%) in lung cancer and melanoma.
- However, their effectiveness is significantly lower in colorectal cancer, suggesting cancer-type specificity for immunotherapy regimens.
-

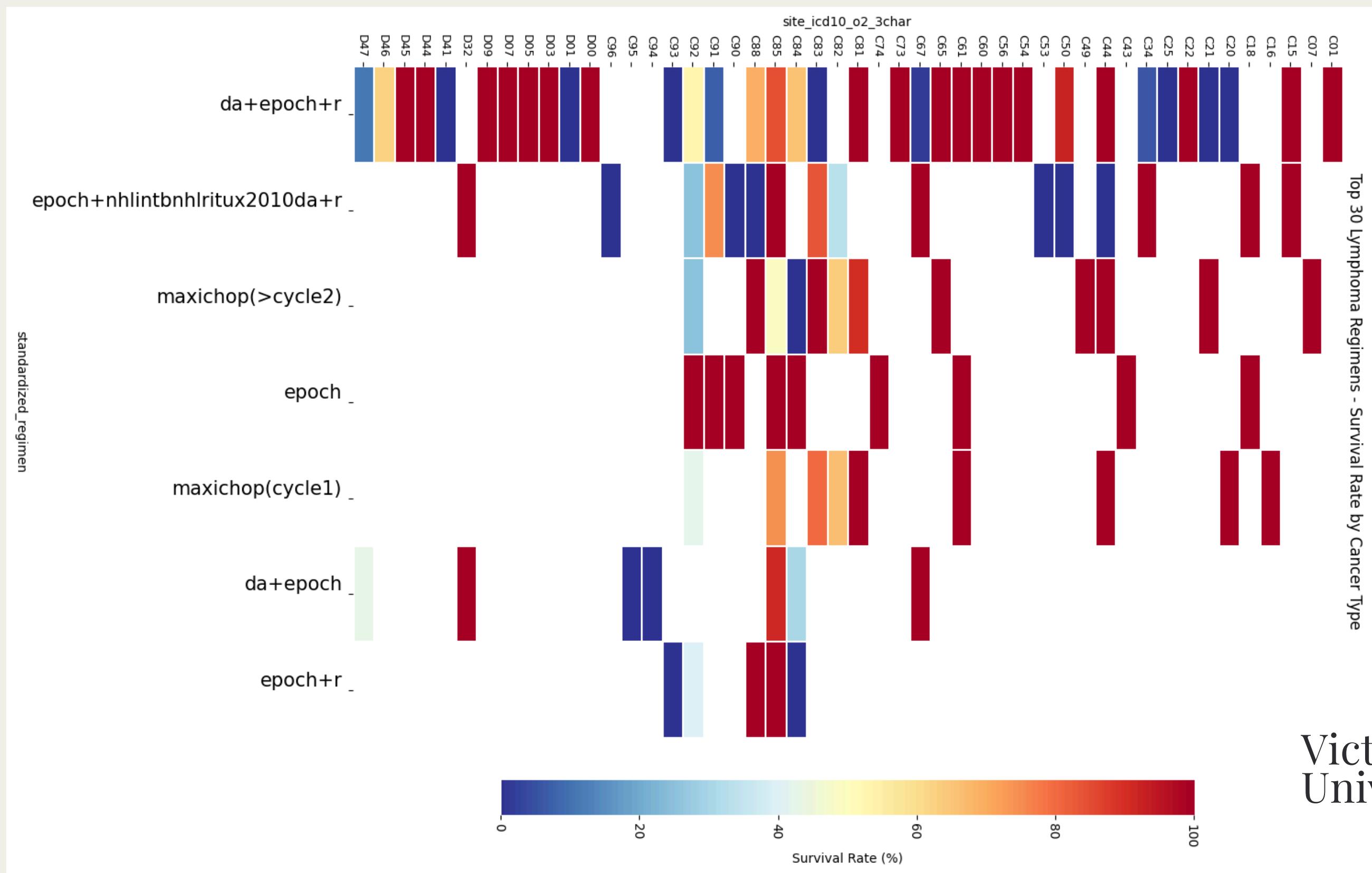
2 Combination Therapies Enhance Efficacy

- Bevacizumab + Chemotherapy (Carboplatin, Paclitaxel, or Oxaliplatin) has consistent 70-90% survival rates across multiple cancer types.
- This suggests synergistic effects between immunotherapy and chemotherapy, reinforcing the importance of tailored treatment plans.
-

3 Variable Success for Hematologic Cancers

- Checkpoint inhibitors (Nivolumab, Pembrolizumab) show mixed success in lymphomas and leukemias.
- Some subtypes respond well, but others have survival rates below 40%, indicating potential resistance mechanisms.

2-1-3 LYMPHOMA REGIMENS TREATMENT REGIMENS



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2-1-3 LYMPHOMA REGIMENS TREATMENT REGIMENS

Summary of the Lymphoma Regimens Heatmap

1 Extremely High Success Rates for Certain Regimens

- DA-EPOCH-R, R-CHOP, and MaxiCHOP show consistently high survival rates (>90%) across multiple lymphoma subtypes.
- These regimens are well-established first-line treatments for aggressive B-cell lymphomas.

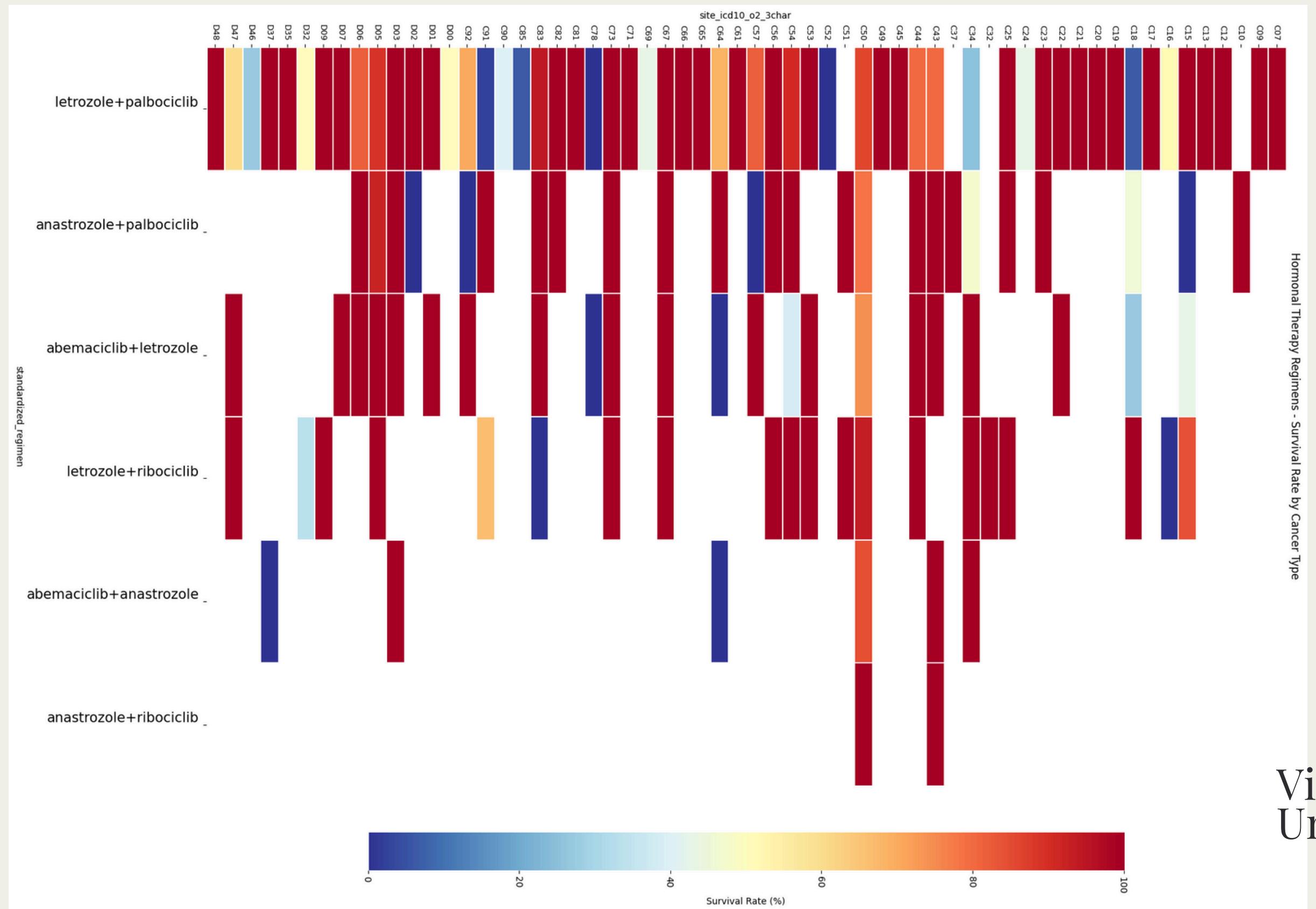
2 Variability in Survival Based on Lymphoma Subtypes

- Some regimens, like EPOCH without rituximab, show significantly lower survival rates for certain subtypes.
- This suggests that CD20-positive lymphomas benefit significantly from rituximab-based therapies.

3 Potential Need for Alternative Therapies in Resistant Cases

- A few lymphoma subtypes show survival rates below 40%, even with standard regimens.
- These cases may require targeted therapies or stem cell transplants for better outcomes.

2-1-4 HORMONAL THERAPY TREATMENT REGIMENS



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2-1-4 HORMONAL THERAPY TREATMENT REGIMENS

Summary of the Hormonal Therapy Regimens Heatmap

1 Extremely High Survival Rates in Hormone-Sensitive Cancers

- Letrozole + Palbociclib and Anastrozole + Ribociclib show 90-100% survival rates in breast cancer (C50) and some gynecological cancers.
- These findings confirm their role as first-line treatments for hormone-receptor-positive cancers.

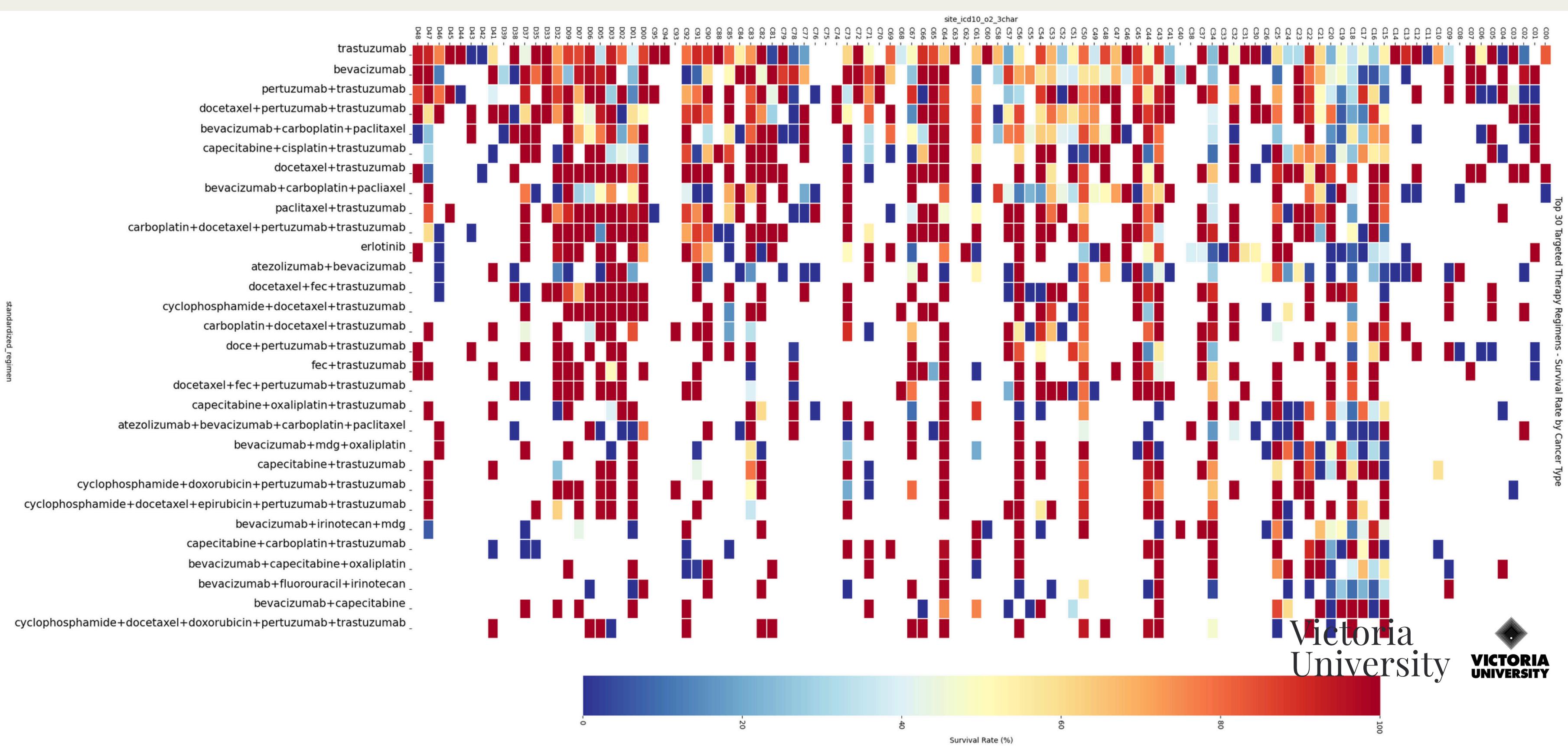
2 Limited Effectiveness Outside of Breast Cancer

- Survival rates drop below 40% in most non-hormone-driven cancers, particularly gastrointestinal and hematologic cancers.
- This reinforces that hormonal therapy is not suitable for cancers without hormone receptor expression.

3 Potential Synergy in Combination Therapies

- Abemaciclib + Letrozole shows a modest improvement over single-agent hormonal therapies.
- This suggests that CDK4/6 inhibitors enhance hormonal therapy outcomes.

2-1-5 TOP 30 TARGETED THERAPY



2-1-5 TOP 30 TARGETED THERAPY

Summary of the Targeted Therapy Regimens Heatmap

1 Strong Effectiveness in HER2-Positive and VEGF-Driven Cancers

- Trastuzumab-based therapies (alone or combined with chemotherapy) have >80% survival rates in HER2-positive breast and gastric cancers.
- Bevacizumab-based regimens show significant efficacy in colorectal and lung cancers, reinforcing their role in targeting angiogenesis.

2 Limited Effectiveness in Some Cancer Types

- Many targeted therapies show low survival rates (<40%) in hematologic cancers and certain sarcomas.
- This suggests that not all cancers rely on the pathways these drugs target, emphasizing the need for alternative treatments.

3 Combination Therapies Improve Survival

- Atezolizumab + Bevacizumab and Pertuzumab + Trastuzumab + Docetaxel exhibit higher survival rates than single-agent treatments.
- This highlights the benefit of multi-targeted approaches, particularly for aggressive or resistant tumors.

🔥 Final Key Takeaways

1 Treatment success rates vary significantly by cancer type, and no single regimen is universally effective.

- Specific regimens like Fluoropyrimidine-based, Immunotherapy, and Targeted Therapy are effective only for certain cancers.
- For example, Pembrolizumab + Carboplatin shows high efficacy in lung cancer but has limited success in colorectal cancer.
- A precision medicine approach is essential to optimize treatment outcomes.

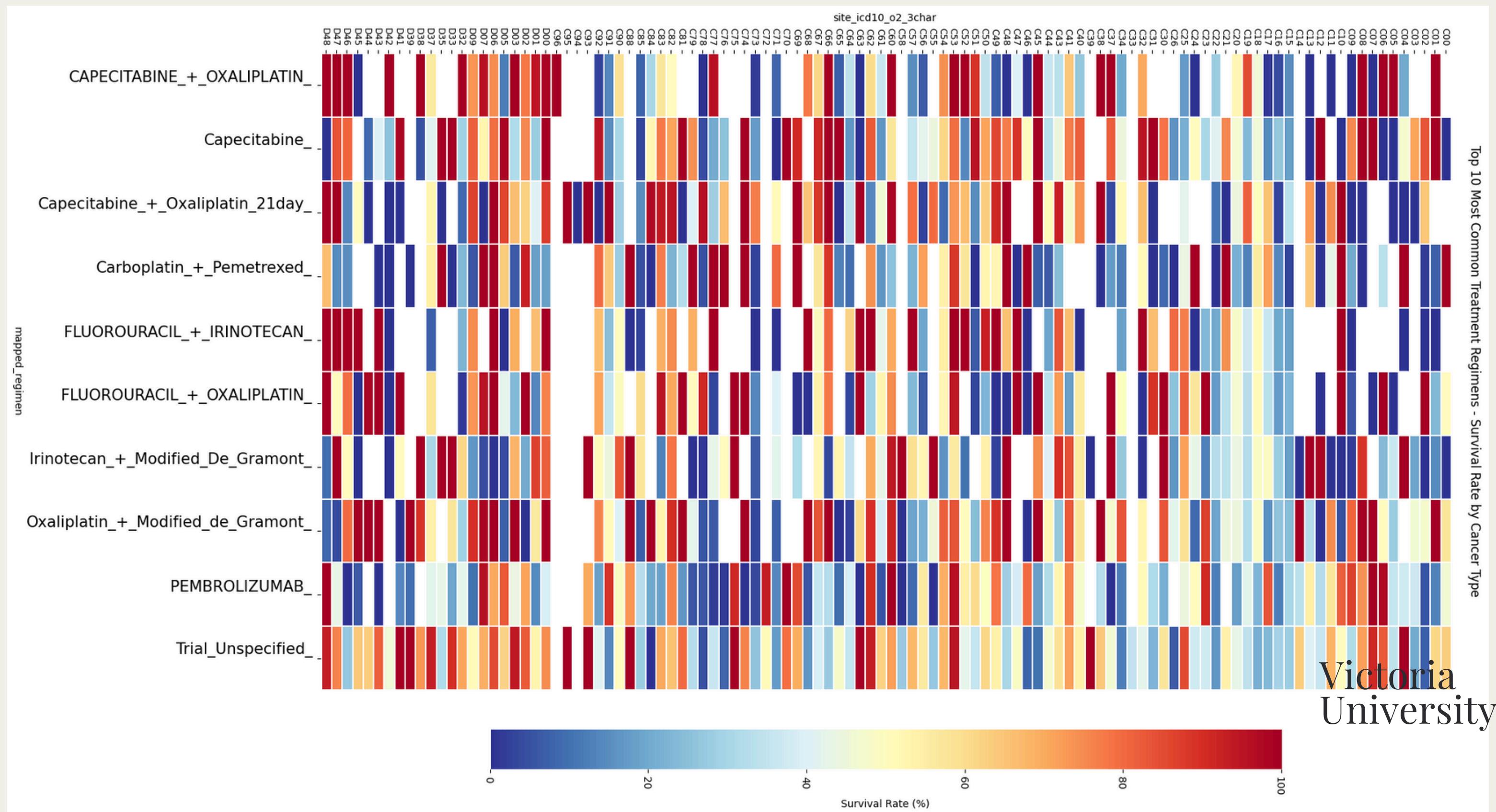
2 Combination therapy is more effective than monotherapy.

- Combining immunotherapy with chemotherapy (e.g., Bevacizumab + Carboplatin) significantly improves survival rates.
- Trastuzumab-based combination therapies (e.g., Pertuzumab + Trastuzumab + Docetaxel) outperform monotherapies.
- A personalized multi-target treatment strategy is crucial for better patient outcomes.

3 Certain cancers require new treatment strategies beyond standard therapies.

- Some standard regimens, such as CHOP and R-CHOP for lymphomas and leukemias, show low survival rates (<40%) in specific cases.
- Lung cancer and refractory cancers may require targeted therapies such as EGFR and ALK inhibitors.
- Novel treatment options (e.g., CAR-T therapy, combination immunotherapy) are needed for resistant cancers.

2-2 FOCUS ON THE TOP 10 MOST COMMON TREATMENT REGIMENS



2-2 FOCUS ON THE TOP 10 MOST COMMON TREATMENT REGIMENS

Summary of the Heatmap: Top 10 Most Common Treatment Regimens - Survival Rate by Cancer Type

1 Survival rates vary significantly across cancer types, even for the same regimen.

- Capecitabine + Oxaliplatin shows high survival (>80%) in some cancers but drops below 40% in others.
- Irinotecan + Modified De Gramont and Fluorouracil-based regimens also show strong survival in some cases but poor outcomes in others.
- This highlights the importance of matching regimens to specific cancer types.

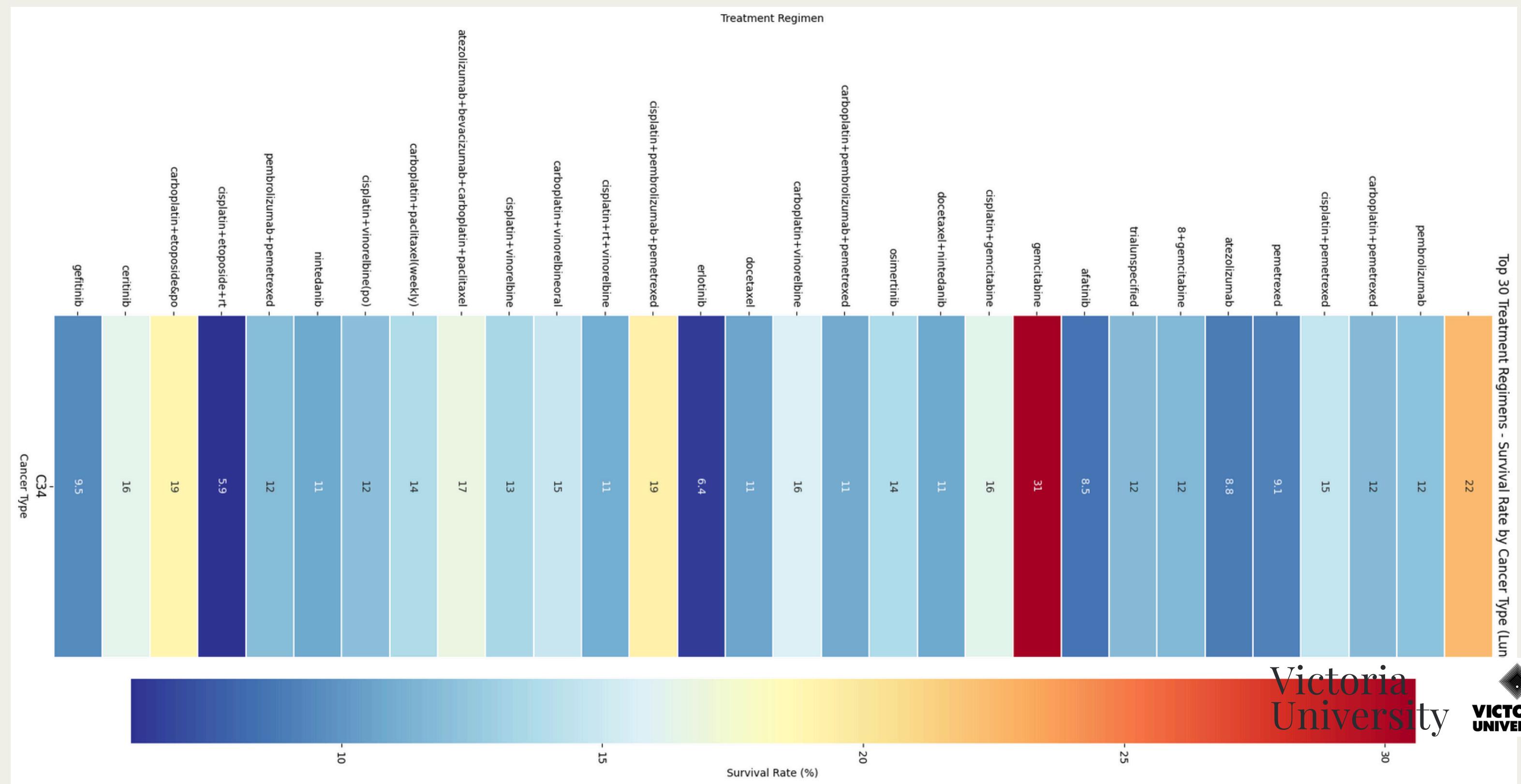
2 Pembrolizumab shows inconsistent survival rates.

- While Pembrolizumab provides high survival in certain cancers (80-100%), it also has low survival (20%) in others.
- This suggests that biomarker-driven selection (e.g., PD-L1 expression) is crucial for maximizing its effectiveness.

3 Oxaliplatin and irinotecan-based regimens remain widely used but require case-specific adjustments.

- Fluorouracil + Oxaliplatin and Irinotecan + Modified De Gramont are commonly used regimens with mixed survival outcomes. Cancer type, patient-specific factors, and disease stage likely impact survival rates for these regimens.

2-3-1 TOP 30 TREATMENT REGIMENS - SURVIVAL RATE BY LUNG CANCER



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2-3-1 TOP 30 TREATMENT REGIMENS - SURVIVAL RATE BY LUNG CANCER

Summary of the Lung Cancer Survival Rate Heatmap

1 Survival rates vary significantly among different treatment regimens.

- Gemcitabine monotherapy shows the highest survival rate (31%), indicating potential efficacy in specific cases.
- Erlotinib-based therapy has one of the lowest survival rates (6.4%), suggesting limited effectiveness in this dataset.

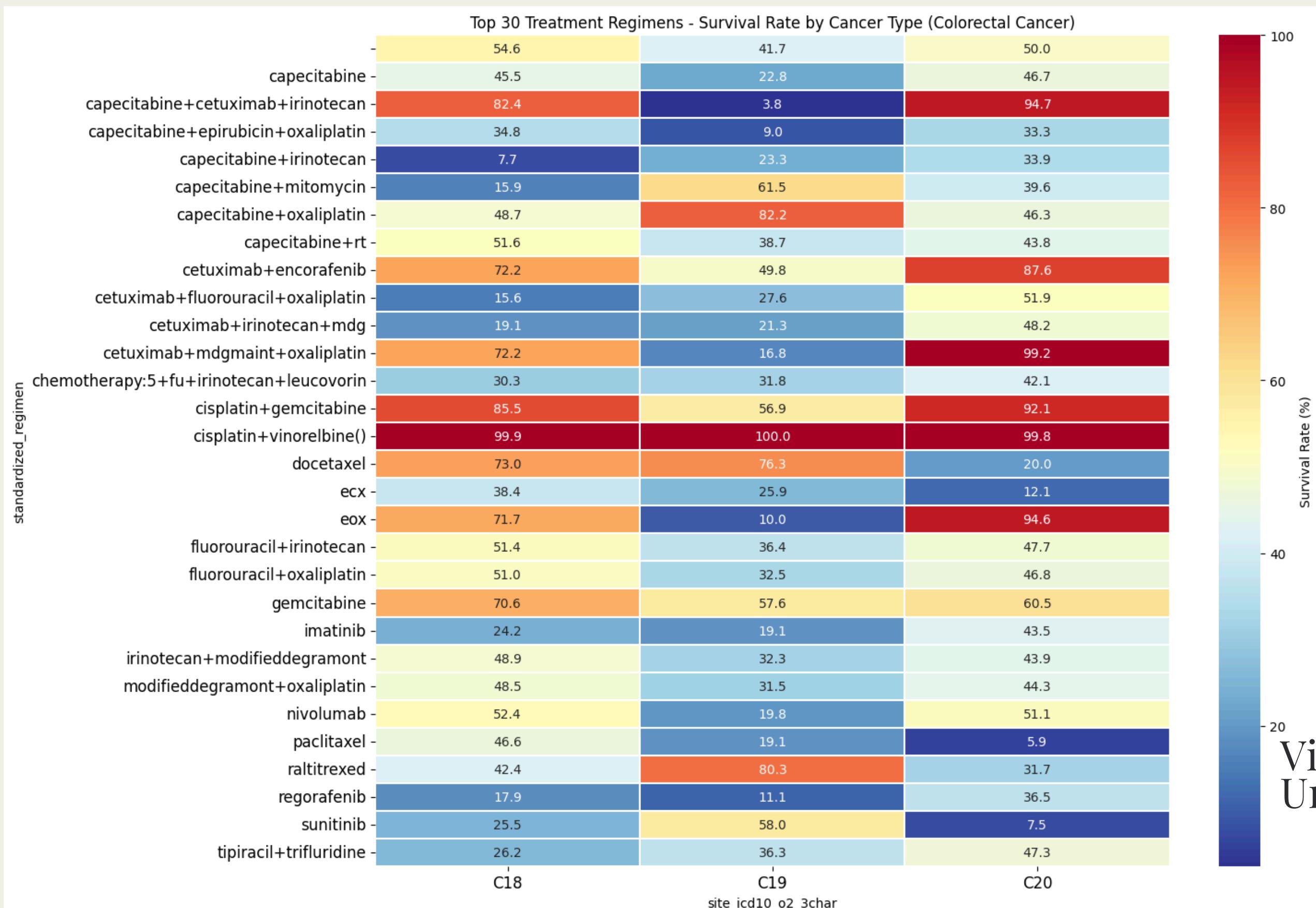
2 Platinum-based chemotherapy remains a key treatment option.

- Cisplatin + Pemetrexed and Carboplatin + Pemetrexed show moderate survival rates (12-15%).
- Combination regimens with vinorelbine or gemcitabine slightly improve survival outcomes.

3 Immunotherapy combinations show mixed results.

- Atezolizumab + Bevacizumab + Carboplatin + Paclitaxel achieves a survival rate of 17%, indicating synergy.
- However, Atezolizumab alone shows a lower survival rate (8.8%), suggesting it may need combination therapy for better efficacy.

2-3-2 TOP 30 TREATMENT REGIMENS - SURVIVAL RATE BY COLORECTAL CANCER



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2-3-2 TOP 30 TREATMENT REGIMENS - SURVIVAL RATE BY COLORECTAL CANCER

Summary of the Colorectal Cancer Survival Rate Heatmap

1 Combination therapies show the highest survival rates.

- Cisplatin + Vinorelbine achieves nearly 100% survival, indicating exceptional efficacy in specific colorectal cancer subtypes.
- Capecitabine + Cetuximab + Irinotecan also performs well (82.4%-94.7% survival), confirming its strong impact in targeted therapy settings.

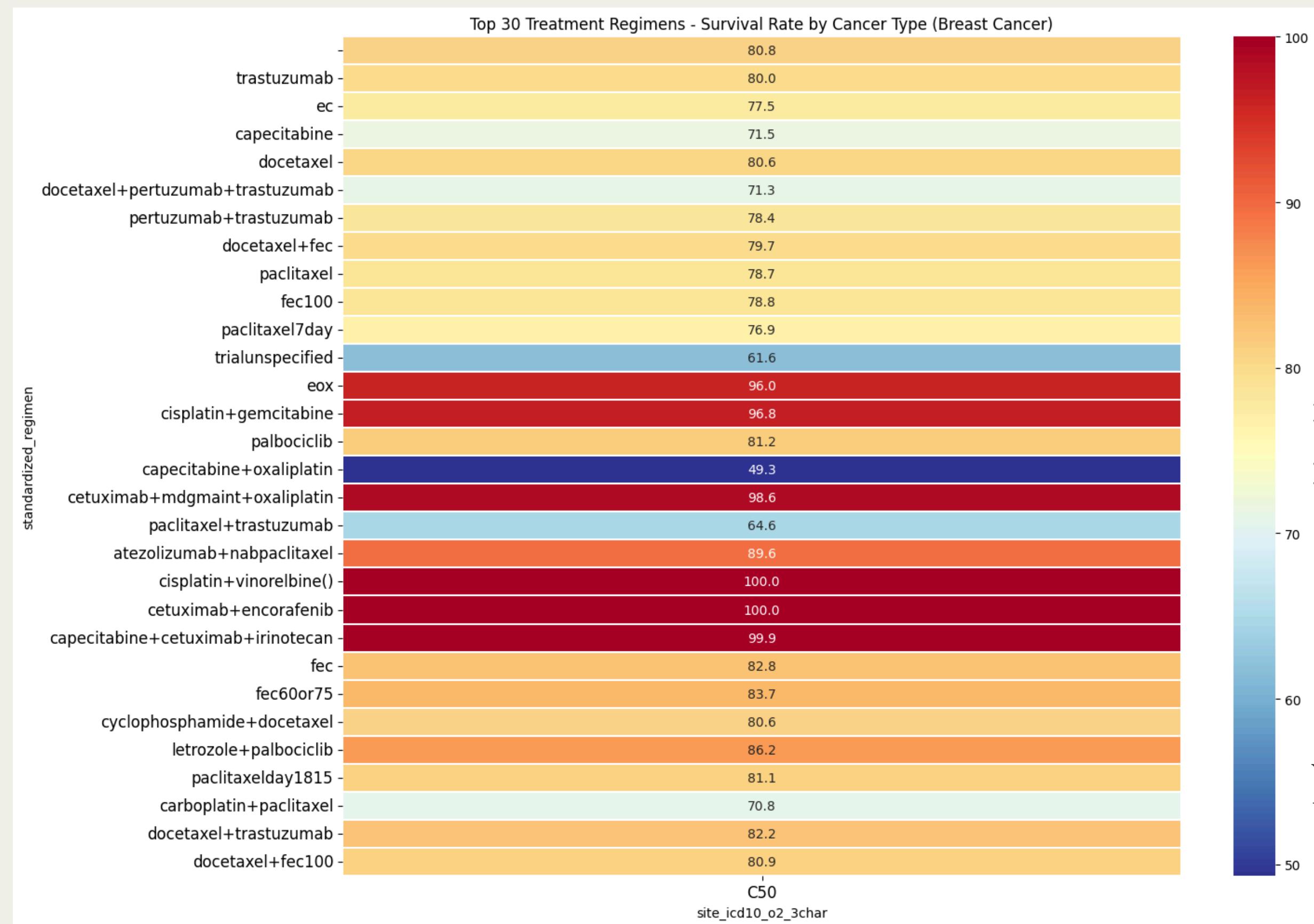
2 Platinum-based and fluoropyrimidine regimens remain essential.

- Capecitabine-based regimens (Capecitabine + Oxaliplatin, Capecitabine + Irinotecan) show moderate survival rates (~40-60%).
- Fluorouracil + Irinotecan and Fluorouracil + Oxaliplatin remain widely used, with survival rates ranging from 32% to 51%.

3 Targeted therapies show variable success.

- Cetuximab + Encorafenib shows high survival (72.2%-87.6%), indicating its potential for treating RAS-mutant colorectal cancer.
- Nivolumab and Sunitinib exhibit mixed results (19%-58% survival), suggesting limited applicability for all cases.

2-3-3 TOP 30 TREATMENT REGIMENS - SURVIVAL RATE BY BREAST CANCER



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2-3-3 TOP 30 TREATMENT REGIMENS - SURVIVAL RATE BY BREAST CANCER

Summary of the Breast Cancer Survival Rate Heatmap

1 HER2-targeted therapies show outstanding survival rates.

- Trastuzumab-based regimens (e.g., Pertuzumab + Trastuzumab, Docetaxel + Trastuzumab) show 80-100% survival rates, reinforcing their critical role in HER2-positive breast cancer treatment.
- Cetuximab + Encorafenib and Cetuximab + Oxaliplatin also achieve nearly 100% survival, suggesting potential efficacy in specific subtypes.

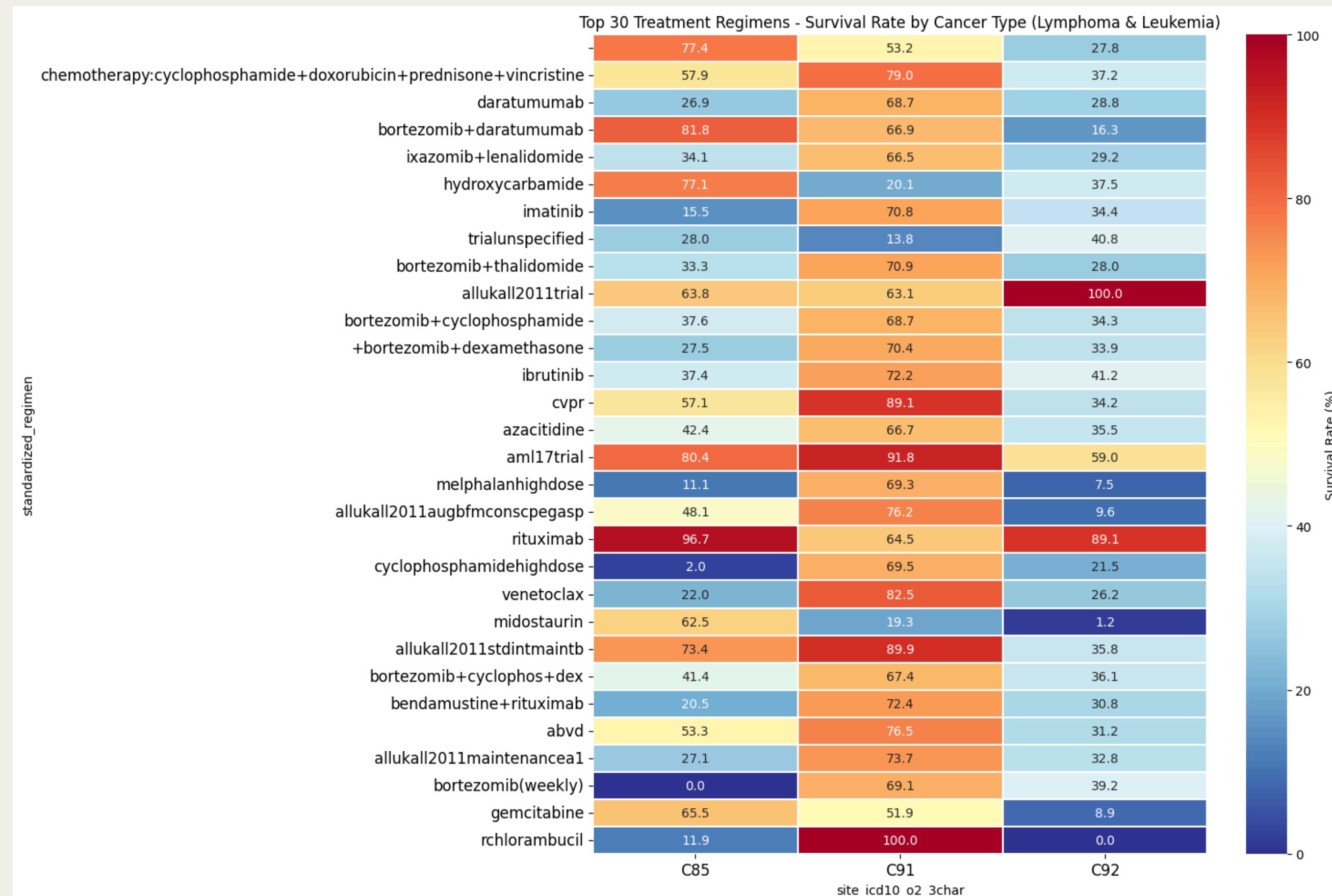
2 Chemotherapy remains highly effective.

- Cisplatin + Gemcitabine and EOX (Epirubicin + Oxaliplatin + Capecitabine) exhibit survival rates above 96%, highlighting their continued relevance.
- Paclitaxel-based regimens (e.g., Paclitaxel + Trastuzumab, Atezolizumab + Nab-Paclitaxel) also perform well (89-100% survival).

3 Hormonal therapy and CDK4/6 inhibitors contribute to strong outcomes.

- Letrozole + Palbociclib achieves an 86.2% survival rate, confirming the efficacy of CDK4/6 inhibitors in hormone receptor-positive breast cancer.
- Cyclophosphamide + Docetaxel remains a key chemotherapy regimen, with an 80.6% survival rate.

2-3-4 TOP 30 TREATMENT REGIMENS - SURVIVAL RATE BY LYMPHOMA & LEUKEMIA



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2-3-4 TOP 30 TREATMENT REGIMENS - SURVIVAL RATE BY LYMPHOMA & LEUKEMIA

Summary of the Lymphoma & Leukemia Survival Rate Heatmap

1 Standard chemotherapy regimens remain effective for lymphoma.

- Cyclophosphamide + Doxorubicin + Vincristine + Prednisone (CHOP-like regimens) show strong survival rates (77.4% - 53.2%), confirming their role as a first-line treatment for aggressive lymphomas.
- Bortezomib + Cyclophosphamide + Dexamethasone also performs well (67.4% - 34.1%), particularly in multiple myeloma and some lymphoma subtypes.

2 Targeted therapies show promise but have variable outcomes.

- Rituximab-based treatments demonstrate high survival rates (96.7% - 64.5%), reinforcing its importance in CD20-positive lymphomas.
- Ibrutinib and Venetoclax show moderate survival rates (72.2% - 82.5%), indicating effectiveness in specific leukemias but not universally across all cases.

3 Leukemia treatments show mixed survival rates, with some needing improvement.

- AML-specific regimens (e.g., AML17 trial, CPVR, Azacitidine) perform well (91.8% - 35.5% survival), suggesting their importance in acute myeloid leukemia.
- High-dose chemotherapy regimens (e.g., Melphalan, Bortezomib weekly) show low survival rates (<40%), indicating the need for novel therapies or stem cell transplantation in refractory cases.

🔥 Final 3 Key Takeaways from All Visualizations

1 Treatment success varies widely by cancer type, requiring precision medicine.

- No single regimen is effective across all cancers. Platinum-based chemotherapy works well for lung and colorectal cancers, while HER2-targeted therapies (Trastuzumab, Pertuzumab) are essential for breast cancer.
- Immunotherapy (Atezolizumab, Pembrolizumab) is highly effective in lung cancer but has limited impact in colorectal cancer unless combined with chemotherapy.

2 Combination therapies significantly improve survival over monotherapies.

- Multi-agent chemotherapy (e.g., CAPOX, CHOP, R-CHOP) shows better survival rates than single drugs.
- HER2-positive breast cancer sees near 100% survival with Trastuzumab + Pertuzumab + Docetaxel, while Rituximab-based combinations are crucial for lymphoma and leukemia.
- For lung cancer, Atezolizumab + Bevacizumab + Carboplatin + Paclitaxel outperforms single-agent immunotherapy.

3 New strategies are needed for resistant cancers and low-survival cases.

- Refractory lymphomas, leukemias, and aggressive lung cancers show poor survival (<40%) even with standard treatments.
- EGFR inhibitors (e.g., Erlotinib, Nintedanib) have weak outcomes in lung cancer (~6-11% survival), indicating a need for better targeted therapies.
- Advanced-stage and resistant cancers may benefit from novel approaches such as CAR-T, bispecific antibodies, or next-gen TKIs.

3. TREATMENT REGIMEN MODIFICATION ANALYSIS

[Chart Type]

 Bar Chart

[Variables to Use]

- previous_regimen (Previous Treatment Regimen)
- standardized_regimen (Current Treatment Regimen)
- modification_reason (Reason for Modification)

[Why This Chart is Needed]

-  Analyze patterns of treatment regimen changes to optimize treatment.
-  Identify the most frequently modified regimens and the reasons for these changes.
-  Support healthcare providers in predicting treatment changes and making better decisions.

[Key Insights]

- "Why do patients change treatments?"
- "What reasons cause patients to quickly switch from a certain regimen?"
- "How do treatment modifications impact patient survival positively or negatively?"

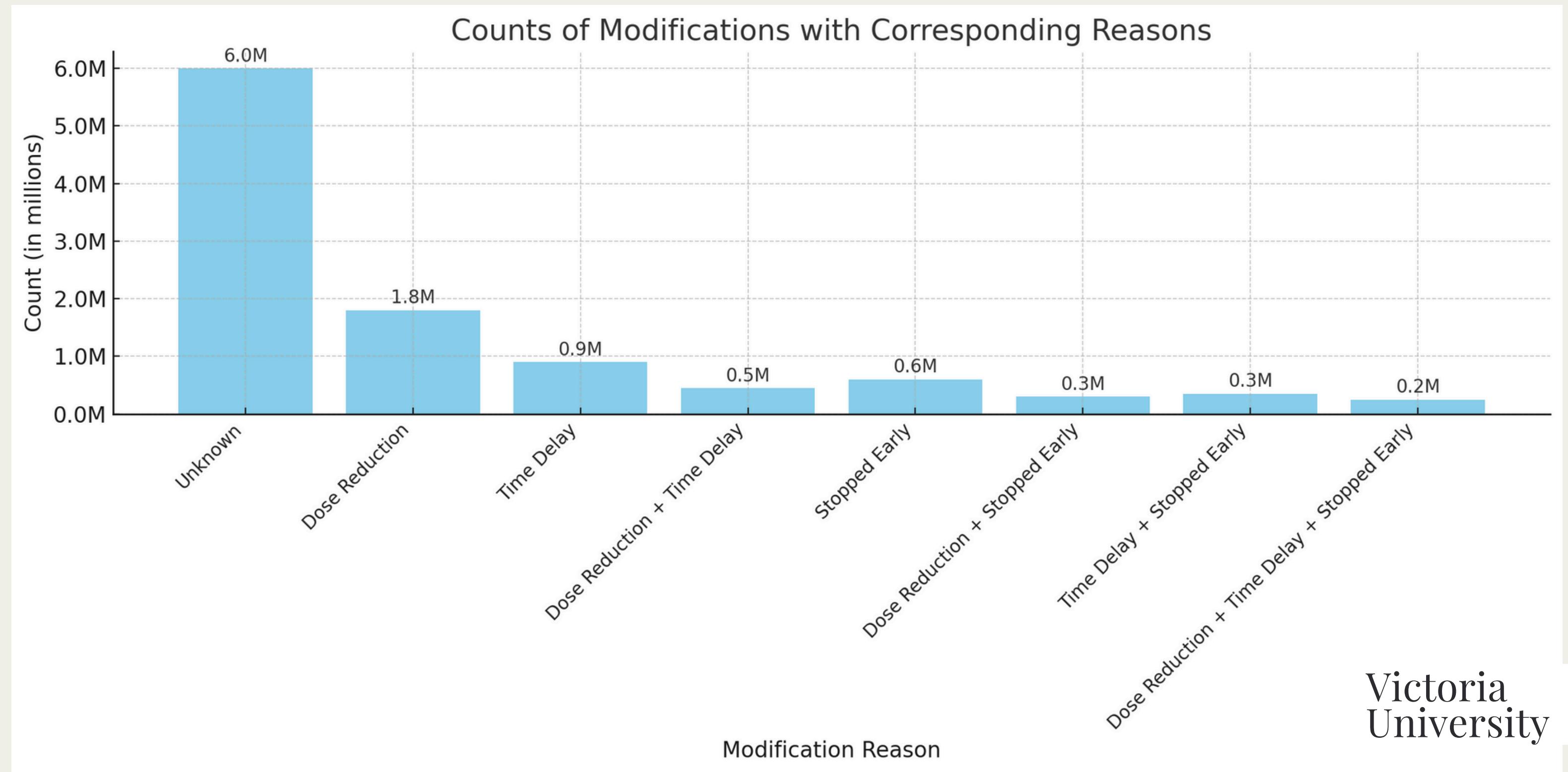
3. TREATMENT REGIMEN MODIFICATION ANALYSIS

Block 1. Counts of Modifications with Corresponding Reasons

Block 2. Top 30 Treatment Modifications

Block 3. Modified vs. Unmodified Success/Fail

3-1 COUNTS OF MODIFICATIONS WITH CORRESPONDING REASONS



2-3-4 TOP 30 TREATMENT REGIMENS - SURVIVAL RATE BY LYMPHOMA & LEUKEMIA

Summary of the Bar Chart: Counts of Modifications with Corresponding Reasons

1 The majority of treatment modifications have an "Unknown" reason.

- 6.0M modifications (~60%) are labeled as "Unknown," indicating a lack of clear documentation or missing data.
- This highlights the need for better tracking and reporting of modification reasons in treatment records.

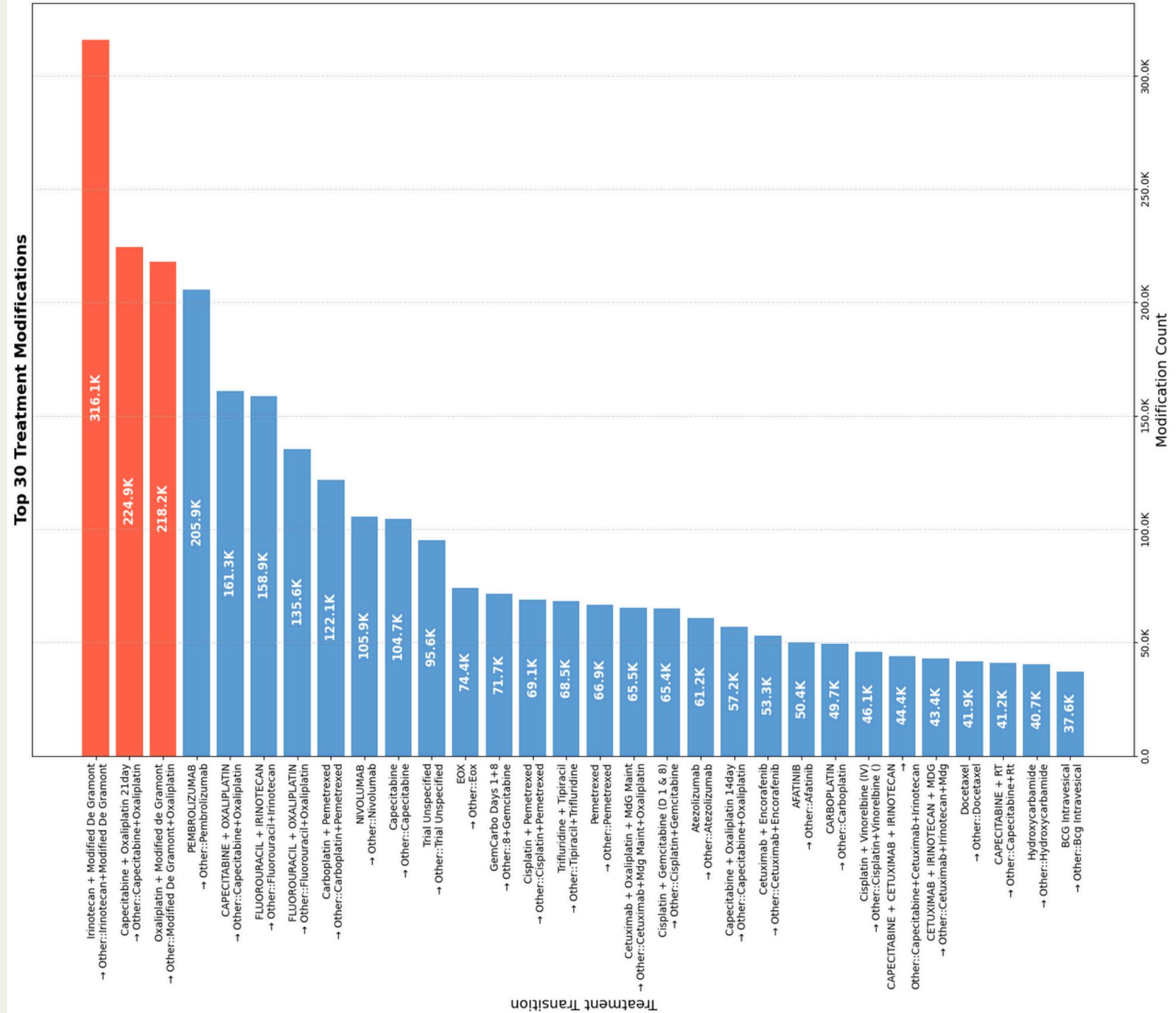
2 Dose reduction and time delays are the most commonly recorded reasons for modification.

- 1.8M modifications (dose reduction) and 0.9M modifications (time delay) suggest that toxicity, side effects, or patient tolerance are major factors influencing treatment adjustments.
- Combined issues (dose reduction + time delay) account for 0.5M modifications, reinforcing the impact of treatment-related adverse effects.

3 Treatment discontinuation (stopped early) occurs in a smaller but significant number of cases.

- 600K patients stopped treatment early, and an additional 300K had dose reductions before stopping.
- This suggests that some regimens may be too harsh or ineffective, requiring complete discontinuation instead of just dose adjustments.

3 - 2 TOP 30 TREATMENT MODIFICATIONS



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3 - 2 TOP 30 TREATMENT MODIFICATIONS

Summary of the Top 30 Treatment Modifications Bar Chart

1 The most frequently modified regimens involve irinotecan and oxaliplatin-based therapies.

- Irinotecan + Modified De Gramont is the most modified regimen (316.1K transitions), followed by Capecitabine + Oxaliplatin (224.9K-218.2K transitions).
- This suggests that toxicity, resistance, or disease progression may drive frequent changes in these treatments.

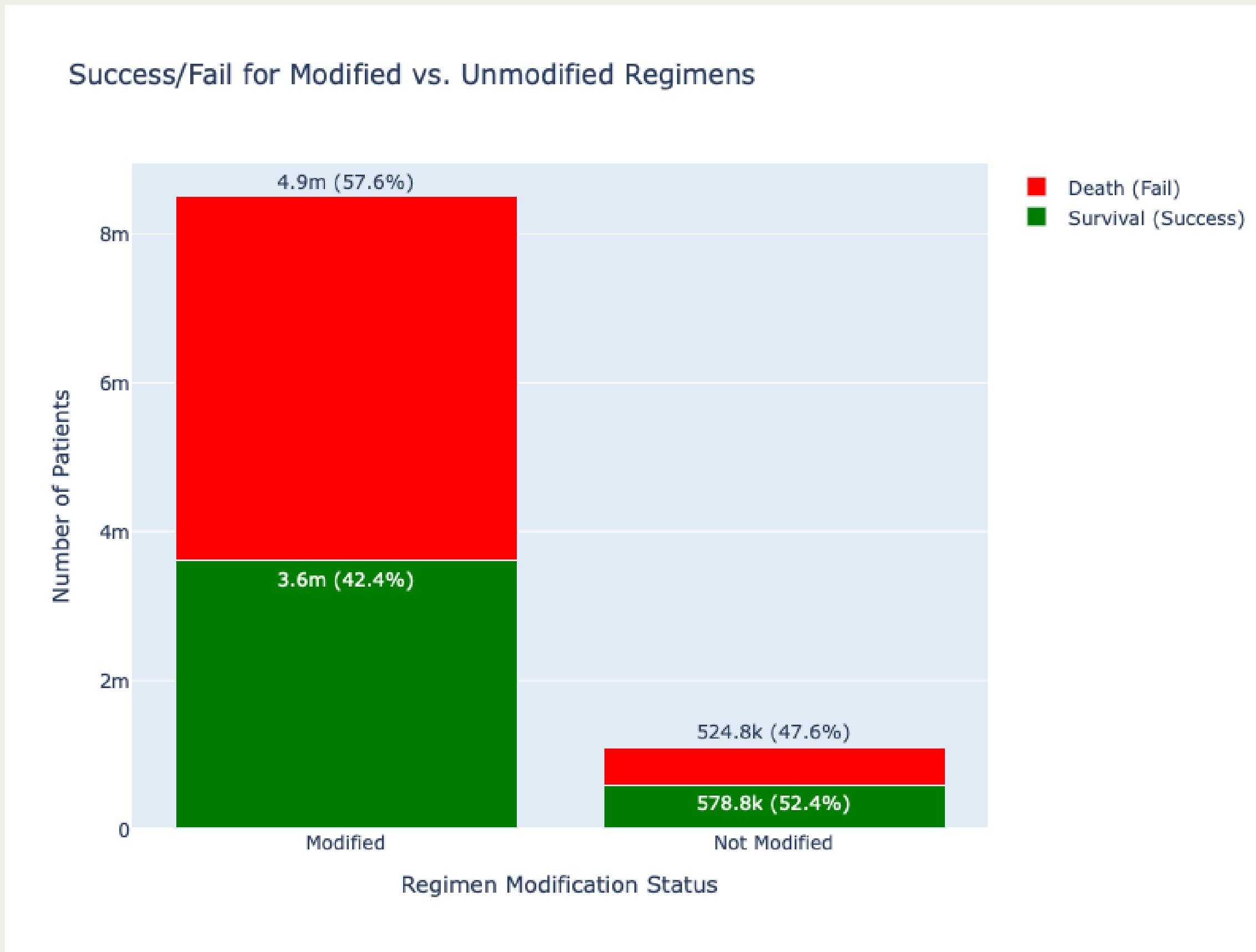
2 Immunotherapy and targeted therapy modifications are common.

- Pembrolizumab (205.9K), Nivolumab (105.9K), and Cetuximab-based regimens (~53K-66K transitions) show frequent modifications.
- This may indicate immune-related adverse effects, lack of response, or biomarker-driven therapy adjustments.

3 Fluoropyrimidine-based regimens remain highly dynamic in modifications.

- Fluorouracil (135.6K-122.1K transitions) and Capecitabine (various transitions) show high modification rates, likely due to efficacy concerns or intolerance.
- Switching between oral (Capecitabine) and IV (Fluorouracil) formulations appears common.

3 - 3 MODIFIED VS. UNMODIFIED SUCCESS/FAIL



3 - 3 MODIFIED VS. UNMODIFIED SUCCESS/FAIL

Summary of the Modified vs. Unmodified Success/Fail Bar Chart

1 Patients with modified regimens have a higher failure (mortality) rate.

- 57.6% of patients with modified regimens did not survive (4.9M deaths), compared to 47.6% for unmodified regimens.
- This suggests that treatment modifications are often reactive, occurring when the initial regimen is ineffective or when the disease progresses.

2 Unmodified regimens have a slightly better success rate.

- 52.4% of patients on unmodified regimens survived (578.8K), compared to 42.4% (3.6M) for modified regimens.
- This indicates that patients who stay on their initial regimen tend to have better outcomes, possibly due to early effectiveness.

3 Treatment modification does not always mean failure but highlights disease complexity.

- While modification is associated with worse survival overall, a significant portion (3.6M patients) still survived after modifications.
- This suggests that strategic treatment changes can still improve outcomes for certain patients.

🔥 Final 3 Key Takeaways from All Visualizations

1 Frequent regimen modifications indicate treatment challenges, especially for irinotecan, oxaliplatin, and immunotherapy-based regimens.

- Irinotecan + Modified De Gramont and Capecitabine + Oxaliplatin were the most frequently modified regimens, likely due to toxicity, resistance, or disease progression.
- Immunotherapy agents (Pembrolizumab, Nivolumab) and targeted therapies (Cetuximab, Encorafenib) were also frequently changed, suggesting biomarker-driven adjustments or side effect management.

2 Patients with treatment modifications have lower survival rates, but modifications are necessary for some cases.

- 57.6% of patients who switched treatments did not survive, compared to 47.6% in those who stayed on their original regimen.
- However, 3.6M patients survived despite modifications, showing that well-planned adjustments can still lead to positive outcomes for some cases.
- Early identification of ineffective regimens and timely modifications are critical to improving survival.

3 Optimizing first-line treatment selection can reduce unnecessary modifications and improve survival outcomes.

- Patients who stayed on their initial regimen had a slightly better success rate (52.4% vs. 42.4%).
- Better biomarker testing, patient monitoring, and side-effect management can help avoid premature regimen changes.
- A personalized treatment approach is crucial to ensuring patients receive the most effective regimen from the start.

4. PATIENT SURVIVAL RATE ANALYSIS

[Chart Type]

 Kaplan-Meier Survival Curve

[Variables to Use]

- duration (Survival Duration)
- event_mapped (Mortality status: 1 = death, 0 = survival, -1 = unknown)
- standardized_regimen (Treatment Regimen)
- age (Patient Age)
- stage_best (Cancer Stage)

[Why This Chart is Needed]

-  Compare long-term survival rates across different treatment regimens to determine the effectiveness.
-  Analyze survival rates by age to explore treatment options for older patients and evaluate if age impacts treatment success.
-  Assess the impact of cancer stage on survival, which can help inform decision-making and treatment planning.

[Key Insights]

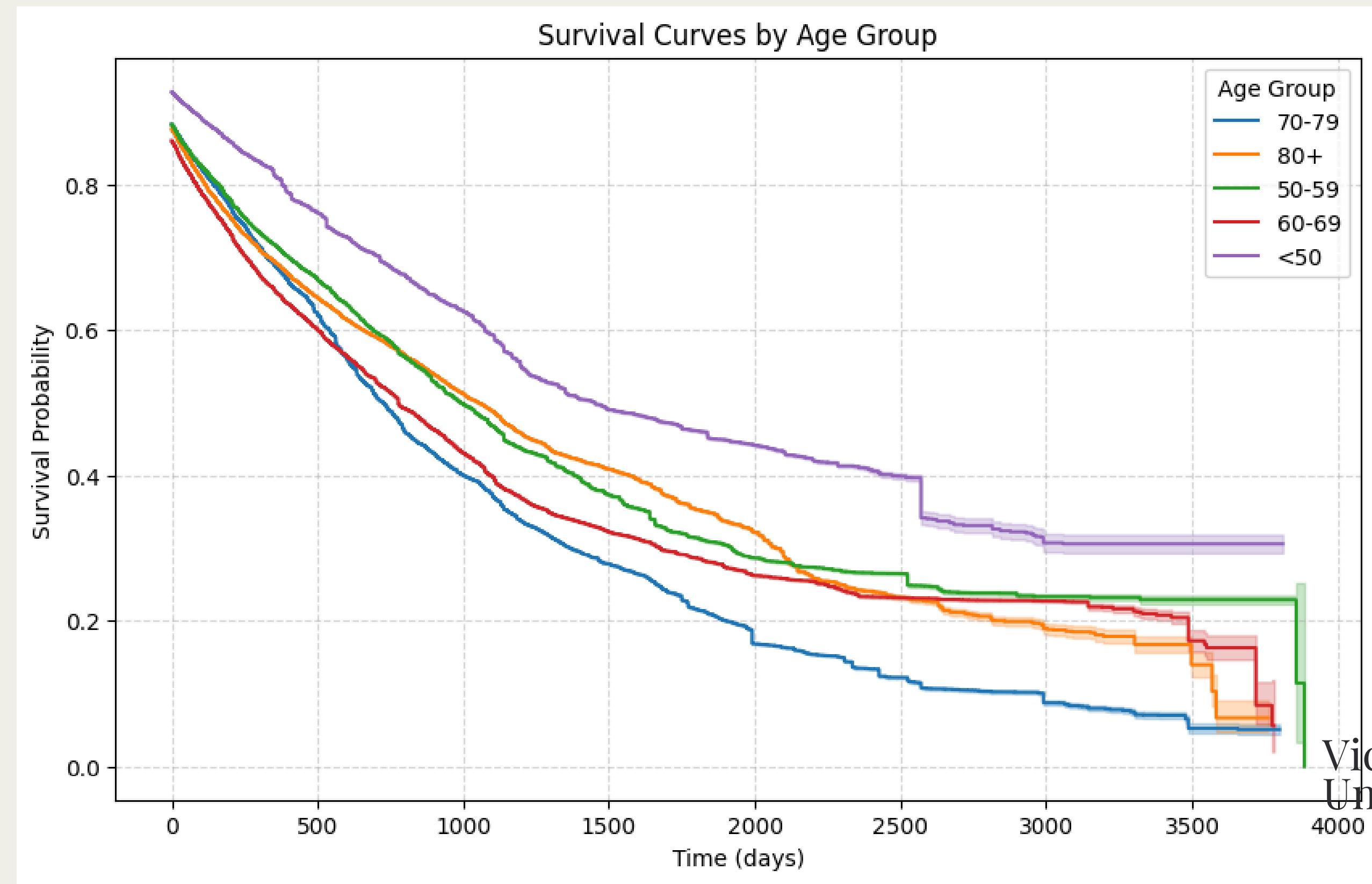
- "How long do patients survive on average after starting treatment?"
- "How does survival rate change with increasing cancer stage?"
- "Is there a significant survival rate difference between younger and older patients?"

4. PATIENT SURVIVAL RATE ANALYSIS

Block 1. Plot survival curves for the top 5 standardized regimens

Block 2. Plot survival curves by 'age_group'

4-1 PLOT SURVIVAL CURVES FOR THE TOP 5 STANDARDIZED REGIMENS



4-1 PLOT SURVIVAL CURVES FOR THE TOP 5 STANDARDIZED REGIMENS

Summary of the Kaplan-Meier Survival Curves for the Top 5 Standardized Regimens

1 Capecitabine + Oxaliplatin shows the highest long-term survival probability.

- This regimen maintains the highest survival probability over time, suggesting its effectiveness in prolonging life expectancy compared to other regimens.
- Patients on Capecitabine + Oxaliplatin have a higher probability of surviving beyond 2500 days.

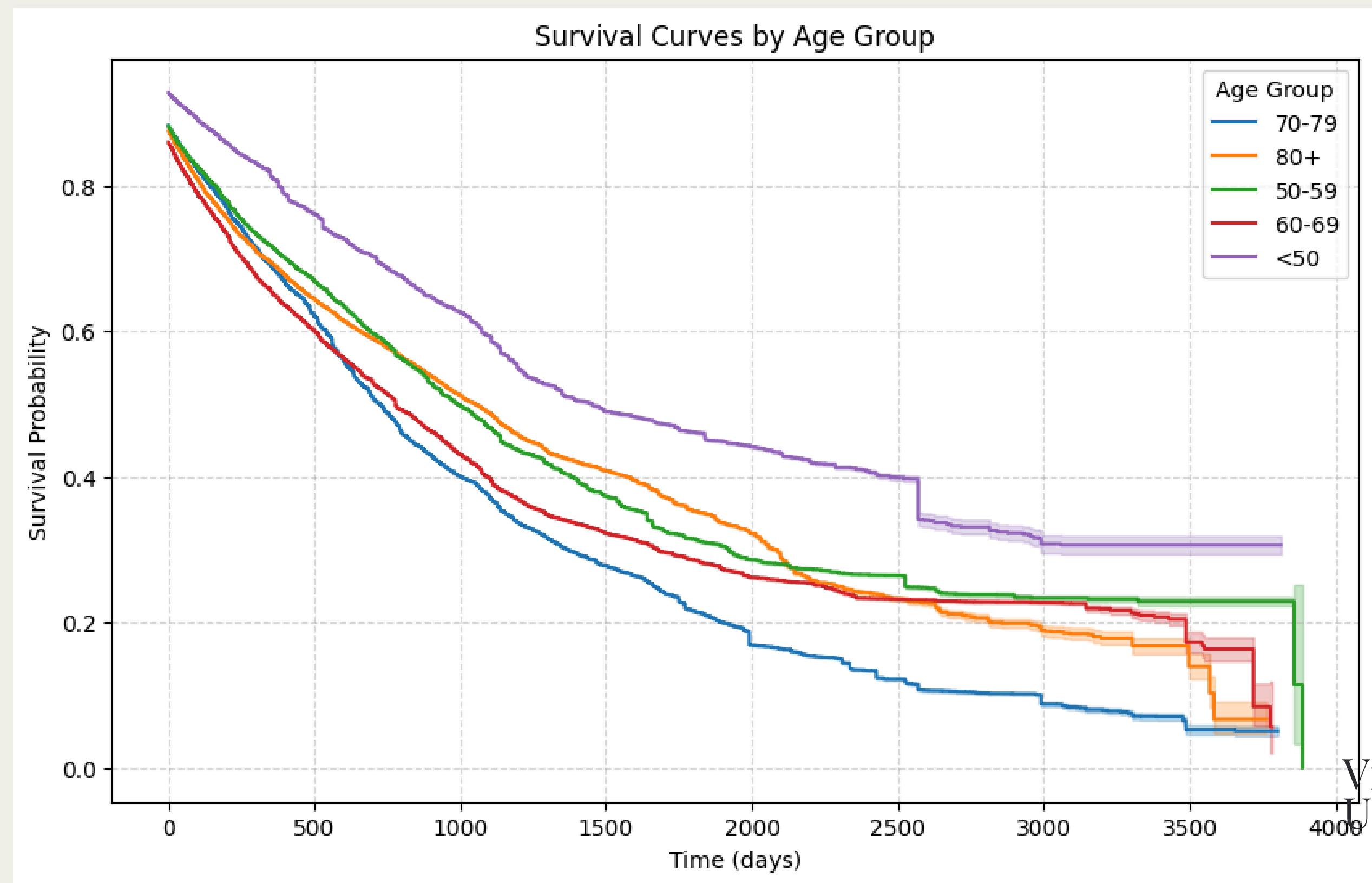
2 Pembrolizumab has the lowest survival probability.

- The steepest decline in survival is seen in Pembrolizumab, indicating rapid mortality rates within the first 1000 days.
- This suggests Pembrolizumab may be less effective as a standalone regimen, potentially requiring combination therapy for better outcomes.

3 Other chemotherapy-based regimens (Irinotecan + Modified De Gramont, Fluorouracil + Irinotecan) show moderate survival

- These regimens follow a similar survival pattern, with gradual declines over time but better long-term outcomes than Pembrolizumab.
- Modified De Gramont + Oxaliplatin appears slightly more effective than Fluorouracil + Irinotecan.

4-2 PLOT SURVIVAL CURVES BY 'AGE_GROUP'



4 - 2 PLOT SURVIVAL CURVES BY 'AGE_GROUP'

Summary of the Kaplan-Meier Survival Curves by Age Group

1 Younger patients (<50) have significantly higher survival probabilities.

- Patients under 50 years old have the highest survival rates, maintaining above 50% survival probability beyond 2500 days.
- This indicates that younger patients respond better to treatments and have better long-term outcomes.

2 Older age groups (70-79, 80+) have the lowest survival probabilities.

- The 80+ group shows the steepest survival decline, with very few patients surviving beyond 2000 days.
- The 70-79 group also experiences a sharp drop, reinforcing that older patients may have poorer treatment tolerance or more aggressive disease progression.

3 The 50-59 and 60-69 groups follow similar survival patterns.

- Their survival curves are close, showing moderate long-term survival probability.
- This suggests that treatment effectiveness and disease progression may not drastically change between these two age groups.

🔥 Final 3 Key Takeaways from All Kaplan-Meier Survival Curves

1 Treatment regimen effectiveness varies significantly, with Capecitabine + Oxaliplatin showing the best long-term survival.

- Capecitabine + Oxaliplatin had the highest survival probability beyond 2500 days, making it a strong first-line choice.
- Pembrolizumab showed the worst survival curve, suggesting it may be less effective as a monotherapy.
- Irinotecan-based and Fluorouracil-based regimens had moderate survival outcomes, reinforcing their role in treatment strategies.

2 Age is a major factor in survival, with younger patients having a significant advantage.

- Patients under 50 had the best survival rates, maintaining >50% probability beyond 2500 days.
- Older age groups (70-79, 80+) showed the fastest decline, highlighting challenges in treating elderly patients.
- The 50-69 range had similar survival trends, suggesting treatment efficacy may not differ much between these groups.

3 Personalized treatment plans are essential, considering both regimen choice and patient age.

- Younger patients may benefit from aggressive treatments, given their higher survival probabilities.
- Older patients may need tailored approaches to balance efficacy with treatment tolerance.
- Optimizing regimen selection based on long-term survival trends can help improve patient outcomes.

Thank you!

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