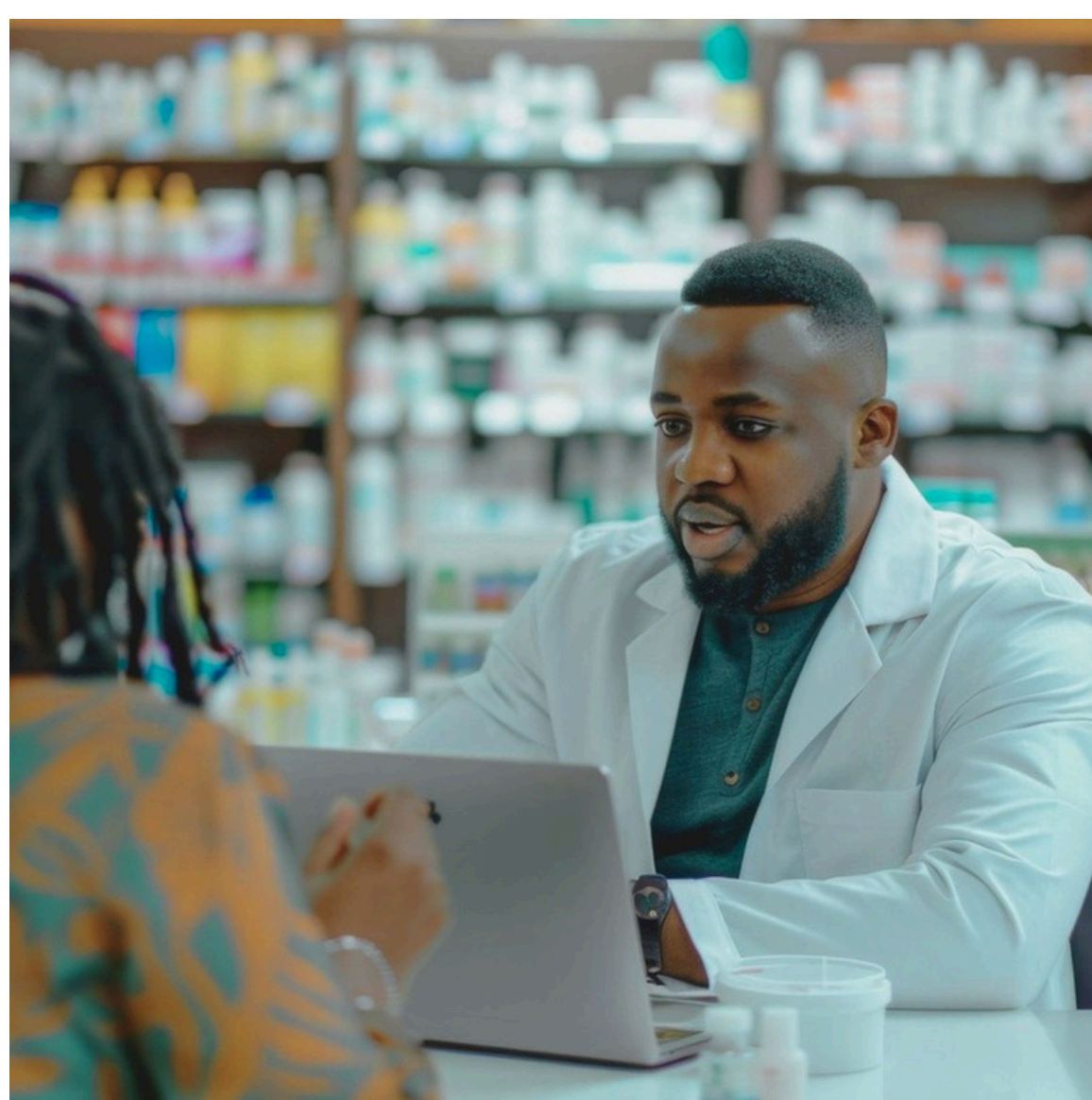




Insights drawn from
28 years of access to
healthcare experience
and over a decade of
patient assistance
program data



THE POWER OF PREDICTION

Using Real-World Insights to Strengthen Access to Healthcare
Programs and Medical Outcomes



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EXECUTIVE SUMMARY

Access has not kept pace with innovation, but the future is bright.

18,076

PATIENTS

21

COUNTRIES

87

ONCOLOGY MEDICINES

4

PATIENT OUTCOMES

Cancer medicines are advancing rapidly, but access has not kept pace. Patient Assistance Programs (PAPs) help address financial barriers to treatment, yet patient outcomes are shaped by a broader range of factors, including healthcare setting, cancer type, treatment characteristics, patient circumstances, and program design.

Limited published evidence exists on how these factors impact patient outcomes. As larger real-world datasets from patients enrolled in PAPs become available, there is an opportunity to move toward predictive access, using data to identify patterns, anticipate potential barriers, and inform more proactive program design and management.

This report presents the first large-scale analysis of administrative data from a multi-country, multi-product oncology PAP portfolio managed by Axios International. The analysis examines 18,076 patients across 21 countries and 87 oncology medicines, identifying factors associated with four key outcomes: survival, treatment duration, serious adverse events, and dropout.



KEY FINDINGS

Factors associated with patient outcomes in PAPs



01

Country plays a significant role.

Country was strongly associated with all four outcomes, even after controlling for patient, disease, and product factors.



02

Patient journeys differ by cancer type.

Gastrointestinal and head and neck cancers were linked to worse survival and shorter treatment. Patients with hematologic malignancies stayed on treatment longer and were less likely to drop out.



03

Treatment duration and completion vary by how a medicine is given.

Oral therapies were associated with longer treatment duration but higher odds of dropout before completion than intravenous therapies, possibly because home-based treatment offers fewer touchpoints with the health system.



04

Support systems can make a difference.

A registered caregiver was linked to longer treatment. Pharmacies with more PAP experience were linked to fewer serious adverse events.

**THE SHIFT TO MORE PREDICTIVE, SUSTAINABLE ACCESS**

This study represents the first phase of a broader effort to make PAP design and management more predictive. Its findings show that the operational data generated by PAPs can do more than document the past. It can reveal the patterns behind differences in patient outcomes and help identify challenges and solutions before they emerge.

The opportunity now is to make predictive access standard practice, combining real-world data, advanced analytics, and patient-centered design to build and manage programs that respond to the needs of each patient and market. The next frontier of access is anticipating what patients will need next and acting before barriers stand in their way.



01

Introduction

A growing cancer burden, rising treatment costs,
the limits of today's access models -- *and the possibilities ahead.*

THE BURDEN

A growing cancer burden amid persistent access challenges

~10M

cancer deaths
worldwide in 2024¹

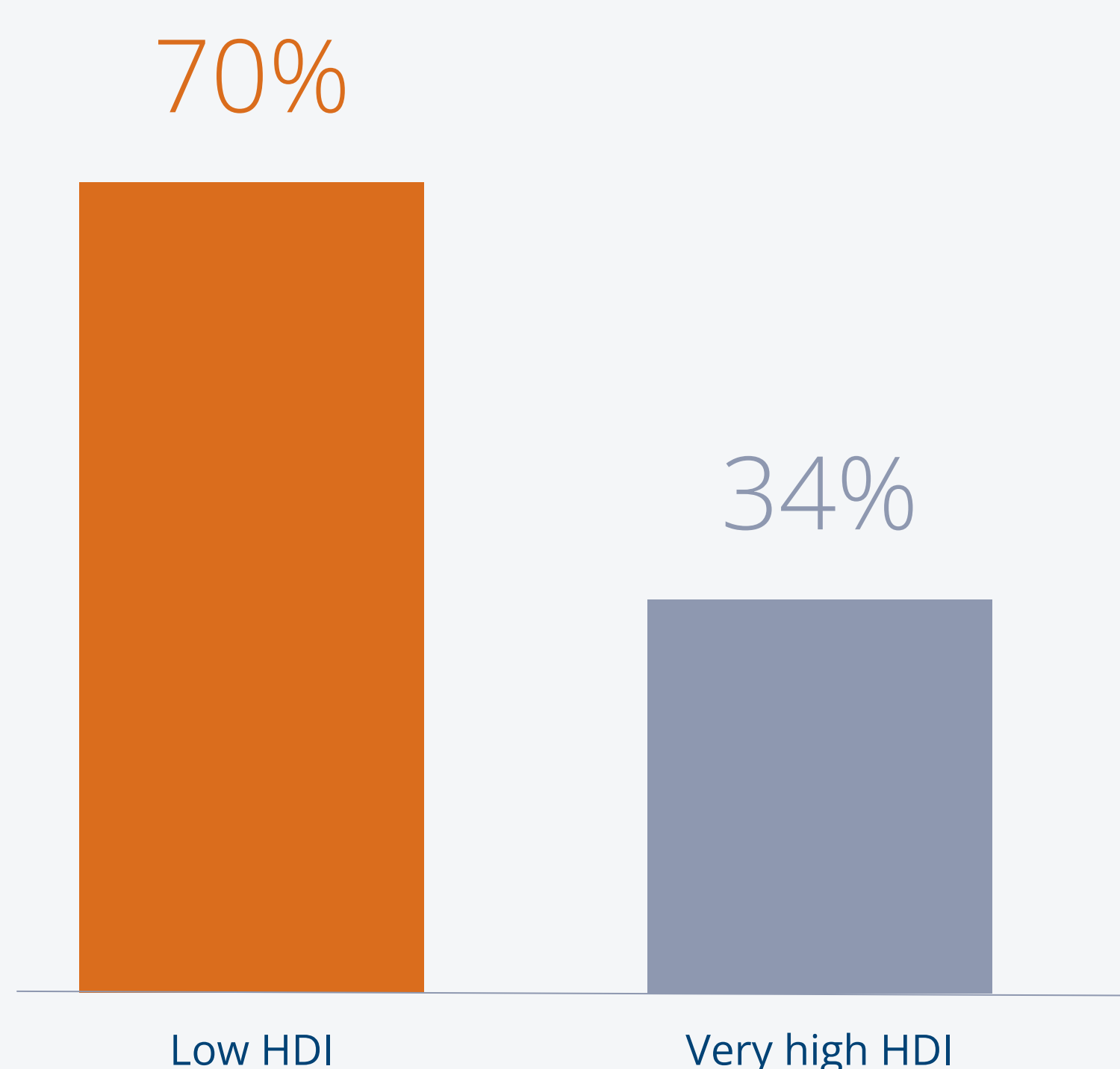
Cancer is a leading cause of death worldwide, accounting for nearly 10 million deaths in 2024¹ and this global health challenge is predicted to increase in the coming decades.²

The burden of cancer falls disproportionately on low- and middle-income countries (LMICs). For example, the mortality-to-incidence ratio (MIR), which provides insight into the timeliness of cancer diagnoses, effectiveness of cancer management, access to cancer care, and healthcare affordability at a population level,³ is more than double in countries that rank lower in the United Nations Human Development Index (HDI), compared to very high HDI countries (70% vs. 34%).

This inequity is projected to grow, with cancer deaths anticipated to increase 146% by 2050 in low-HDI countries compared with 57% in very high-HDI countries.²

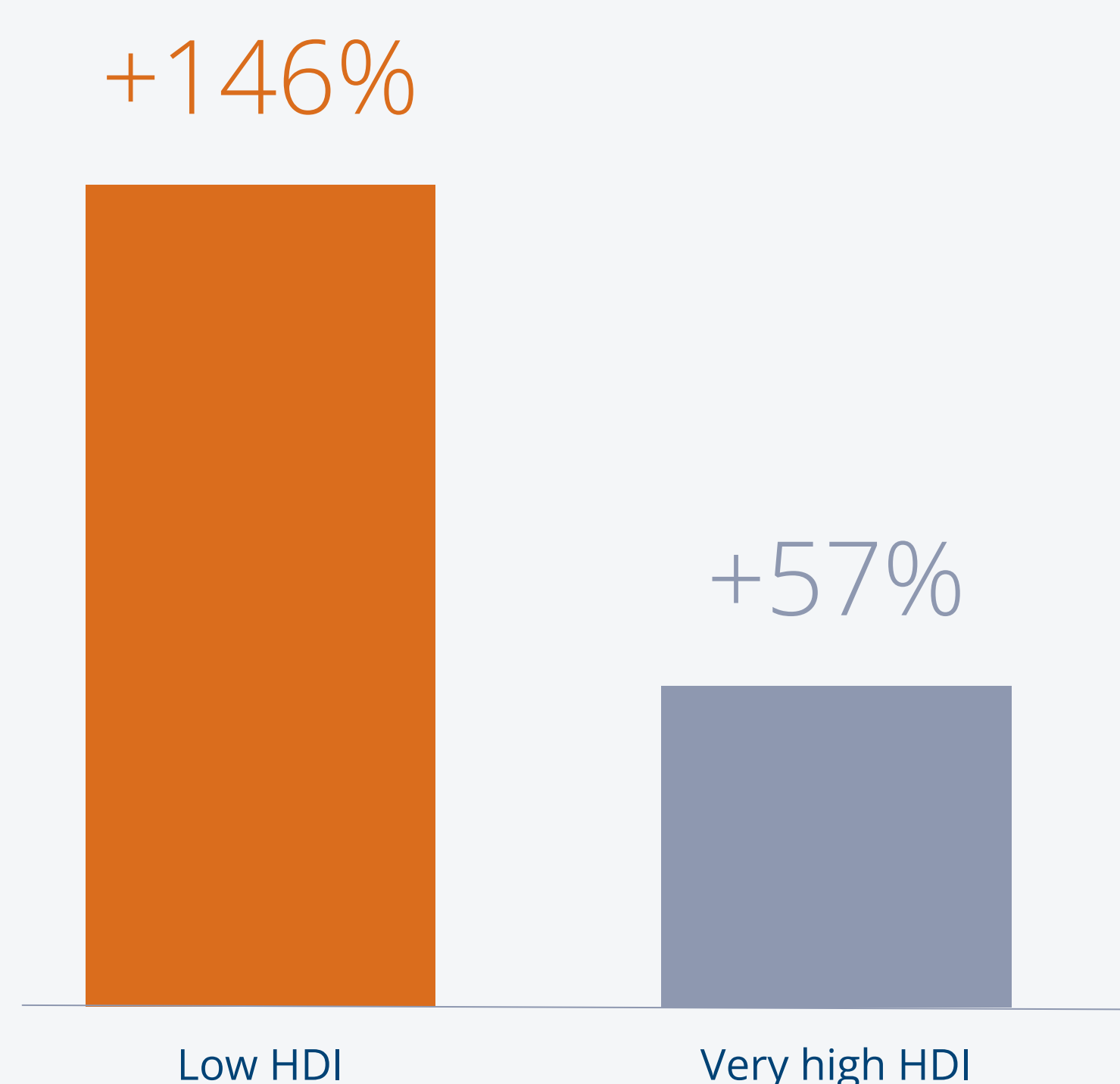
MORTALITY-TO-INCIDENCE RATIO

Share of diagnosed cancer cases that result in death



PROJECTED RISE IN DEATHS BY 2050

Increase in cancer deaths, by HDI level²



BEYOND INCOME LEVEL

High out-of-pocket costs are not limited to LMICs

42%

of annual income spent out of pocket in LMICs

It is important to recognize that high cancer-related out-of-pocket costs are not limited to LMICs. Even in high-income countries (HIC) with private insurance or universal health coverage, patients may face substantial cost sharing for cancer medicines and other treatment-related expenses.^{4,5}

16%

of annual income spent out of pocket in HICs

A systematic literature review found that cancer patients and caregivers spent 42% and 16% of their annual income on out-of-pocket expenses in low- and middle-income countries and HICs, respectively.⁴

BARRIERS ACROSS THE CONTINUUM OF CARE

The disproportionate burden of cancer mortality in both HICs and LMICs results from limitations across the entire continuum of care, including health system, societal, and financial factors. These include:

-  Underinvestment in prevention and early detection
-  Late-stage diagnosis and delayed presentation resulting from limited awareness of cancer symptoms, cultural/socioeconomic barriers to seeking care, time and cost needed to travel for medical care, and limited primary care and cancer specialist personnel
-  Limited diagnostic infrastructure
-  Limited access to treatment following diagnosis due to health system capacity constraints
-  High cost of specialty, innovative medicines and inadequate reimbursement or insurance coverage, resulting in many patients paying out of pocket for their medications.⁶

AFFORDABILITY IS A GLOBAL CHALLENGE

Affordability barriers are not confined to LMICs. In many upper-middle and high-income markets, public reimbursement or insurance may not fully cover the cost of innovative cancer medicines. As a result, a meaningful share of patients must pay out-of-pocket for their treatment.

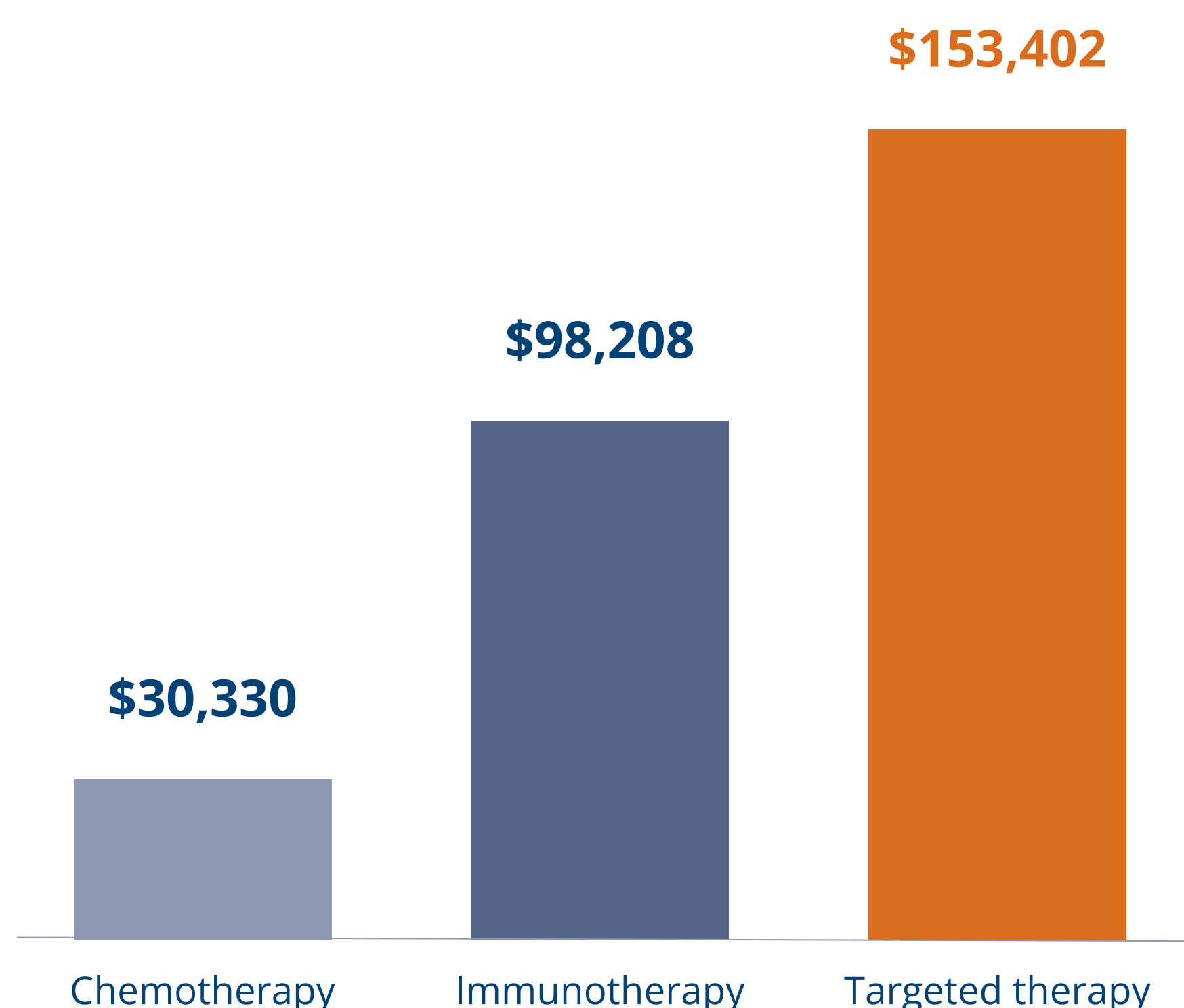
THE COST OF PROGRESS

Innovation outpacing affordability

Over the past decade, cancer treatment has moved beyond conventional chemotherapy toward targeted therapies, immunotherapies, and antibody-drug conjugates matched to the biology of each patient's tumor.

These advances have extended and improved millions of lives, but they come at a steep price. In gastrointestinal cancers, for example, the median total cost of treatment is US\$30,330 for chemotherapy, \$98,208 for immunotherapy, and \$153,402 for targeted therapy.⁷

Lower prices in emerging markets do not close the gap. Adjusted for GDP, that same targeted therapy would cost \$48,299 in China and \$19,131 in India. While the dollar price is lower in China and India compared with the United States, further assessment of these prices relative to nominal Gross National Income (GNI) per capita finds that the cost is 1.8x annual GNI per capita in the United States, 3.5x annual GNI per capita in China, and 7.2x annual GNI per capita in India.

**MEDIAN TOTAL TREATMENT COST,
GI CANCERS (US\$)****COST OF TARGETED THERAPY
ADJUSTED FOR GDP**

Multiples of annual GNI per capita

UNITED STATES**CHINA****INDIA**

Consequently, even at significantly lower prices, innovative cancer therapies remain financially out of reach for many patients living in countries where they must pay out-of-pocket for such medications.⁷⁻⁹

COMPOUNDING THE PROBLEM

To further compound the problem, many cancers are now managed as long-term conditions, with patients on treatment for months or years instead of a fixed number of cycles.

TODAY'S ACCESS MODELS

Overcoming financial barriers to cancer care in countries with significant out-of-pocket populations

Several access models have been developed to reduce the financial barriers faced by patients who pay out of pocket for cancer medicines. These include:



Donation programs

Medicines are provided free of charge



Tiered or differential pricing

Prices are adjusted to reflect local economic conditions



Public-private partnerships

Governments, NGOs, and pharmaceutical companies work together to lower medicine costs and reduce the financial burden on patients



Performance-based financial incentives

Pharmaceutical companies that supply lower-cost medicines receive interest subsidies, milestone payments, or performance-based rebates



Cost-sharing models

Such as Patient Assistance Programs (PAPs), in which patients cover a portion of the treatment cost



This analysis focuses on cost-sharing PAPs.

THE SUSTAINABILITY GAP

While these approaches have made headway in reducing the cost burden of cancer medicines, many have proven unsustainable for the patient or other involved stakeholders. As a result, many therapies remain financially out of reach.¹⁰

In this paper, sustainability refers to an access model's ability to support patients through their full prescribed course of treatment. A sustainable program helps patients not only start treatment but also complete it, giving them the best chance of achieving optimal medical outcomes.

OVERCOMING THE AFFORDABILITY GAP

Affordability is only one dimension of access

A key reason many access models are not sustainable is that affordability is only one dimension of access. Treatment initiation and adherence are shaped by a broad range of socioeconomic, health system, patient, disease, and medicine-related factors. When these factors are not reflected in program design, the result is often early patient dropout and premature program closure.

Factors that shape whether patients start and stay on treatment



OBJECTIVE OF THIS PAPER

From experience-based design to data-driven, predictive models

THEN

Experience, local market knowledge, retrospective evaluation



NOW

Systematic analysis of real-world program data to inform predictive insights

Despite their importance, there is limited published evidence on how these factors relate to patient outcomes within PAPs. This is largely because PAPs have historically been designed and managed on the basis of experience, and local market knowledge, rather than systematic analysis of program data.

That is beginning to change. As larger, longitudinal datasets become available, there is an opportunity to complement this expertise with data-driven, predictive insights. With oncology treatment costs rising and demand for PAPs growing, predictive tools built on real-world data can help pharmaceutical companies anticipate program performance, allocate resources more effectively, and address potential barriers before they arise, ultimately improving outcomes for patients.

This report presents the first large-scale analysis of administrative data from a multi-country, multi-product oncology PAP portfolio managed by Axios International. The analysis identifies the factors most strongly associated with four key patient outcomes: survival, duration of treatment, serious adverse events, and dropout. In doing so, it explores how real-world operational data can inform the design and management of future PAPs, and marks a first step in the shift from retrospective evaluation toward predictive access.



02

Study Overview

The Axios Oncology PAP database, the patient cohort, and how outcomes were measured.

ABOUT THE AXIOS ONCOLOGY PAP DATABASE

28 years of real-world program data

This study utilized data extracted from the Axios Oncology PAP database and included all patients in a PAP for an oncology product enrolled between June 10, 2016 and September 30, 2025.

18,076

patients enrolled in
oncology PAPs

21

countries

87

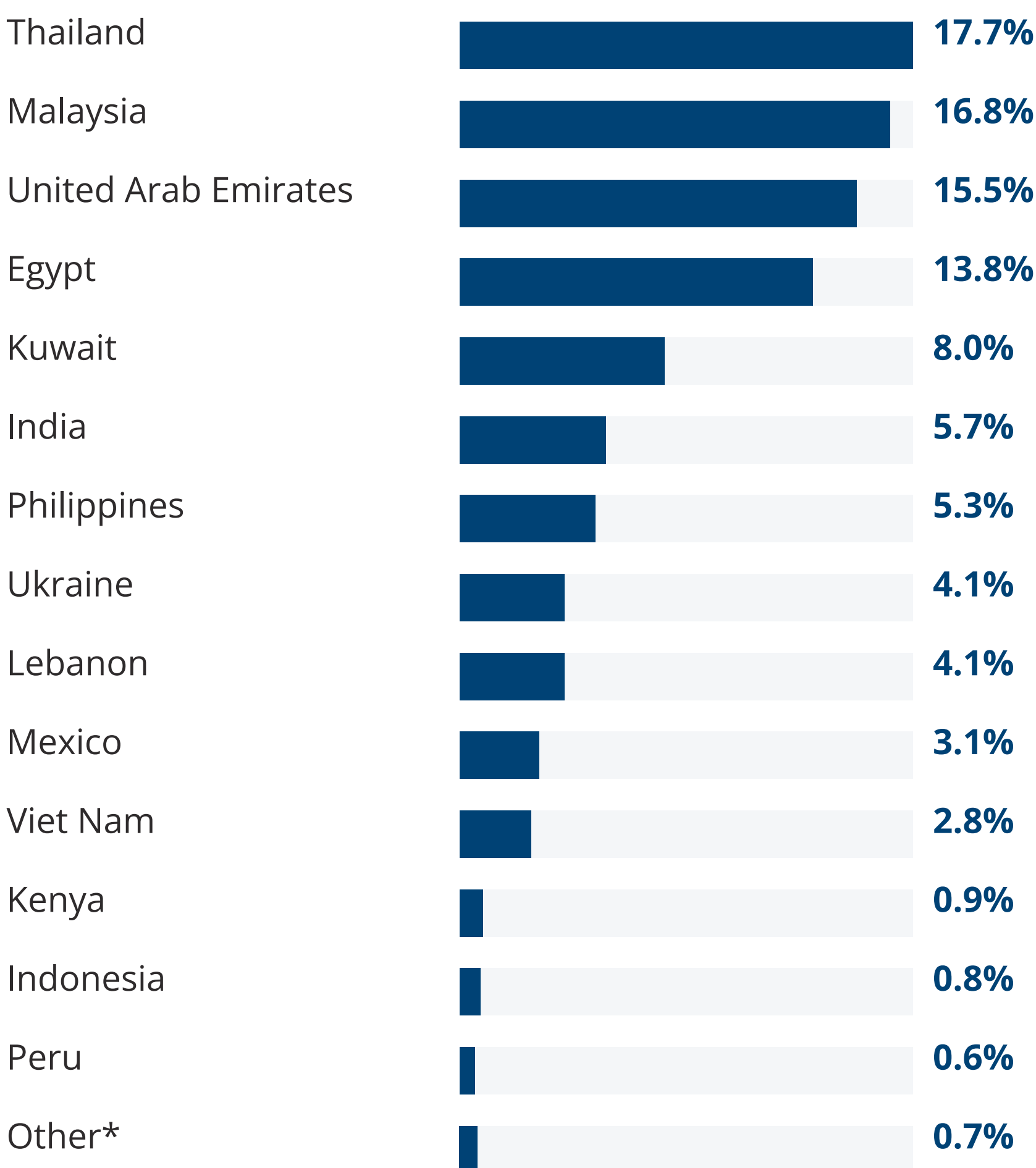
unique oncology
medications for a
range of cancers

28

years designing and
implementing PAPs

THE COHORT AT A GLANCE

PATIENTS BY COUNTRY



*Barbados, Ecuador, Guatemala, Jordan, Saudi Arabia, Trinidad and Tobago, and United Republic of Tanzania, collectively 1% of the cohort.

PATIENT PROFILE

54%

female

51.4

mean age (years) at
treatment start

8.2

average months in a PAP

11%

had a registered caregiver

TREATMENT FACILITY

Private 58%

Public 42%

30%

had health insurance*

48%

received charity support

*Insurance often did not cover the full cost of therapy, which is why patients participated in the PAP.

ANALYSIS COHORTS

18,076

Survival & duration of treatment

14,698

Serious adverse events & dropout

Excludes 3,378 patients still active at cutoff

Table 1 (see Appendix) summarizes characteristics of the patient cohort.

The cohort for serious adverse event and dropout is a subset of the full cohort used for survival and duration of treatment analysis. For the serious adverse events and dropout outcomes, analysis excluded patients still active on treatment at the cutoff date of September 30, 2025 (n=3,378 patients active) since their final outcome status was not yet known. The distribution of patients across factor levels is broadly similar between the full cohort and subset.

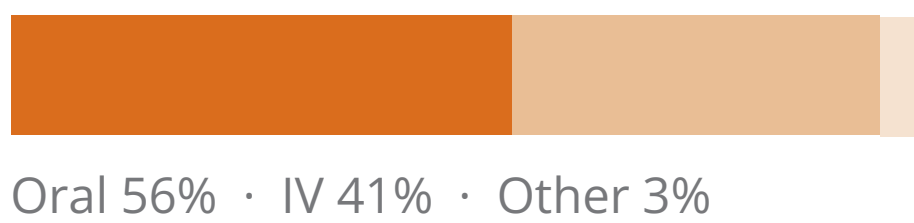
TREATMENT AND PROGRAM PROFILE

How patients were treated and supported

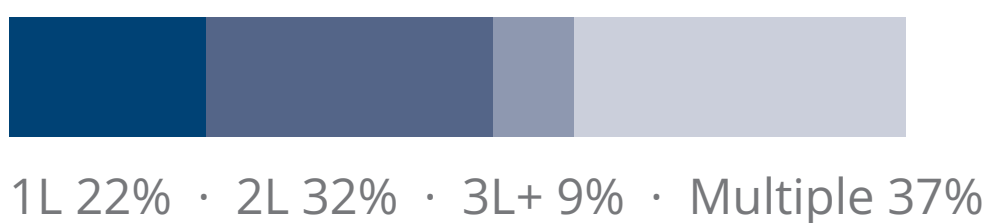
PRODUCT CLASS



ADMINISTRATION ROUTE



TREATMENT LINE



With respect to therapy-related factors, 22% and 32% of patients received the PAP therapy as first- or second-line treatment, respectively, and most patients (82%) received a targeted therapy.

Most patients (56%) received oral therapy, 41% received intravenous therapy, and 3% received therapy via other routes of administration.

SHARED-PAYMENT PROGRAMS

Importantly, this cohort comprises patients who participated in PAPs structured as shared payment programs.



While 46% of patients participated in a PAP with a fixed patient contribution (e.g., buy-one-get-one free), 54% were in PAPs in which patients contributed to the cost of their cancer medication based on their ability to pay as determined by Axios' Patient Financial Evaluation Tool (PFET).

ABOUT THE PATIENT FINANCIAL EVALUATION TOOL (PFET)

Developed by Axios, the PFET is a validated, multilateral index for determining patients' ability to contribute financially to the cost of medication based on income, expenditures, and asset-based wealth.¹¹

Importantly, the PFET can be adapted on a country-by-country basis to account for local economic variations. As an effective tool for determining an individual's ability to pay for medication, the PFET enables tiered PAP models that may help to increase access to high-price medications in out-of-pocket populations.



OUTCOMES AND FACTORS MEASURED

Outcomes and factors, tracked while patients were enrolled in the PAP

Four outcomes were assessed in this analysis. Together, these measures help show how long patients remained in the program and on treatment, as well as whether they experienced serious adverse events or discontinued participation.

WHILE ENROLLED IN THE PAP:



FACTORS ASSESSED

The following factors were assessed to determine their association with the above outcomes:



NOTE

Because the data source is PAP administrative information, each of these outcomes is limited to the time patients are in a PAP. For example, survival is not overall survival but survival while in a PAP. If a patient passes away after leaving a PAP, their death is not recorded in the database. In addition, it should be noted that clinical data such as cancer stage were not available.

METHOD

Method for determining association between outcomes and factors

1

Model all factors together

We used statistical models to assess which factors were associated with each outcome while accounting for other factors at the same time.

2

Compare with a reference

All factors were compared with a reference category. For example, Egypt, which is first in the alphabetized list of countries included in the analysis, was the reference level for the country factor in all analyses. Similarly, breast cancer is first in the alphabetized list of cancer indications and was thus used as the reference level for the indication factor in all analyses.

3

Test for significance

A heatmap was also created to make it easier to see which factors were associated with each outcome. Only associations that met the predefined threshold for statistical significance ($p \leq 0.05$) were included in the heatmap. When an association did not meet this threshold, the data were considered insufficient to conclude that there was a meaningful association.

4

Rank by strength

Among the statistically significant associations, we also compared the relative size of the effect. Larger effects were described as “strong” associations, while smaller effects were described as weak or moderate. Note that “strong” describes relative size within this model. It is not an absolute or clinically validated threshold.

See appendix for additional details on methodology.



03

Results

Which factors are most strongly associated with survival, duration of treatment, serious adverse events, and dropout.

OUTCOME 1 OF 4

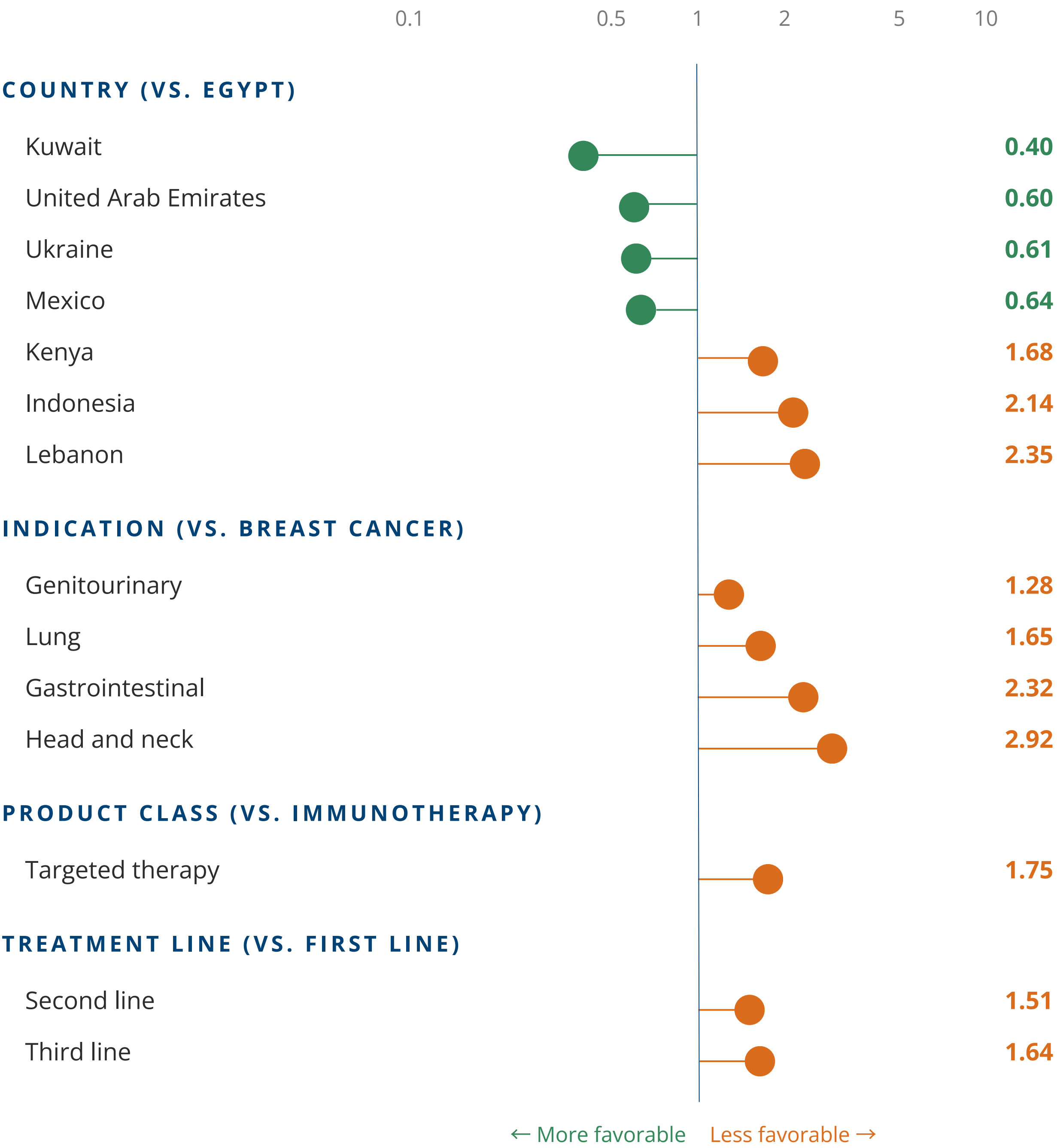
Factors associated with survival

Factors most strongly associated with survival were country, cancer type, class of product, and treatment line of product. Compared with Egypt, survival was better in Kuwait, the United Arab Emirates, Ukraine, and Mexico but worse in Lebanon, Indonesia, and Kenya. Head and neck, gastrointestinal, lung, and genitourinary cancers were linked to worse survival than breast cancer. Targeted therapies (versus immunotherapies) and second- and third-line treatments (versus first-line) were also linked to worse survival. Several other factors showed smaller but still meaningful associations with survival.

STRONGEST FACTORS

- Country
- Indication
- Product class
- Treatment line

Hazard ratio (HR) of death while in the PAP



Hazard ratios (HR) for death while in the PAP. Values below 1 indicate a more favorable outcome than the reference group; values above 1 a less favorable one. Strongest associations shown; full results in the figure that follows.

OUTCOME 1 OF 4 | SURVIVAL

What this tells us

Country context plays an important role in survival, even after controlling for all factors. Differences across countries could be driven by underlying issues such as access to diagnosis, access to care, differences in disease stage at inclusion in the program, or ability to regularly access a specialist physician.

Regarding product class, targeted therapy had worse survival compared with immunotherapy, which could reflect differences in efficacy among drugs. Additionally, indicated use of immunotherapy in some cancers with potentially better survival rates could also explain this result. Second- and third-line products were associated with worse survival compared with first-line, which probably reflects survival expectations for more advanced disease.

FIGURE 1: SURVIVAL | FULL MODEL RESULTS

A forest plot can be helpful to visually assess strength of association: is the relationship between the factor and the outcome statistically significant (p-value≤0.05), and if yes, how far does the Hazard ratios (HR) fall from the dotted line?

HR are shown as dots, and 95% confidence intervals (95% CI) are shown as bars extending from each dot. If the confidence intervals cross the dotted line at 1, it means there is not a statistically significant difference between a given level and the reference level of that factor.

HR values above 1 (red) indicate higher hazard of death while in PAP compared to the reference level. HR values below 1 (green) indicate lower hazard of death while in PAP compared to the reference level.

EXAMPLE

After controlling for all other factors, at any given moment cancer patients in Indonesia have 2.14 times higher hazard of death (114% higher) while in their PAP than cancer patients in Egypt.

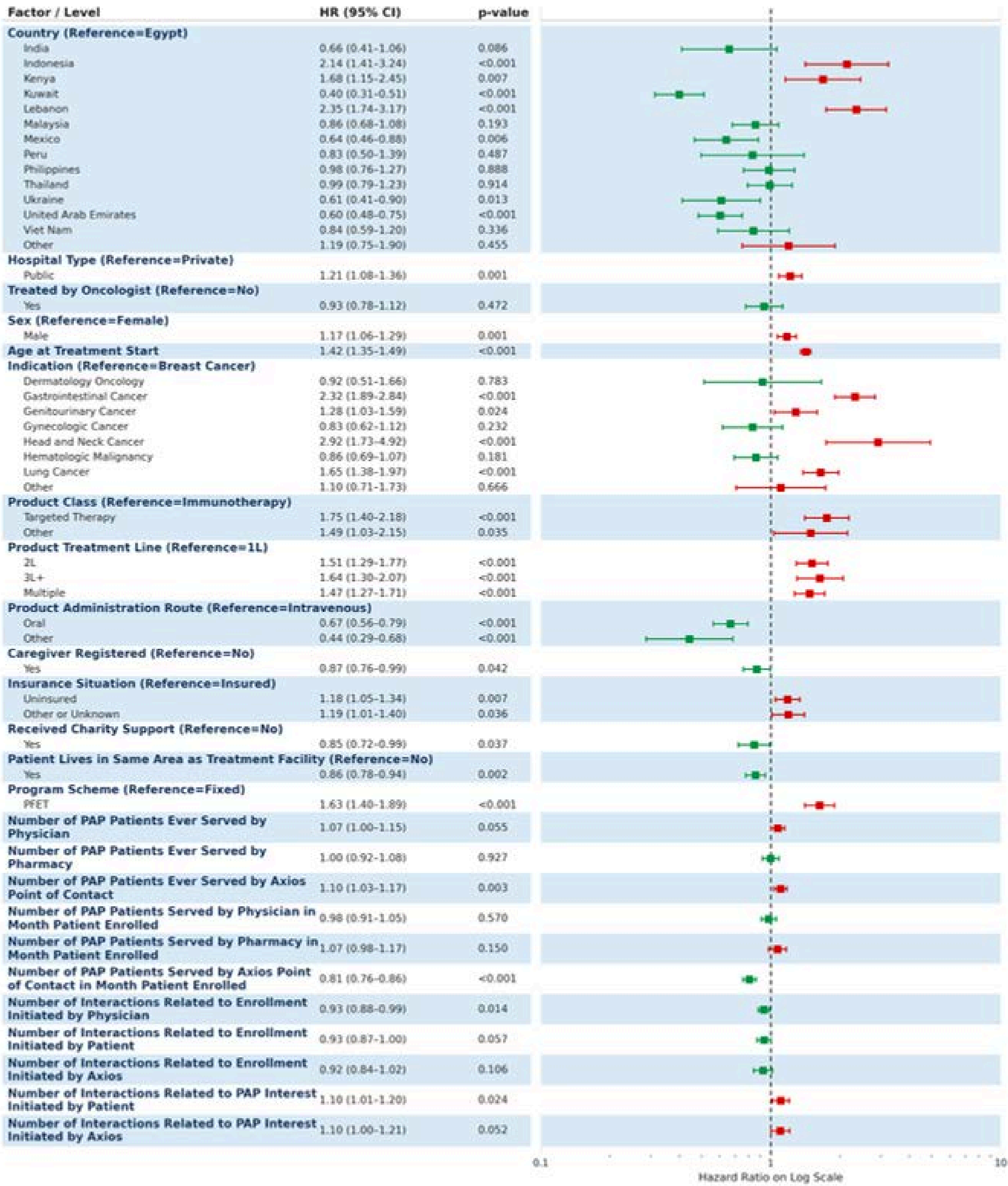


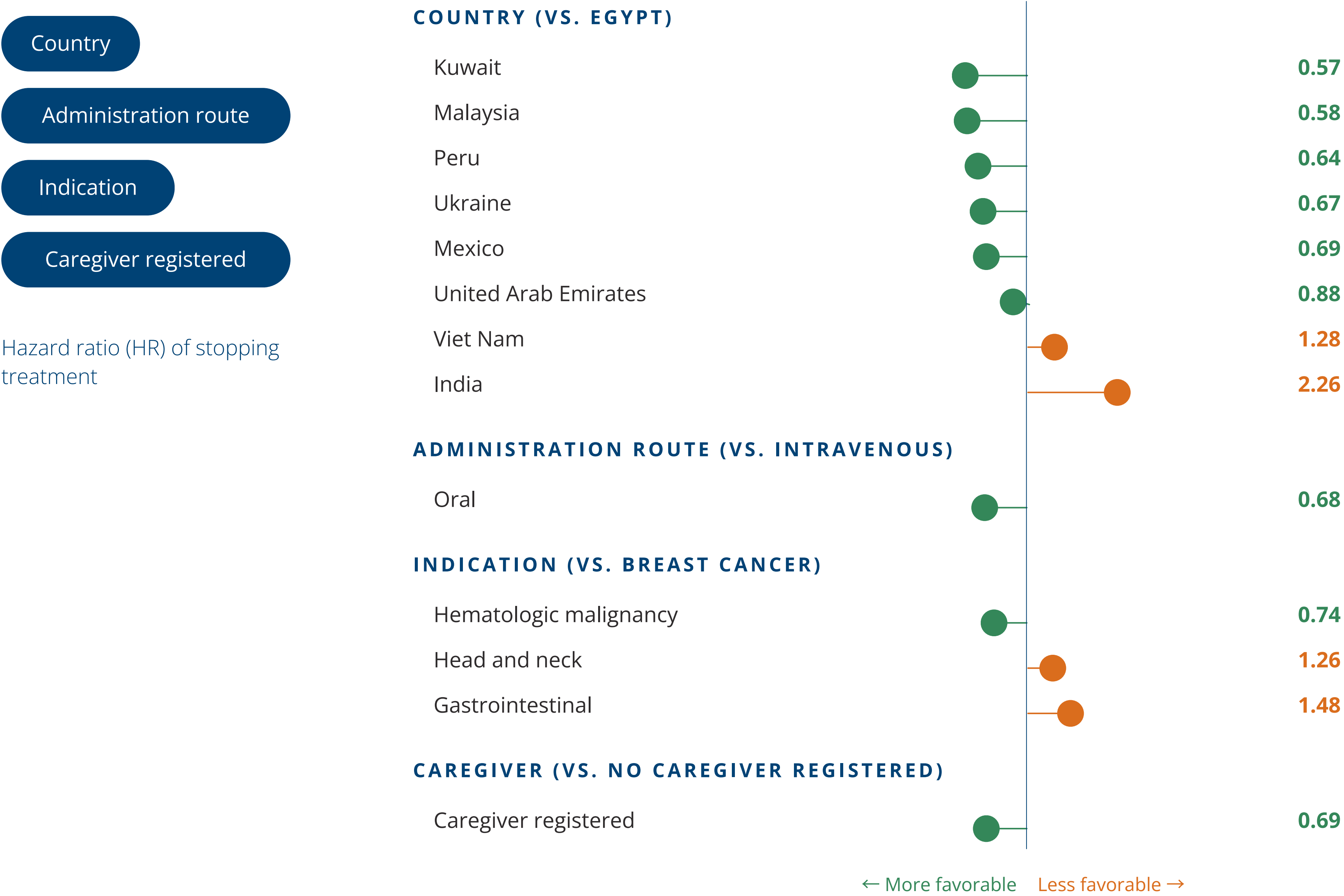
Figure 1. Forest plot summarizing the outputs of the cause-specific Cox model for survival.

OUTCOME 2 OF 4

Factors associated with duration of treatment

Factors most strongly associated with duration of treatment were country, product administration route, indication, and whether a caregiver was registered for the patient. Compared with Egypt, duration of treatment was longer in Kuwait, Malaysia, Peru, Ukraine, Mexico, and the United Arab Emirates, but shorter in India and Viet Nam. Products administered orally were associated with longer duration of treatment than those administered intravenously. Compared with breast cancer, hematologic malignancy was associated with longer duration of treatment while gastrointestinal and head and neck cancers were associated with shorter duration of treatment. Having a registered caregiver was associated with longer duration of treatment. Several other factors showed smaller but still meaningful associations.

STRONGEST FACTORS



Hazard ratios (HR) for stopping treatment; below 1 means longer duration of treatment. Values below 1 indicate a more favorable outcome than the reference group; values above 1 a less favorable one. Strongest associations shown; full results in the figure that follows.

OUTCOME 2 OF 4 | DURATION OF TREATMENT

What this tells us

As with survival, country context was an important factor in duration of treatment, with meaningful differences observed across countries even after accounting for other factors in the analysis.

Indication was also associated with differences in treatment duration. These differences may reflect several considerations, including the average length of treatment regimens for products used within each indication, differences in treatment tolerance (adverse events), physician preferences around switching products, or differences in disease progression across indications, or vulnerability of patients, among other reasons.

Regarding route of administration, oral therapy can be administered at home, removing travel or cost barriers that may exist with intravenous therapies administered preferentially in a clinic and helping patients stay on treatment longer. Otherwise, caregiver support may help patients remain on treatment by providing practical or emotional support and helping patients manage the demands of ongoing care.

FIGURE 2: DURATION OF TREATMENT | FULL MODEL RESULTS

HRs above one (red) indicate increased hazard of stopping treatment and generally shorter duration of treatment, while HRs below one (green) indicate decreased hazard of stopping treatment and generally longer duration of treatment, relative to the reference level.

See Figure 1 for how to read a forest plot.

EXAMPLE

After controlling for all other factors, at any given moment cancer patients in India have 2.26 times higher hazard of stopping their treatment (126% higher) than cancer patients in Egypt. A patient stops their treatment due to treatment plan completion or dropout, with dropout including serious adverse event and mortality.



Figure 2. Forest plot summarizing the outputs of the Cox model for duration of treatment.

OUTCOME 3 OF 4

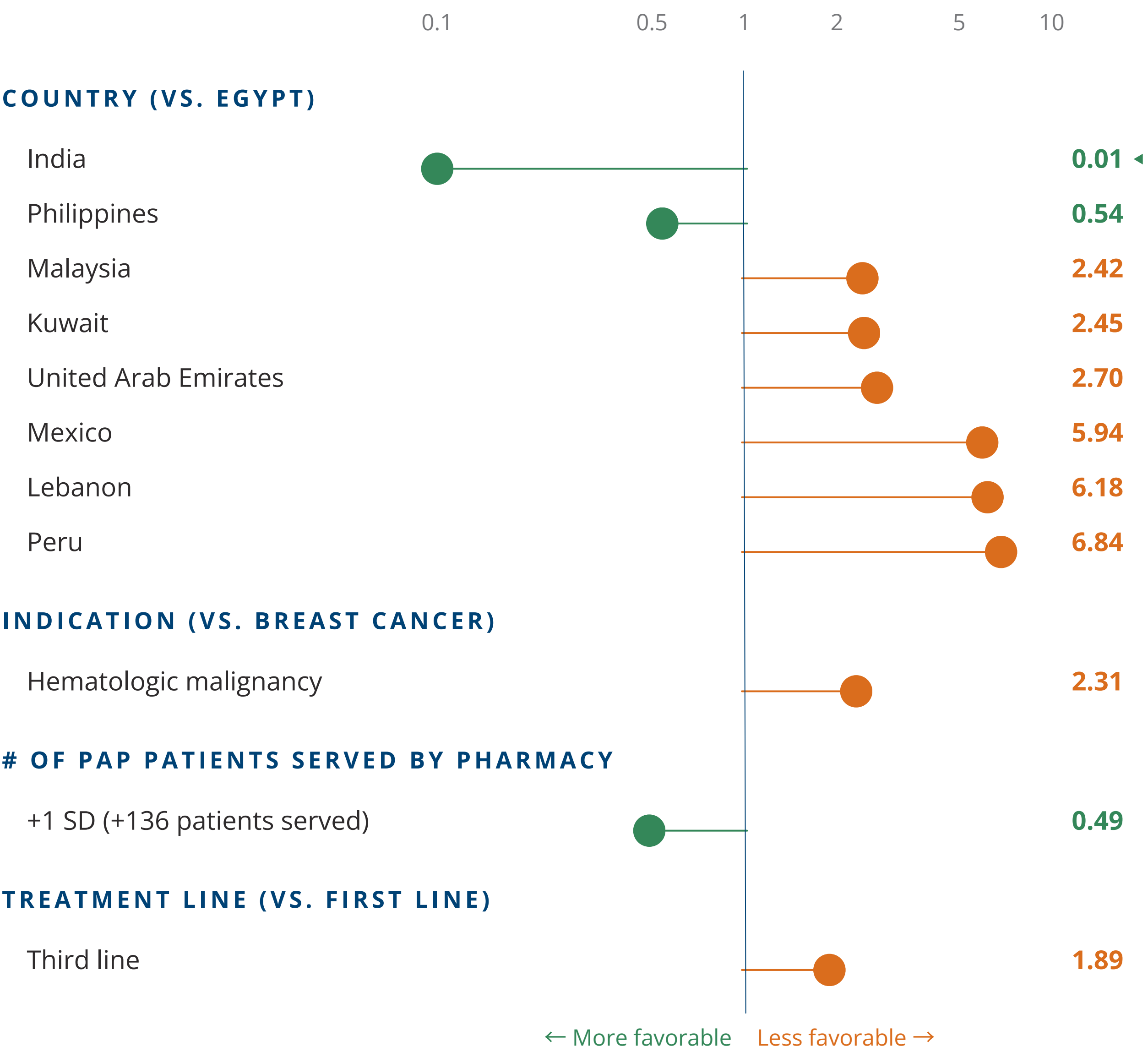
Factors associated with serious adverse events

Factors most strongly associated with serious adverse events were country, indication, number of PAP patients ever served by pharmacy, and product treatment line. Compared with Egypt, the odds of serious adverse events were lower in India and the Philippines but higher in Peru, Lebanon, Mexico, the United Arab Emirates, Kuwait, and Malaysia. No serious adverse events were recorded in India, likely reflecting patients' shorter time in the program. Hematologic malignancy was linked to higher odds of serious adverse events than breast cancer. A patient obtaining their medicine from a pharmacy with more experience serving PAP patients was associated with lower odds of serious adverse events. Third-line products were associated with higher odds of serious adverse events compared with first-line products. Overall, fewer factors were linked to serious adverse events than to survival or duration of treatment.

STRONGEST FACTORS

- Country
- Indication
- Number of PAP patients served by pharmacy
- Treatment line

Odds ratio (OR) of a serious adverse event



Odds ratios (OR) for a serious adverse event while in the PAP. India's OR of 0.01 is shown at the edge of the scale. Values below 1 indicate a more favorable outcome than the reference group; values above 1 a less favorable one. Strongest associations shown; full results in the figure that follows.

OUTCOME 3 OF 4 | SERIOUS ADVERSE EVENTS

What this tells us

Consistent with the findings for survival and duration of treatment, country was an important factor in the odds of experiencing serious adverse events while enrolled in the PAP. Differences across countries may reflect differences in disease stage, patient characteristics, treatment tolerance, or how consistently serious adverse events are perceived by the patient (e.g. cultural background), identified and reported. The finding in India is notable, with no serious adverse events recorded among cancer patients in the analysis. Because events could have been recorded but were not, this represents a finding rather than missing data. One possible explanation is the much shorter treatment duration observed in India. Patients spending less time in the program have less opportunity for a serious adverse event to occur. In terms of indication, patients with hematologic malignancy may have higher odds of serious adverse events due to stronger, more toxic treatments or weaker baseline health, relative to breast cancer patients.

Pharmacy experience with PAP patients was associated with lower odds of serious adverse events. The number of PAP patients a pharmacy has served can act as a measure of its experience supporting patients who use high-cost oncology medicines. More experienced pharmacists may be better positioned to help patients identify and address potential problems early, including through medication guidance, monitoring for warning signs, and advice on appropriate medication use. Finally, third-line treatment was associated with higher odds of serious adverse events than first-line treatment. This may reflect differences in patients' underlying health at later stages of treatment.

FIGURE 3: SERIOUS ADVERSE EVENTS | FULL MODEL RESULTS

The models used for survival and duration of treatment reported HRs. The higher the HR, the higher the rate at which patients experience the event (death or stopping treatment) at any given point in time. This model instead reports odds ratios (ORs). Unlike HRs, ORs are not concerned with when an event happens, just whether it happened.

OR values above 1 (red) indicate higher odds of serious adverse events while in PAP compared to the reference level, while OR values below 1 (green) indicate lower odds of serious adverse events while in PAP compared to the reference level.

EXAMPLE

After controlling for all other factors, cancer patients in Kuwait have 2.45 times higher odds of experiencing a serious adverse event while in their PAP (145% higher) than cancer patients in Egypt.

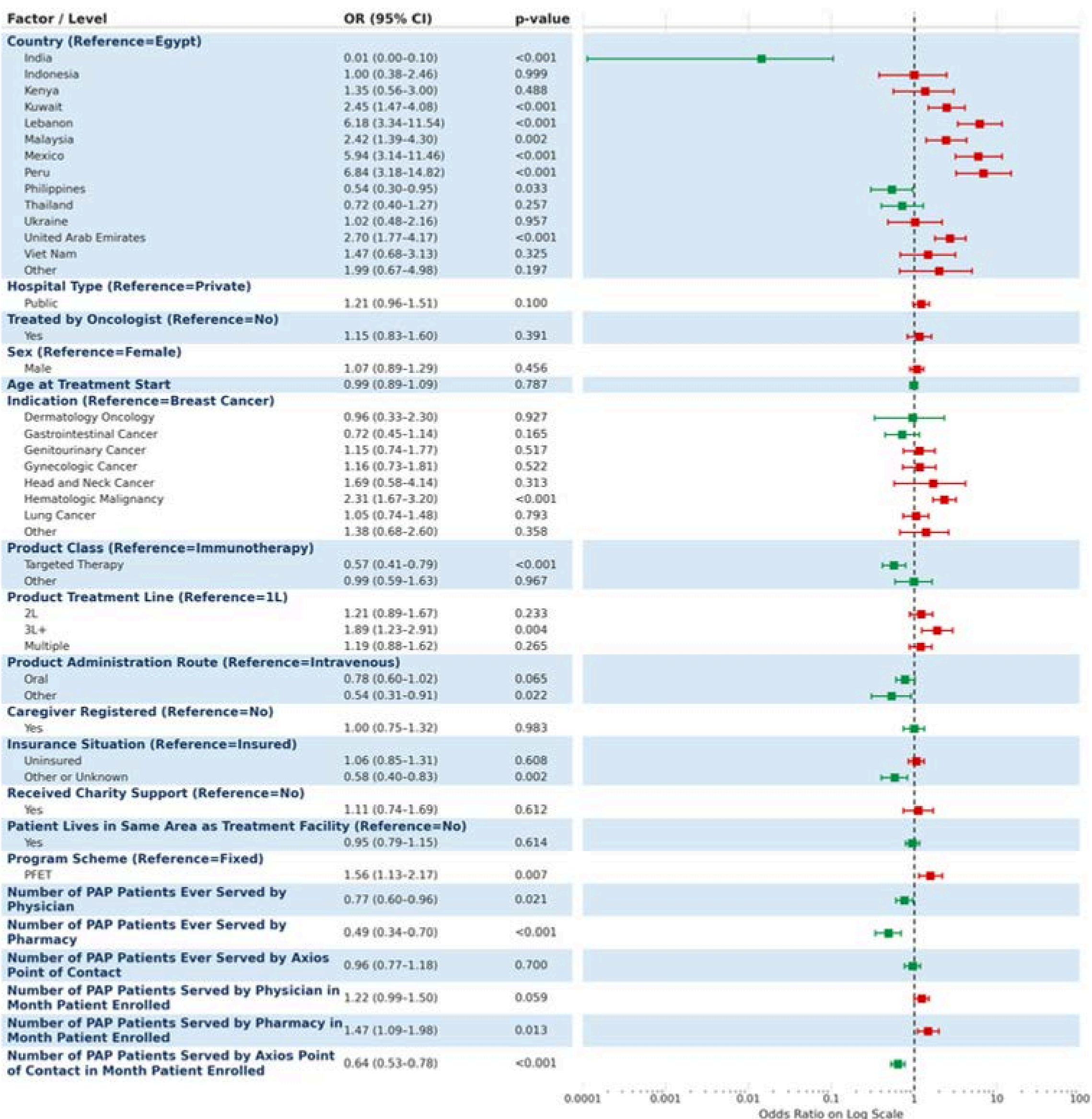


Figure 3. Forest plot summarizing the outputs of the multivariable Firth's bias-reduced penalized-likelihood logistic regression model for serious adverse event.

OUTCOME 4 OF 4

Factors associated with dropout

Factors most strongly associated with dropout were indication, country, product class, and product administration route. Hematologic malignancy was associated with lower odds of dropout while gastrointestinal cancer was associated with higher odds of dropout than breast cancer. Compared with Egypt, the odds of dropout were lower in Malaysia and Lebanon but higher in India, the United Arab Emirates, and the Philippines. Targeted therapies were associated with lower odds of dropout than immunotherapies. Products administered orally were associated with higher odds of dropout than those administered intravenously. Several other factors showed smaller but still meaningful associations with dropout.

STRONGEST FACTORS

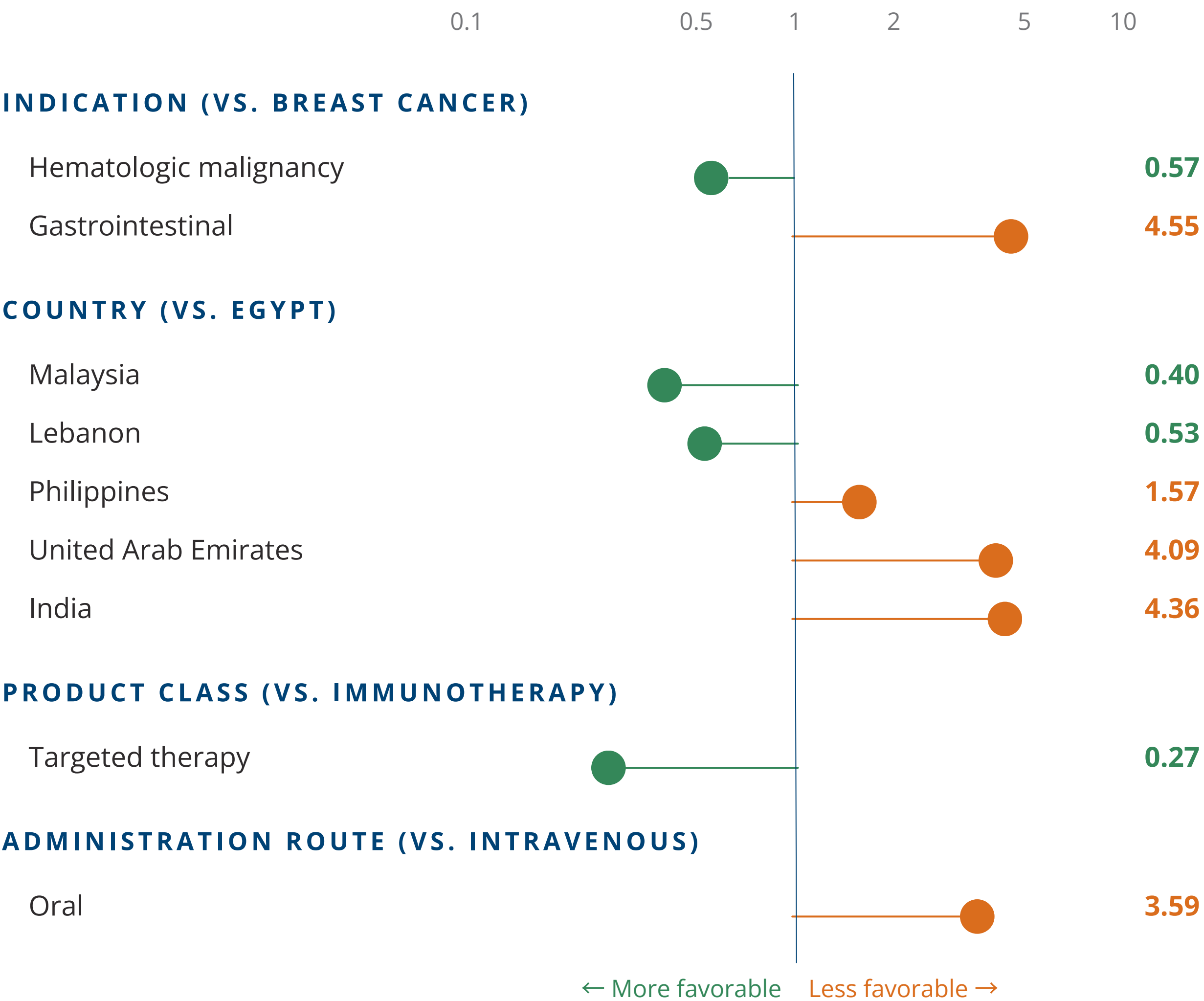
Indication

Country

Product class

Administration route

Odds ratio (OR) of dropping out of the PAP



Odds ratios (OR) for dropout. Values below 1 indicate a more favorable outcome than the reference group; values above 1 a less favorable one. Strongest associations shown; full results in the figure that follows.

OUTCOME 4 OF 4 | DROPOUT

What this tells us

As with the other outcomes, country was an important factor in dropout. Differences in patient education, cultural background and experiences, household resources, health system factors, management of drug by physician, program management, and other local circumstances may contribute to these differences. Indication related findings may be associated with typical disease progression and treatment patterns, with hematologic malignancies often requiring more sustained treatment and less product switching, while gastrointestinal cancers may progress more quickly and involve more frequent treatment changes.

Lower odds of dropout for targeted therapy versus immunotherapy could be due to differences in tolerability. The findings for oral versus intravenous treatment are particularly interesting. Oral therapy was associated with longer overall treatment duration but also higher odds of dropout. Taken together, this suggests that patients taking oral medicines may remain on treatment longer overall, but when they stop, they may be more likely to do so before completing their treatment plan. Taking medication at home may reduce travel, time, and other costs associated with clinic-based intravenous treatment, helping patients stay on therapy. At the same time, oral treatment at home involves less direct interaction with the healthcare system, which may mean fewer routine touchpoints to reinforce treatment continuation or identify challenges early.

FIGURE 4: DROPOUT | FULL MODEL RESULTS

Like the model for serious adverse events, this model also reports ORs. Values above 1 (red) indicate higher odds of dropout compared to the reference level, while OR values below 1 (green) indicate lower odds of dropout compared to the reference level.

EXAMPLE

After controlling for all other factors, cancer patients in India have 4.36 times higher odds of dropout (336% higher) than cancer patients in Egypt.

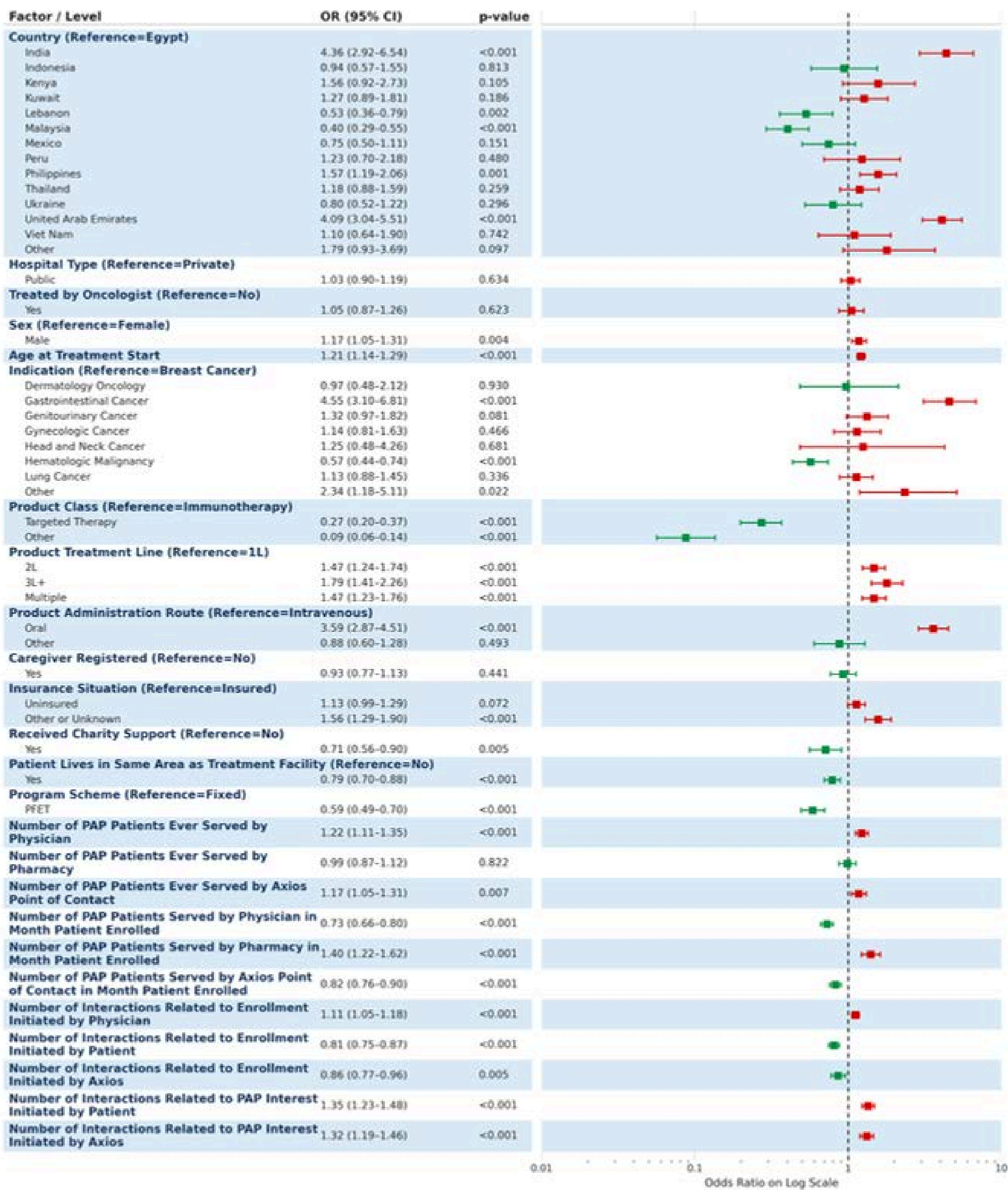


Figure 4. Forest plot summarizing the outputs of the multivariable logistic regression model for dropout.

Predictive Heatmap Summary

This heatmap gives a quick visual sense of how strongly each factor relates to each outcome. It also shows which factors have strong links across several levels and outcomes.

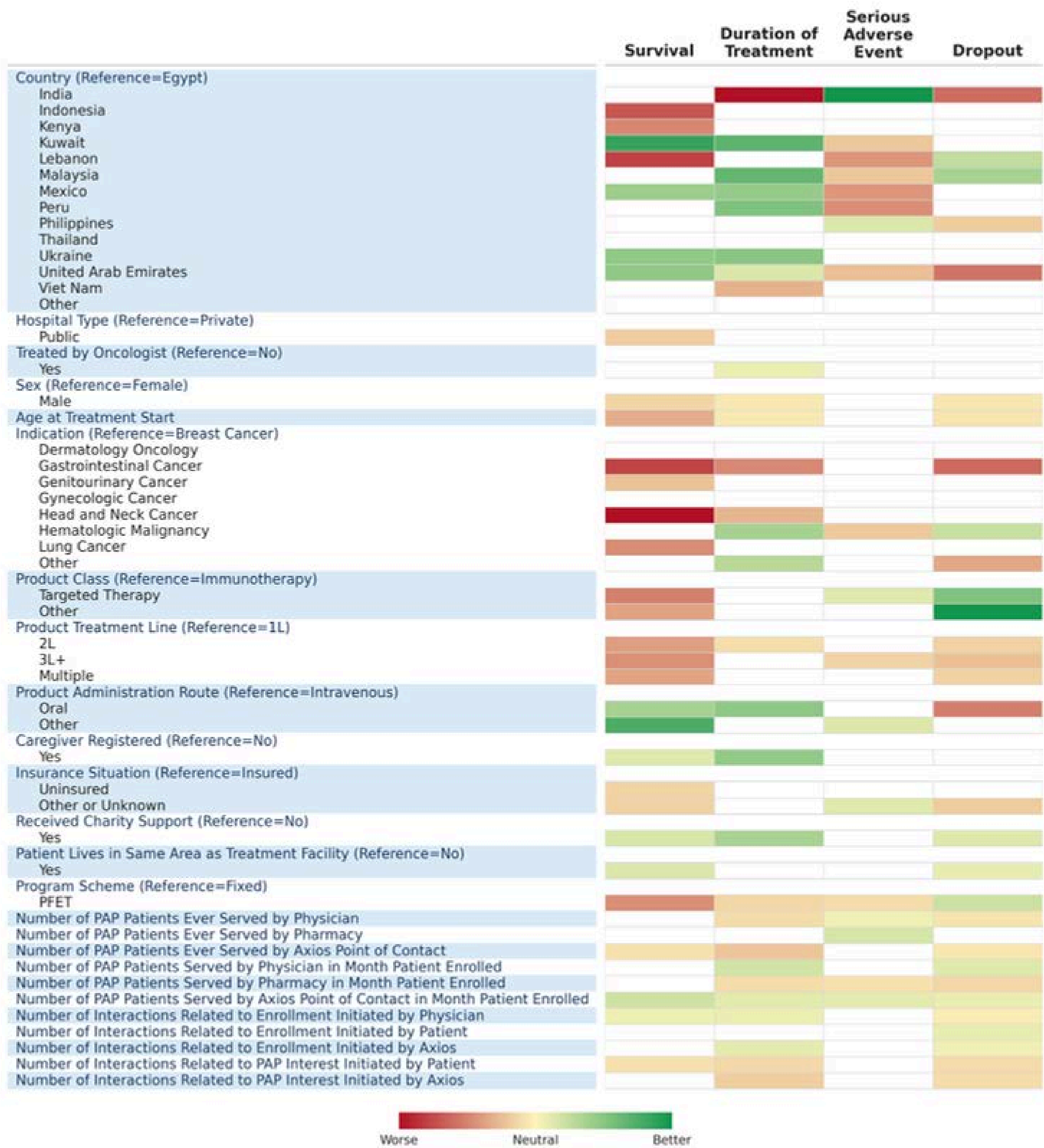
HOW TO READ IT

The columns capture outcomes, and the rows capture factors and levels within each factor. Darker shading means a stronger link to the outcome.

-  Green means a better outcome for patients.
-  Red means a worse outcome.
-  White means the result was not statistically significant (p≤0.05 was not met) for that outcome.

For non-numeric factors, such as country or cancer type, each category is compared with a reference category. For example, every country is compared with Egypt.

Figure 5: Factors Associated with Outcomes



These patterns illustrate why the outcomes should be considered together rather than interpreted in isolation.

EXAMPLE INTERPRETATION FOR KUWAIT

After controlling for all other factors, being in Kuwait versus Egypt is associated with better survival, longer duration of treatment and increased odds of experiencing serious adverse events. The cell for dropout is white because there is insufficient evidence that the odds of dropout differ between patients in Kuwait and those in Egypt.

FACTORS WITH STRONG ASSOCIATIONS ACROSS OUTCOMES

Country

Country remained strongly associated with the measured outcomes even after accounting for patient demographics, cancer type, and product characteristics. This suggests that the country variable may capture a range of underlying factors that differ across healthcare settings and may influence patient outcomes, including:

- 

Health system and economic context

A country’s economic conditions, healthcare system, and level of government coverage can affect access to care, treatment costs, and patients’ ability to remain on treatment.
- 

Genetic variation

Genetic differences across populations may influence disease progression, response to treatment, and medication tolerability. However, the current analysis does not establish whether genetic differences explain the observed country-level associations.
- 

Cultural factors

Attitudes toward cancer, medication use, and healthcare can vary across countries and may influence treatment adherence and program retention. In a previous study of medication adherence in chronic disease, Axios International found that patients who reported cultural habits or spiritual beliefs as influential in their lives were more likely to be lost to follow-up at one year.¹² Because the importance of these factors varies across the countries included in the current analysis, they may be among the factors contributing to the observed association between country and patient outcomes.

READING OUTCOMES TOGETHER: COMPARED WITH PATIENTS IN EGYPT

	Survival	Duration	Serious adverse events	Dropout
Kuwait	Better	Better	Worse	–
Mexico	Better	Better	Worse	–
India	–	Worse	Better	Worse

Dash = no statistically significant difference. “Better” on serious adverse events means lower odds.

Looking across outcomes reveals some interesting country-level patterns. For example, compared with patients in Egypt, patients in Kuwait and Mexico had longer survival and treatment duration, but higher odds of a serious adverse event. In contrast, patients in India had shorter treatment duration but lower odds of serious adverse events than patients in Egypt.

One possible explanation is the amount of time patients spend in the PAP. Patients in Kuwait and Mexico remain in the program longer, providing more opportunity for a serious adverse event to occur and be recorded. Conversely, patients in India leave the PAP sooner, resulting in less time during which a serious adverse event could occur or be observed.

FACTORS WITH STRONG ASSOCIATIONS ACROSS OUTCOMES

Indication

Looking across outcomes, most cancer types with a statistically significant association showed less favorable outcomes than breast cancer. Gastrointestinal and head and neck cancers showed substantially shorter survival and modestly shorter treatment duration compared with breast cancer.

READING OUTCOMES TOGETHER: COMPARED WITH BREAST CANCER

	Survival	Duration	Serious adverse events	Dropout
Gastrointestinal	Worse	Worse	–	Worse
Head and neck	Worse	Worse	–	–
Hematologic malignancy	–	Better	Worse	Better

Dash = no statistically significant difference. “Better” on duration means longer treatment; “Worse” on serious adverse events means higher odds.

Hematologic malignancies showed a different pattern. Patients had longer treatment duration and lower odds of dropout than patients with breast cancer, but slightly higher odds of experiencing a serious adverse event.

The higher odds of a serious adverse event may partly reflect longer treatment duration and lower dropout, which give patients more time and opportunity to experience and have an event recorded. It is also possible that serious adverse events are more common among patients with hematologic malignancies or with the treatments used for these cancers.

These findings are not contradictory. Serious adverse events accounted for only a small proportion of dropouts, meaning that an indication can have higher odds of a serious adverse event while still having lower overall odds of dropout.

FACTORS WITH STRONG ASSOCIATIONS ACROSS OUTCOMES

Product class and administration route



Product class

Targeted therapies were associated with shorter survival but lower odds of serious adverse events and dropout compared with immunotherapies. These differences may partly reflect differences in patient disease status, as patients with more advanced or serious disease may be more likely to receive targeted therapies.

The lower odds of serious adverse events and dropout could also reflect differences in treatment tolerability. Targeted therapies may be less likely to cause serious adverse events that lead patients to discontinue treatment than immunotherapies.

Because dropout includes death, the combination of shorter survival and lower dropout among patients receiving targeted therapies is notable. It suggests that while these patients were less likely to drop out overall, those who did drop out may have been more likely to do so because of death.

Product administration route

Oral therapies were associated with longer survival and treatment duration, but higher odds of dropout, compared with intravenous therapies. As with product class, these differences may partly reflect patient characteristics, with patients in poorer health potentially more likely to receive intravenous treatment.

The higher odds of dropout among patients receiving oral therapies may also reflect differences in how treatment is managed. Unlike intravenous therapy, which typically involves scheduled clinic visits for each treatment cycle, oral therapy is often taken at home and may involve fewer routine healthcare touchpoints.

The combination of better survival and higher dropout suggests that patients receiving oral therapies may be more likely to discontinue the PAP for reasons other than death, such as a change in medication or treatment plan.

FACTORS LACKING STRONG ASSOCIATIONS ACROSS OUTCOMES

What mattered less than expected

Several factors showed a weak or moderate association with one of the four outcomes and no statistically significant association with the remaining outcomes:



Hospital type

Public versus private hospitals showed a weak association with survival, with modestly shorter survival observed in public hospitals, but no statistically significant association with the other three outcomes.



Physician type

Patients treated by an oncologist had slightly longer treatment duration, but physician type was not statistically significant for the other outcomes.



Insurance status

Uninsured patients had slightly worse survival than insured patients, but insurance status was not statistically significant for the other outcomes.



Pharmacy PAP experience

The number of PAP patients previously served by a pharmacy was strongly associated only with serious adverse events, with greater pharmacy experience associated with lower odds of a serious adverse event. It was not statistically significant for the other outcomes.

WHAT THESE FINDINGS SUGGEST

After accounting for the other factors in the analysis, we found no statistically significant evidence that multiple outcomes varied based on hospital type, physician type, insurance status, or pharmacy PAP experience.

Importantly, a lack of statistically significant evidence does not mean that two groups are equivalent. These findings may also reflect broader factors, including where PAPs are deployed, how they are implemented, and the types of patients they serve.

Taken together, these findings help distinguish which factors appear consistently associated with patient outcomes from those with weaker or more limited associations. This can help identify areas for further research and inform how PAPs are designed and implemented to better support patients.



04

Conclusions

Real-world data as the foundation for predictive access, and a phased path to get there.

ENABLING PREDICTIVE ACCESS

The value of real-world data as an enabler of predictive access

Expanding access to life-saving medicines in low- and middle-income countries (LMICs), as well as for non-reimbursed populations in higher-income countries, is essential to improving health outcomes for millions of patients. As the global cancer burden continues to grow, there is an urgent need for access programs that are sustainable, scalable, and responsive to patients' real-world needs.

Real-world data from Patient Assistance Programs (PAPs) offer a valuable resource for developing more patient-centered and sustainable models of access. By analyzing operational and patient outcome data, organizations can move beyond simply measuring program performance to identifying patterns, anticipating challenges, and informing more proactive program design and management.

THESE INSIGHTS CAN HELP

Improve program design by identifying patient, treatment, and program factors associated with outcomes



Set more realistic expectations for program performance across different markets and patient populations



Identify where targeted interventions may be needed to improve treatment continuation and patient retention



Support proactive decision-making to improve patient outcomes while strengthening program sustainability



Identify potential drivers of success and root causes of underperformance, providing a foundation for continuous program improvement

PUTTING INSIGHTS TO WORK

From findings to program decisions

RETENTION CHALLENGE

India

2.26x

hazard of stopping treatment vs. Egypt

4.36x

odds of dropout vs. Egypt

ROOT-CAUSE ANALYSIS

This study illustrates how these insights can be applied. For example, our study found that patients in India had shorter treatment duration and higher dropout than patients in Egypt, even after accounting for other factors.

Identifying the underlying drivers of lower retention and treatment plan completion in India could help inform targeted interventions and future PAP design.

DRIVER OF SUCCESS

Malaysia

0.58

hazard of stopping treatment vs. Egypt (longer treatment)

0.40

odds of dropout vs. Egypt

LEARN AND REPLICATE

In contrast, patients in Malaysia exhibit much higher duration of treatment and lower dropout than patients in Egypt. An exploration of drivers of relative success may reveal program design features or staff practices that could be emulated in other settings.

Alternatively, such an analysis may identify cultural or sociodemographic factors specific to Malaysia, which could be incorporated into new programs deployed in the country.

Understanding whether these differences are driven by program operations, patient characteristics, healthcare system factors, or other influences is an important step toward addressing challenges before they become persistent barriers to patient access.

A phased approach to realizing the power of predictive access

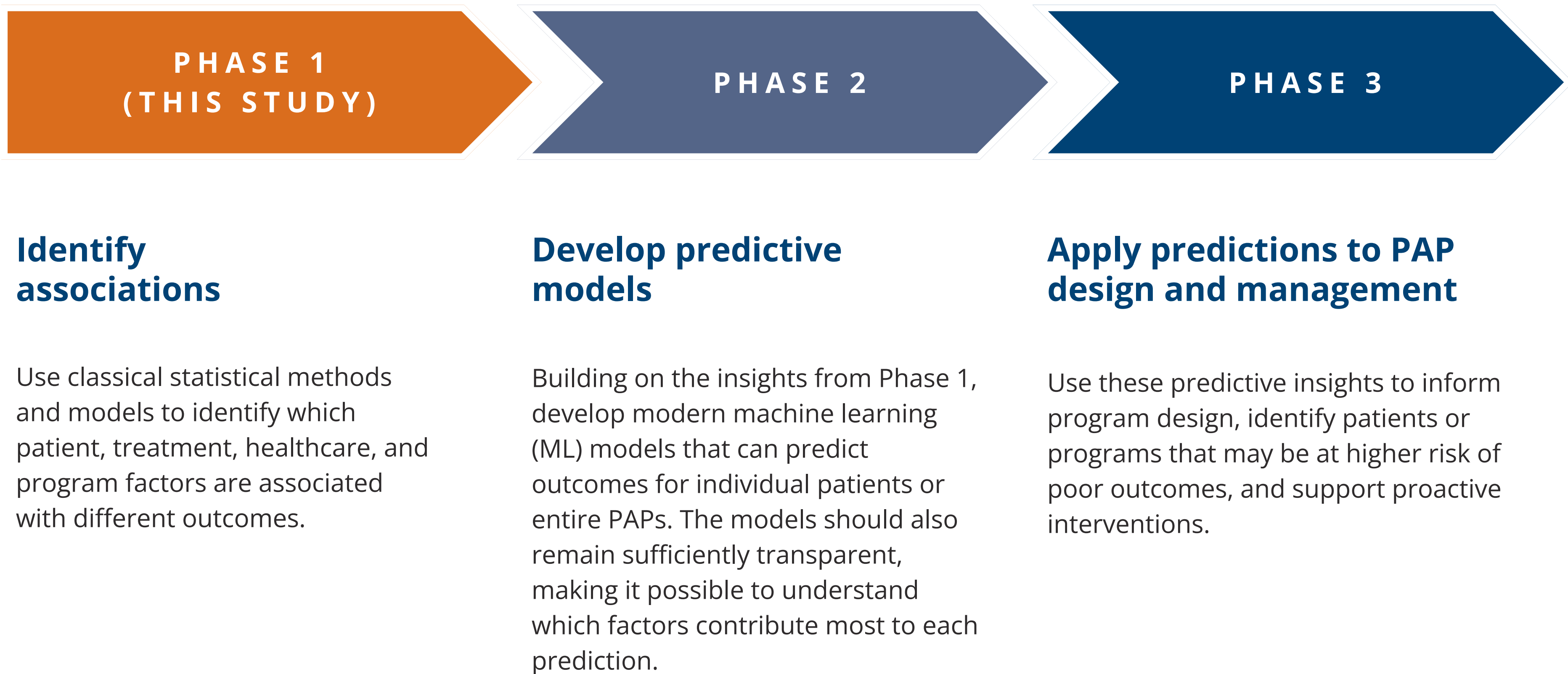
PREDICTIVE ACCESS

The use of real-world operational and patient data to anticipate program performance, identify risks before they occur, and design patient access programs tailored to each market, therapy, and patient population.

PAP design and management are entering a new era of predictive access, driven by the growing availability of real-world data.

Just as predictive analytics are transforming clinical care and supply chains, so predictive access has the potential to transform PAPs. While predictive access remains an emerging concept, studies such as this demonstrate that the data needed to support it already exists. The opportunity now is to transform these operational insights into predictive tools that help design more effective, more equitable, and more sustainable PAPs.

We propose a three-phase approach to using real-world data to move from understanding patient outcomes to predicting and proactively improving them:



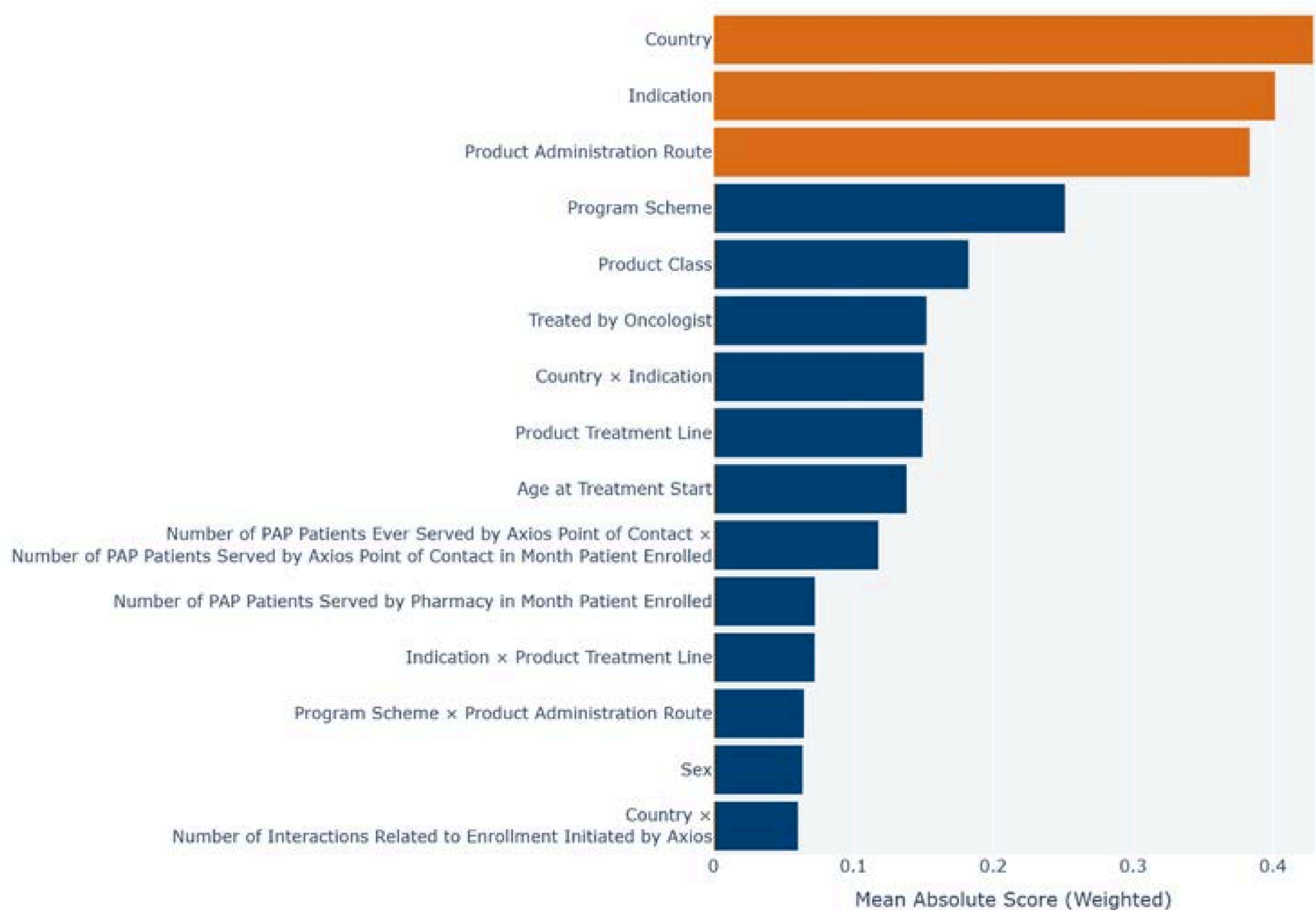
The analysis presented in this study represents Phase 1, demonstrating how classical statistical methods can be used to identify associations between different factors and patient outcomes.

FUTURE SNAPSHOT: PHASE 2 ILLUSTRATION

PAP-level predictive insights

To illustrate Phase 2 and the direction of our future research, we applied a machine learning approach to the dropout data analyzed in Phase 1. Specifically, we developed an Explainable Boosting Machine (EBM) model. This model better captures non-linear relationships between factors and outcomes than classical models, and automatically identifies the most important interaction between factors. Figure 6 shows the results.

FIGURE 6 ML MULTIVARIABLE ANALYSIS OF FACTORS ASSOCIATED WITH DROPOUT



UNDERSTANDING THE GRAPH

In this figure, factors are ranked based on their average contribution to predicted dropout. Country is at the top of the chart. This means that, on average, country is the factor that most affected (positively or negatively) the dropout prediction.

The large score for the first three factors suggests that much of the difference in predicted dropout can be explained by country, indication, and product administration route. Other factors still play a role in the dropout prediction, but a smaller one. Only the most important 15 factors and interactions are shown.

TOP THREE DRIVERS OF PREDICTED DROPOUT

- 01 Country
- 02 Indication
- 03 Administration route

FUTURE SNAPSHOT: PHASE 2 ILLUSTRATION

Patient-level predictive insights using hypothetical patients

The EBM model can also generate predictions for individual patients. To illustrate, we show the predicted probability of dropout for two hypothetical patients who were not included in the model's training data.

The model starts with a baseline dropout rate, represented by the intercept. This reflects the overall dropout rate in the training data before considering any information about an individual patient. Each patient's characteristics then adjust this baseline probability up or down. Factors that increase the predicted probability of dropout are shown in orange, while factors that decrease it are shown in blue. These individual effects are combined with the baseline rate to produce the patient's final predicted probability of dropout.

In this example, the objective is to use the trained EBM model with data for a completely new patient (data the model has never seen) to predict whether that patient is likely to drop out versus complete treatment. Importantly, the model does more than predict whether a patient is likely to drop out or complete treatment. It also shows how much each factor contributes to the prediction, making the reasoning behind the prediction transparent.

FIGURE 7A | GI CANCER, MALAYSIA

97% predicted probability of dropout

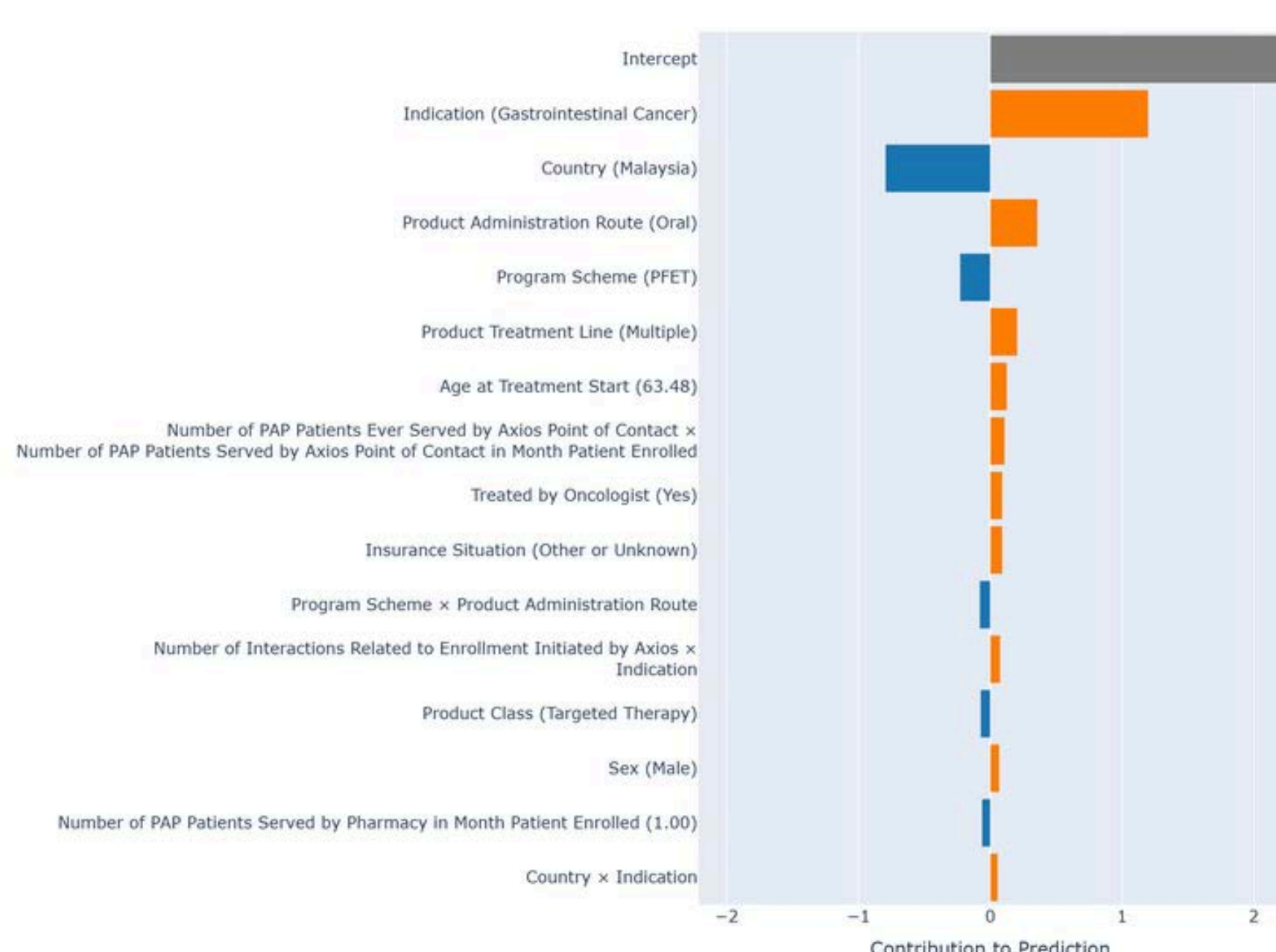


Figure 7A shows the analysis for a patient with gastrointestinal cancer treated in Malaysia. The model predicts that this patient has a 97% probability of dropout prior to treatment completion. The factors that most contribute to the dropout prediction are at the top of the chart.

The patient's indication of gastrointestinal cancer is the main contributor to the prediction. While being in Malaysia (vs. another country) and in a PFET (vs. fixed) scheme reduce the odds of dropout, these variables are not enough to offset the increases in dropout probability from the other factors. Only the most important 15 factors and interactions are shown.

FIGURE 7B | HEMATOLOGIC, THAILAND

34% predicted probability of dropout



Figure 7B shows the analysis for a patient with hematologic malignancy treated in Thailand. The model predicts that this patient has only a 34% probability of dropout. The most likely outcome is that the patient completes their treatment plan. Here again, the factor most contributing to this prediction is the patient's indication.

Being treated by a specialist other than an oncologist, taking a product with intravenous administration, and a young age at treatment start also make relatively large contributions to the final prediction.

WHY IT MATTERS

Intervening before patients disengage



1

ENROLLMENT

Estimate risk

2

EARLY FOLLOW-UP

Target support

3

CONTINUATION

Address barriers

Being able to estimate dropout risk at the time of enrollment could help program managers identify patients who may benefit from additional follow-up, monitoring, or support during treatment. Rather than waiting for a patient to disengage from the program, managers could use these insights to intervene earlier and potentially address barriers before they affect treatment continuation.

Note that the contribution of specific factors to the prediction for an individual patient may be different than the average contribution for the population as a whole. For example, although country is the most important factor for predicting dropout across all patients in the training data set (Figure 6), the most important factor for predicting dropout in these two patients is indication.

Similar models could be used to predict a range of outcomes for individual patients as well as entire PAPs. Over time, these predictive insights could support more proactive PAP management, targeted interventions, and program designs tailored to the needs and risk profiles of different patient populations, with the goal of improving patient outcomes and program sustainability.

FROM PREDICTIVE INSIGHTS TO BETTER PATIENT ACCESS

The data needed for predictive access already exists

This study demonstrates how real-world data can provide a foundation for making predictive access a practical standard for PAP design and management. The analysis shows that patient, treatment, healthcare, and program factors are associated with meaningful differences in survival, treatment duration, serious adverse events, and dropout. The application of machine learning to a robust and growing real-world database creates an opportunity to build on these insights, moving from retrospective analysis of completed programs toward proactive management of existing PAPs and more data-driven design of new programs.

While predictive access remains an emerging concept, the data needed to support it already exists within the operational experience of PAPs. The opportunity now is to transform these data into transparent predictive tools that can help identify risks earlier, target support where it is most needed, and design programs that are more effective, equitable, and sustainable.

The broader goal should be to treat access to cancer medicines as a public health objective, with success measured not simply by the number of patients enrolled in a program, but by whether patients receive clinically appropriate treatment in a timely manner, are able to continue treatment for as long as it remains indicated, and achieve outcomes that matter to them.

EQUITY AS A MEASURE OF ACCESS PERFORMANCE

Equity should be an explicit measure of access performance. Wherever feasible, programs should assess the proportion of eligible patients reached, identify underserved populations, and examine differences in treatment initiation and continuity across socioeconomic and geographic groups. Evaluation should also consider patient-reported financial burden and quality of life. These measures provide a more complete picture of whether an access program is truly reaching the patients who need it and supporting them throughout their treatment journey.

The ultimate measure of progress is straightforward: can patients who need effective cancer treatment receive it in time, continue it when clinically appropriate, and do so without financial hardship?

CONCLUSIONS

LOOKING AHEAD

Other areas of healthcare are already demonstrating the potential of artificial intelligence and machine learning to use complex data to improve decision-making, reduce risk, and increase efficiency. The findings from this study suggest that patient access programs can similarly benefit from moving beyond retrospective measurement toward predictive, evidence-informed design, and management.

As the global cancer burden grows and healthcare systems and pharmaceutical companies face increasing pressure to deliver sustainable access, predictive access offers a new way to address these challenges. By combining real-world data, advanced analytics, and patient-centered program design, PAPs can evolve from mechanisms that respond to access barriers into programs that anticipate them and act before they prevent patients from receiving or continuing treatment.

OUR COMMITMENT

As Axios International approaches its 30th anniversary, we remain committed to developing innovative and sustainable access solutions that help more people, in more places, achieve better health. The next frontier of access is not simply knowing what happened to patients or what their needs are today. It is anticipating what they will need and acting before barriers stand in their way.



05

Appendix

Methodology in Detail

Four outcomes were assessed in this analysis.

Survival	Number of months a patient remained alive while enrolled in a PAP.
Duration of treatment	Number of months a patient was enrolled and treated in a PAP until treatment stop (treatment stop can be due to treatment plan completion or dropout, with dropout including serious adverse events and mortality).
Serious adverse events	Occurrence of an adverse event that led to stopping treatment. Because these events end treatment, every serious adverse event is also counted as a dropout.
Dropout	Patient failed to complete their treatment plan for any reason (e.g., death, physician recommendation to change medicine, lost-to-follow-up). For patients with more than one treatment plan, a single dropout instance categorized the patient as dropped out.

The analysis also looked at several patient, treatment, healthcare setting, and program factors to understand how they may influence these outcomes.

To identify associations between factors and outcomes, we performed descriptive and univariate analysis of the input data and fit one multivariable model (Cox proportional hazards or logistic regression).

For the survival outcome, a cause-specific Cox model was used to account for the competing risks of treatment plan completion and stopping treatment for a non-mortality reason.

For the serious adverse events outcome, Firth's bias-reduced penalized-likelihood logistic regression was used due to sparse outcome data for some categorical variables.

All categorical factors were dummy coded, with the first level when sorted alphabetically serving as the reference. For example, Egypt, which is first in the alphabetized list of countries included in the analysis, was the reference level for the country factor in all analyses. Similarly, breast cancer is first in the alphabetized list of cancer indications and was thus used as the reference level for the indication factor in all analyses. All continuous variables were centered and scaled such that a one-unit increase reflected a one standard deviation increase.

As a final step, we created a heatmap to facilitate comparison between all outcomes and factors. We retained only coefficients from the multivariable models with $p \leq 0.05$. For other coefficients, the data did not provide sufficient evidence of an association. Next, within each outcome, retained coefficients were normalized to a scale of -1 (least favorable for patients) to +1 (most favorable for patients). Finally, normalized values for each outcome were compiled into a single table and used to generate a heatmap.

This paper classifies factors by statistical significance and, among significant factors, by relative strength of association. A factor and level are considered to have a statistically significant association with the outcome if it meets $p \leq 0.05$ in the multivariable model. Among significant factors, those with a large effect size relative to other factors and levels in the model are further classified as having a "strong" association; significant factors with smaller effect sizes are classified as having a weak or moderate association. Note that "strong" reflects relative magnitude within this model, not an absolute or clinically validated threshold.

Table 1. Characteristics of the patients contributing to each analysis data set

Values are n (%) for categorical variables and mean (SD) for continuous variables; percentages use the column n as the denominator. † Not applicable to the serious adverse events data set.

Factor / Level	Survival (n = 18,076)	Duration of Treatment (n = 18,076)	Serious Adverse Event (n = 14,698)	Dropout (n = 14,698)
Country				
Egypt	2,493(13.8%)	2,493(13.8%)	2,099(14.3%)	2,099(14.3%)
India	1,036(5.7%)	1,036(5.7%)	833(5.7%)	833(5.7%)
Indonesia	150(0.8%)	150(0.8%)	146(1.0%)	146(1.0%)
Kenya	166(0.9%)	166(0.9%)	117(0.8%)	117(0.8%)
Kuwait	1,438(8.0%)	1,438(8.0%)	965(6.6%)	965(6.6%)
Lebanon	747(4.1%)	747(4.1%)	726(4.9%)	726(4.9%)
Malaysia	3,033(16.8%)	3,033(16.8%)	1,984(13.5%)	1,984(13.5%)
Mexico	564(3.1%)	564(3.1%)	561(3.8%)	561(3.8%)
Peru	117(0.6%)	117(0.6%)	108(0.7%)	108(0.7%)
Philippines	954(5.3%)	954(5.3%)	905(6.2%)	905(6.2%)
Thailand	3,202(17.7%)	3,202(17.7%)	3,029(20.6%)	3,029(20.6%)
Ukraine	749(4.1%)	749(4.1%)	657(4.5%)	657(4.5%)
United Arab Emirates	2,793(15.5%)	2,793(15.5%)	1,971(13.4%)	1,971(13.4%)
Viet Nam	515(2.8%)	515(2.8%)	490(3.3%)	490(3.3%)
Other	119(0.7%)	119(0.7%)	107(0.7%)	107(0.7%)
Hospital Type				
Private	10,456(57.8%)	10,456(57.8%)	8,387(57.1%)	8,387(57.1%)
Public	7,620(42.2%)	7,620(42.2%)	6,311(42.9%)	6,311(42.9%)
Treated by Oncologist				
No	2,996(16.6%)	2,996(16.6%)	2,535(17.2%)	2,535(17.2%)
Yes	15,080(83.4%)	15,080(83.4%)	12,163(82.8%)	12,163(82.8%)
Sex				
Female	9,848(54.5%)	9,848(54.5%)	7,812(53.2%)	7,812(53.2%)
Male	8,228(45.5%)	8,228(45.5%)	6,886(46.8%)	6,886(46.8%)
Age at Treatment Start				
Indication	51.4(17.9)	51.4(17.9)	50.9(18.3)	50.9(18.3)
Breast Cancer	3,019(16.7%)	3,019(16.7%)	2,382(16.2%)	2,382(16.2%)
Dermatology Oncology	194(1.1%)	194(1.1%)	176(1.2%)	176(1.2%)
Gastrointestinal Cancer	1,995(11.0%)	1,995(11.0%)	1,802(12.3%)	1,802(12.3%)
Genitourinary Cancer	1,558(8.6%)	1,558(8.6%)	1,245(8.5%)	1,245(8.5%)
Gynecologic Cancer	813(4.5%)	813(4.5%)	637(4.3%)	637(4.3%)
Head and Neck Cancer	100(0.6%)	100(0.6%)	94(0.6%)	94(0.6%)
Hematologic Malignancy	6,180(34.2%)	6,180(34.2%)	5,259(35.8%)	5,259(35.8%)
Lung Cancer	3,975(22.0%)	3,975(22.0%)	2,941(20.0%)	2,941(20.0%)
Other	242(1.3%)	242(1.3%)	162(1.1%)	162(1.1%)
Product Class				
Immunotherapy	2,450(13.6%)	2,450(13.6%)	2,115(14.4%)	2,115(14.4%)
Targeted	14,891(82.4%)	14,891(82.4%)	11,982(81.5%)	11,982(81.5%)
Therapy Other	735(4.1%)	735(4.1%)	601(4.1%)	601(4.1%)
Product Treatment Line				
1L	4,009(22.2%)	4,009(22.2%)	2,928(19.9%)	2,928(19.9%)
2L	5,707(31.6%)	5,707(31.6%)	5,023(34.2%)	5,023(34.2%)
3L+	1,653(9.1%)	1,653(9.1%)	1,459(9.9%)	1,459(9.9%)
Multiple	6,707(37.1%)	6,707(37.1%)	5,288(36.0%)	5,288(36.0%)
Product Administration Route				
Intravenous	7,406(41.0%)	7,406(41.0%)	6,345(43.2%)	6,345(43.2%)

Table 1 (continued)

Factor / Level	Survival (n = 18,076)	Duration of Treatment (n = 18,076)	Serious Adverse Event (n = 14,698)	Dropout (n = 14,698)
Oral	10,103(55.9%)	10,103(55.9%)	7,854(53.4%)	7,854(53.4%)
Other	567(3.1%)	567(3.1%)	499(3.4%)	499(3.4%)
Caregiver Registered				
No	16,045(88.8%)	16,045(88.8%)	13,195(89.8%)	13,195(89.8%)
Yes	2,031(11.2%)	2,031(11.2%)	1,503(10.2%)	1,503(10.2%)
Insurance Situation				
Insured	5,444(30.1%)	5,444(30.1%)	4,516(30.7%)	4,516(30.7%)
Uninsured	9,571(52.9%)	9,571(52.9%)	7,893(53.7%)	7,893(53.7%)
Other or Unknown	3,061(16.9%)	3,061(16.9%)	2,289(15.6%)	2,289(15.6%)
Received Charity Support				
No	9,321(51.6%)	9,321(51.6%)	7,717(52.5%)	7,717(52.5%)
Yes	8,755(48.4%)	8,755(48.4%)	6,981(47.5%)	6,981(47.5%)
Patient Lives in Same Area as Treatment Facility				
No	5,549(30.7%)	5,549(30.7%)	4,376(29.8%)	4,376(29.8%)
Yes	12,527(69.3%)	12,527(69.3%)	10,322(70.2%)	10,322(70.2%)
Program Scheme				
Fixed	8,324(46.1%)	8,324(46.1%)	6,656(45.3%)	6,656(45.3%)
PFET	9,752(53.9%)	9,752(53.9%)	8,042(54.7%)	8,042(54.7%)
Number of PAP Patients Ever Served by Physician	16.3(31.1)	16.3(31.1)	14.7(30.0)	14.7(30.0)
Number of PAP Patients Ever Served by Pharmacy	86.4(149.4)	86.4(149.4)	76.9(136.4)	76.9(136.4)
Number of PAP Patients Ever Served by Axios Point of Contact	115.6(130.0)	115.6(130.0)	118.5(138.6)	118.5(138.6)
Number of PAP Patients Served by Physician in Month Patient Enrolled	7.1(10.0)	7.1(10.0)	6.5(9.5)	6.5(9.5)
Number of PAP Patients Served by Pharmacy in Month Patient Enrolled	33.3(49.5)	33.3(49.5)	30.6(46.7)	30.6(46.7)
Number of PAP Patients Served by Axios Point of Contact in Month Patient Enrolled	58.5(49.8)	58.5(49.8)	56.7(48.3)	56.7(48.3)
Number of Interactions Related to Enrollment Initiated by Physician	0.2 (0.5)	0.2 (0.5)	—	0.1 (0.4)
Number of Interactions Related to Enrollment Initiated by Patient	1.0 (1.3)	1.0 (1.3)	—	0.9 (1.3)
Number of Interactions Related to Enrollment Initiated by Axios	4.0 (2.0)	4.0 (2.0)	—	3.9 (2.1)
Number of Interactions Related to PAP Interest Initiated by Patient	0.1 (0.3)	0.1 (0.3)	—	0.1 (0.3)
Number of Interactions Related to PAP Interest Initiated by Axios	0.7 (0.4)	0.7 (0.4)	—	0.7 (0.5)
Duration of Treatment (Months) Survival Event and Competing Risks	8.2 (8.5)	8.2 (8.5)	—	—
Censored	3,333 (18.4%)	—	—	—
Completed Treatment	2,560 (14.2%)	—	—	—
Dropped Out (Non-Mortality Related)	10,004 (55.3%)	—	—	—
Passed Away	2,179 (12.1%)	—	—	—
Duration of Treatment Event				
Censored	—	3,333 (18.4%)	—	—
Discontinued	—	14,743 (81.6%)	—	—

Table 1 (continued)

Factor / Level	Survival (n = 18,076)	Duration of Treatment (n = 18,076)	Serious Adverse Event (n = 14,698)	Dropout (n = 14,698)
Serious Adverse Event				
No	—	—	13,997(95.2%)	—
Yes	—	—	701(4.8%)	—
Dropout				
No	—	—	—	2,527(17.2%)
Yes	—	—	—	12,171(82.8%)

Values are n (%) for categorical variables and mean (SD) for continuous variables; percentages use the column n as the denominator. — Not applicable to this data set.

Study Limitations

1

No time-to-event model for SAEs and dropout

One limitation of the analysis is that a time-to-event model was not used for serious adverse events (SAEs) and dropout. Instead, patients who remained active at the end of the study period were excluded, which may introduce selection bias.

This approach maintained the patient as the unit of analysis across outcomes and enabled the use of advanced machine learning approaches, such as Explainable Boosting Machines (EBMs), which do not support time-to-event data. Table 1 compares the full cohort with the subset included in the SAE and dropout analyses. The groups are broadly similar across the factors measured, providing some reassurance about the representativeness of the subset, although this does not eliminate the potential for bias.

2

No correction for multiple comparisons

A second limitation is that there was no correction for multiple comparisons across the models and coefficients evaluated. Given the large number of models, factors, and levels included, it is possible that some levels are significant at the $p \leq 0.05$ level due to chance alone. Thus, the associations identified in this study and their patterns in the heatmap should be interpreted primarily as exploratory and hypothesis-generating.

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