Real-world multiple myeloma risk factors and outcomes by non-Hispanic Black/African American and non-Hispanic White race/ethnicity in the United States

Tondre Buck,[1] Monique A. Hartley-Brown,[2] Yvonne A. Efebera,[3] Carter P. Milner,[4] Jeffrey A. Zonder,[5] Paul G. Richardson,[2] Taylor Salinardi[6°] and Megan S. Rice[6°]

[1]Spartanburg Medical Center, Center for Research and Cancer Institute, Spartanburg, SC; [2]Division of Hematologic Malignancy, Department of Medical Oncology, Jerome Lipper Multiple Myeloma Center, Harvard Medical School, Dana-Farber Cancer Institute, Boston, MA; [3]Division of Blood and Marrow Transplant and Cellular Therapy, OhioHealth, Columbus, OH; [4]Division of Hematology and Medical Oncology, Department of Medicine, University of Mississippi Medical Center, Jackson, MS; [5]Department of Oncology, Barbara Ann Karmanos Cancer Institute, Wayne State University, Detroit, MI and [6]Sanofi, Cambridge, MA, USA

°Current address TS: Azurity Pharmaceuticals, Woburn, MA, USA.

°Current address MSR: Vertex Pharmaceuticals Incorporated, USA.

Correspondence: T. Buck
tbuck@gibbscc.org

Received: January 25, 2023.
Accepted: November 17, 2023.
Early view: November 30, 2023.

https://doi.org/10.3324/haematol.2023.282788

Real-world multiple myeloma risk factors and outcomes by race/ethnicity in the United States

Tondre Buck, Monique A. Hartley-Brown, Yvonne A. Efebera, Carter P. Milner, Jeffrey A. Zonder, Paul G. Richardson, Taylor Salinardi, Megan S. Rice

SUPPLEMENT

SUPPLEMENTARY METHODS:

Exclusion criteria

The following patients were excluded from the study:

- Those with a "line 0" treatment regimen (i.e., patients with evidence of treatment from unstructured activity >30 days prior to the start of a patient's structured activity and patients whose first multiple myeloma treatment was a stem cell transplant [SCT])
- Those without evidence of structured activity within the 90 days post diagnosis (i.e., patients who fail Flatiron Health's "90-day gap rule")
- Those without at least one line of therapy
- Those whose first-line treatment started prior to 1/1/2016
- Those with evidence of multiple myeloma treatment more than 14 days prior to their diagnosis date
- Those who participated in a clinical trial at any time
- Those missing data on race/ethnicity
- Those whose race/ethnicity is not one of the following: Non-Hispanic Black/African-American or Non-Hispanic White

Assessments and outcomes

Patient and disease characteristics

The following patient and disease characteristics were examined, by race/ethnicity, for the overall populations of Non-Hispanic Black/African American and Non-Hispanic White patients and by subgroups:

- Age in years at multiple myeloma diagnosis (continuous, categorical: <65, 65-<75, ≥75)

- Age in years at start of first line of therapy (continuous, categorical: <65, 65-<75, ≥75)
- Sex (Female, Male)
- Race/ethnicity [overall analyses] (Non-Hispanic Black/African American, Non-Hispanic White)
- Geographic region (Not South [Northeast, Midwest, West, Other/Missing], South)
- Practice type (Academic, Community)
- M-protein type (IgG, IgA, Light chain, Other, Missing)
- ISS stage at initial diagnosis (Stage I, Stage II, Stage III, Missing)
- eGFR-MDRD mL/min/1.73m^2 at the start of first line of therapy (as well as the highest value during first line of therapy for the exploratory aim) (<60, ≥60, <50, ≥50, Missing)
    - eGFR-MDRD will be calculated from creatinine lab values using the following equation: 175 × (creatinine mg/dL)-1.154 × (age at time of creatinine lab)-0.203 × (0.742 if female) × (1.212 if Black/African American). Extreme creatinine values (>99.99 percentile or <0.01 percentile) will be set to missing. The creatinine value used to calculate eGFR-MDRD will be the closest non-missing to the index date (within 60 days prior to and including the index date). If multiple creatinine values are available on the same day, they will be averaged. Patients with missing race will be categorized as missing eGFR-MDRD.
- ECOG status at the start of line of therapy (0, 1, ≥2, Missing)
    - ECOG status will be determined by the closest non-missing ECOG value to the index date within the 60 days prior to and including the index date.
- Year of start of first line of therapy (2016, 2017, 2018, 2019, 2020, 2021)
- Time from multiple myeloma diagnosis to the first line of therapy in months (continuous)
- 1q21+status [first measure] (absent, present)
    - Presence of 1q21+ was defined as gain (3 copies) or amplification (≥4 copies) of 1q21
- Cytogenetic risk [first measure] (standard, high)
    - High risk cytogenetics were defined as the presence of del(17p), t[4;14], and/or t[4;16]
- del[17p] [first measure] (absent, present)
- t[4;14] [first measure] (absent, present)
- t[14;16] [first measure] (absent, present)

Treatment characteristics

Primary first-line treatment by treatment class:

The following definitions were used to define drug groupings:

- Proteasome inhibitors (PIs): bortezomib, carfilzomib, ixazomib
- Immunomodulatory drugs (IMiDs): lenalidomide, pomalidomide, thalidomide
- Antibody agents: daratumumab, daratumumab/hyaluronidase-fihj, elotuzumab, isatuximab-irfc
- Chemotherapy: bendamustine, cisplatin, cyclophosphamide, doxorubicin, etoposide, liposomal doxorubicin, melphalan, vincristine
- Steroids: dexamethasone, prednisone
- "Other":
    - B-cell maturation antigen--targeting drugs: belantamab mafodotin, idecabtagene vicleucel
    - Novel mechanism of action drugs: panobinostat, selinexor, melphalan flufenamide (melflufen)

For characterization of types of regimens, the following definitions were used:

- PI-based: Regimens containing at least one PI (+/- steroids) but do not contain IMiDs, chemotherapies, monoclonal antibodies, or "other" drugs (see above)
- IMiD-based: Regimens containing at least one IMiD (+/- steroids), but do not contain PIs, chemotherapies, monoclonal antibodies, or "other" drugs (see above)
- PI+IMiD based: Regimens containing at least one IMiD and at least one PI (+/- steroids), but do not contain chemotherapies, monoclonal antibodies, or "other" drugs (see above)
- Chemo-based: Regimens containing at least one chemotherapy agent (+/- steroids), but do not contain monoclonal antibodies or "other" drugs (see above)
- Antibody-based: Regimens containing at least one monoclonal antibody agent (+/- steroids), but do not contain "other" drugs (see above)
- Other: Regimens containing "other" treatments (see above)

Other treatment characteristics:

- SCT (Yes, No)
- Consolidation therapy [among patients with SCT only] (Yes, No)
- Maintenance therapy (Yes, No)
- Secondarily:

- Primary treatment by agents (e.g., lenalidomide+dexamethasone)
- Primary treatment by drug class (e.g., PI + IMiD +/- steroid)
- Primary treatments by individual drug class (e.g., IMiD [yes, no])
- Primary treatments by individual agents (e.g., lenalidomide [yes, no])

Rules for real-world progression-free survival (rwPFS)

Patients were observed from the start of first-line therapy to the first of date of first progression event (at least 30 days post index date) or date of death (at least 30 days post index date) (event; progression or death at least 30 days post index date), or patients without an observed date of progression or death were censored at the last lab date (at least 30 days post index date) for the patient's specimen type (censoring; i.e., last lab date). Patients with an imputed date of death that occurred within 30 days of the index date or patients who were censored within 30 days of the index date were excluded from rwPFS analyses. Patients with no abstracted M spike lab values or structured free light chain lab values were also excluded from rwPFS analyses. If the imputed date of death was before the last progression event (due to imputation of death date to the 15th of the month), the last progression event was used as the event date.

Rules for real-world overall survival (rwOS)

Patients were observed from the start of first-line therapy to the date of death (event; death), or patients without an observed date of death were censored at the last confirmed activity date (censoring; i.e., last confirmed activity).

Statistical Analysis

Subgroup definition

The following subgroups were analyzed, by race/ethnicity, in rwPFS and rwOS Cox proportional hazards models:

- Age in years at start of first line of therapy start (categorical: <65, 65-74, ≥75)
- Sex (Female, Male)
- Practice type (Academic, Community, Academic + Community)
- M-protein type (IgG, IgA, Light chain, Other/Missing)
- ISS stage at multiple myeloma diagnosis (Stage I, Stage II, Stage III, Missing)
- Cytogenetic risk (High risk, Standard risk, Missing)
- 1q21+ status (Present, Absent, Missing)

- eGFR-MDRD mL/min/1.73m^2 at the start of first line of therapy (<60, ≥60, Missing)
- ECOG PS at the start of line of therapy (0, 1, ≥2, Missing)
- Time from multiple myeloma diagnosis to the first line of therapy (<median, ≥median)
- Insurance type (Commercial, Medicare and Medicare+, Patient Assistance Program, Other, Missing)
- Geographic region (South, Not South)

Analysis of eGFR-MDRD for line 1, by race/ethnicity (exploratory)

eGFR-MDRD at the start of the line of therapy, the highest measure of eGFR-MDRD during the first line of therapy, and the highest measure of eGFR-MDRD during the first line of therapy by eGFR-MDRD at the start of the line of therapy were summarized for line 1 among all patients and among subgroups defined by race/ethnicity. eGFR-MDRD was categorized as <50, ≥50, <60, ≥60 mL/min/1.73 m^2, or missing. Frequencies and percentages are presented for these categorical variables.

SUPPLEMENTARY RESULTS:

eGFR exploratory analysis

At the start of the first line of therapy, a lower percentage of NH White patients had an eGFR ≥60 mL/min/1.73 m^2 (43.9% vs 48.9% of NH Black/AA patients). After initiation of first-line therapy, that difference was reduced: 68.7% of NH White patients and 70.2% of NH Black/AA patients achieved at least one eGFR value ≥60 mL/min/1.73 m^2 during the first line of therapy. The degree of missing eGFR values at start of first line of therapy and during first line of therapy was similar between races/ethnicities. Further breakdown of eGFR values can be found in Supplementary Table 6.

Supplementary Table 1. Primary treatment (top 10 regimens), overall and by race/ethnicity in first LOT.

Primary treatment by agent, n (%)	Regimen type	All patients (N=4,614)	NH Black/African American patients (n=1,077)	NH White patients (n=3,537)
Bortezomib+dexamethasone+lenalidomide	PI + IMiD-based	2,241 (48.6)	540 (50.1)	1,701 (48.1)
Dexamethasone+lenalidomide	IMiD-based	558 (12.1)	129 (12.0)	434 (12.3)
Bortezomib+dexamethasone	PI-based	480 (10.4)	124 (11.5)	367 (10.4)
Bortezomib+cyclophosphamide+dexamethasone	Chemo-based	457 (9.9)	113 (10.5)	328 (9.3)
Carfilzomib+dexamethasone+lenalidomide	PI + IMiD-based	97 (2.1)	21 (2.0)	84 (2.4)
Bortezomib+daratumumab/hyaluronidase-fihj+dexamethasone+lenalidomide	Antibody-based	92 (2.0)	17 (1.6)	75 (2.1)
Bortezomib	PI-based	83 (1.8)	14 (1.3)	66 (1.9)
Bortezomib+cyclophosphamide+dexamethasone+lenalidomide	Chemo-based	80 (1.7)	13 (1.2)	62 (1.8)
Daratumumab/hyaluronidase-fihj+dexamethasone+lenalidomide	Antibody-based	49 (1.1)	12 (1.1)	40 (1.1)
Bortezomib+daratumumab+dexamethasone+lenalidomide	Antibody-based	47 (1.0)	8 (0.7)	37 (1.1)

Chemo: chemotherapy; IMiD: immunomodulatory drug; LOT: line of therapy; NH: non-Hispanic; PI: proteasome inhibitor.

Supplementary Table 2. Unadjusted and age-adjusted Cox models for rwPFS, overall and for all subgroups examined.

	Unadjusted Cox model			Age-adjusted Cox model		
rwPFS HR (95% CI)	**All patients**	**NH Black/African American patients**	**NH White patients**	**All patients**	**NH Black/African American patients**	**NH White patients**
Race/Ethnicity						
NH Black/African-American	0.98 (0.88-1.09)	--	--	1.07 (0.96-1.19)	--	--
NH White	1 (Ref)	--	--	1 (Ref)	--	--
Age at first LOT start (years)						
<65	1 (Ref)	1 (Ref)	1 (Ref)	--	--	--
65 to <74	1.23 (1.09-1.38)	1.19 (0.95-1.49)	1.26 (1.10-1.45)	--	--	--
≥75	2.08 (1.86-2.32)	1.89 (1.51-2.38)	2.16 (1.89-2.46)	--	--	--
Sex						
Female	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Male	1.01 (0.93-1.11)	1.05 (0.87-1.27)	1.00 (0.90-1.11)	1.05 (0.96-1.14)	1.08 (0.90-1.31)	1.05 (0.95-1.16)
Practice type						
Academic	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Community	1.06 (0.93-1.21)	0.86 (0.65-1.14)	1.11 (0.96-1.29)	0.98 (0.86-1.12)	0.85 (0.64-1.12)	1.01 (0.87-1.17)
Academic + community	0.93 (0.65-1.34)	0.74 (0.30-1.85)	0.99 (0.67-1.47)	0.97 (0.68-1.39)	0.80 (0.32-2.01)	1.02 (0.69-1.52)
M-protein type						
IgG	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
IgA	1.13 (1.01-1.26)	1.22 (0.95-1.57)	1.11 (0.98-1.25)	1.10 (0.99-1.23)	1.24 (0.97-1.60)	1.08 (0.95-1.22)
Light chain	1.08 (0.96-1.22)	1.15 (0.89-1.48)	1.06 (0.93-1.22)	1.09 (0.96-1.23)	1.15 (0.89-1.48)	1.07 (0.93-1.23)
Other/missing	1.50 (1.21-1.86)	1.72 (1.13-2.61)	1.44 (1.12-1.86)	1.53 (1.23-1.90)	1.68 (1.11-2.56)	1.50 (1.16-1.92)
ISS stage at diagnosis						
Stage I	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Stage II	1.65 (1.43-1.90)	1.70 (1.26-2.29)	1.64 (1.39-1.93)	1.54 (1.33-1.78)	1.62 (1.20-2.18)	1.54 (1.30-1.81)
Stage III	2.18 (1.90-2.51)	2.66 (1.99-3.54)	2.10 (1.78-2.46)	2.03 (1.76-2.33)	2.49 (1.86-3.32)	1.96 (1.67-2.30)
Missing	1.84 (1.62-2.09)	1.62 (1.26-2.09)	1.92 (1.66-2.24)	1.70 (1.49-1.93)	1.49 (1.16-1.93)	1.78 (1.53-2.07)
ECOG PS						
0	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
1	1.35 (1.18-1.54)	1.12 (0.85-1.47)	1.43 (1.23-1.66)	1.25 (1.09-1.42)	1.06 (0.81-1.39)	1.31 (1.13-1.53)
≥2	2.07 (1.79-2.39)	2.27 (1.70-3.04)	2.01 (1.70-2.38)	1.89 (1.64-2.19)	2.11 (1.57-2.83)	1.84 (1.56-2.18)
Missing	1.30 (1.15-1.46)	1.18 (0.92-1.51)	1.34 (1.16-1.54)	1.26 (1.12-1.43)	1.18 (0.92-1.51)	1.30 (1.13-1.49)

Supplementary Table 2, continued. Unadjusted and age-adjusted Cox models for rwPFS, overall and for all subgroups examined.

	Unadjusted Cox model			Age-adjusted Cox model		
rwPFS comparison, HR (95% CI)	**All patients**	**NH Black/African American patients**	**NH White patients**	**All patients**	**NH Black/African American patients**	**NH White patients**
Cytogenetic risk						
High risk*	1.30 (1.14-1.49)	1.47 (1.11-1.95)	1.26 (1.09-1.47)	1.36 (1.19-1.56)	1.47 (1.11-1.94)	1.34 (1.15-1.56)
Standard risk	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Missing	1.03 (0.93-1.14)	1.01 (0.81-1.26)	1.04 (0.93-1.17)	1.03 (0.93-1.14)	1.01 (0.81-1.26)	1.04 (0.92-1.17)
1q21+†						
Present	1.35 (1.20-1.51)	1.45 (1.13-1.86)	1.32 (1.15-1.51)	1.34 (1.19-1.51)	1.43 (1.11-1.84)	1.31 (1.15-1.50)
Absent	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Missing	1.19 (1.08-1.32)	1.19 (0.97-1.47)	1.19 (1.06-1.33)	1.17 (1.06-1.29)	1.17 (0.95-1.44)	1.16 (1.04-1.31)
eGFR‡ (mL/min/1.73 m^2)						
<60	1.43 (1.30-1.57)	1.52 (1.24-1.87)	1.40 (1.26-1.56)	1.28 (1.16-1.41)	1.37 (1.11-1.68)	1.26 (1.13-1.40)
≥60	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Missing	1.15 (1.01-1.31)	1.29 (0.99-1.69)	1.11 (0.95-1.29)	1.12 (0.98-1.28)	1.26 (0.96-1.64)	1.09 (0.93-1.26)
Time from diagnosis to first LOT						
<Median	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
≥Median	0.94 (0.86-1.03)	1.06 (0.88-1.27)	0.92 (0.84-1.02)	0.94 (0.86-1.03)	1.04 (0.86-1.25)	0.93 (0.84-1.03)
Insurance type						
Commercial health plan	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Medicare & Medicare +	1.18 (1.05-1.32)	1.13 (0.86-1.48)	1.19 (1.05-1.35)	1.04 (0.92-1.17)	0.98 (0.74-1.30)	1.05 (0.92-1.20)
Patient assistance program	1.06 (0.89-1.27)	0.96 (0.67-1.38)	1.10 (0.89-1.36)	0.97 (0.81-1.17)	0.92 (0.64-1.32)	0.99 (0.80-1.22)
Other	1.15 (1.00-1.33)	1.24 (0.95-1.62)	1.12 (0.95-1.32)	1.13 (0.98-1.29)	1.18 (0.90-1.54)	1.10 (0.93-1.30)
Missing	0.93 (0.81-1.06)	0.92 (0.70-1.19)	0.93 (0.80-1.08)	0.94 (0.83-1.07)	0.95 (0.73-1.24)	0.94 (0.81-1.09)
Region						
South	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Non-South (Northeast, Midwest, or West)	1.04 (0.95-1.13)	1.19 (0.98-1.44)	0.99 (0.90-1.10)	1.01 (0.93-1.11)	1.17 (0.96-1.41)	0.99 (0.90-1.10)

*High-risk cytogenetics were defined as the presence of ≥1 of del(17p), t(4;14), or t(14;16). †1q21+ was defined as gain (3 copies) or amplification (≥4 copies) of 1q21. ‡Assessed using the MDRD equation.

CI: confidence interval; ECOG: Eastern Cooperative Oncology Group; eGFR: estimated glomerular filtration rate; HR: hazard ratio; Ig: immunoglobulin; ISS: International Staging System; LOT: line of therapy; MDRD: Modification of Diet in Renal Disease; NH: non-Hispanic; PS: performance status; Ref: reference; rwPFS: real-world progression-free survival.

Supplementary Table 3. MV-adjusted Cox models (primary and sensitivity analyses) for rwPFS, overall and for all subgroups examined.

	MV-adjusted model (primary analysis)				MV-adjusted model (sensitivity analysis)			
rwPFS HR (95% CI)	**All patients**	**NH Black/African American patients**	**NH White patients**	**p-interaction**	**All patients**	**NH Black/African American patients**	**NH White patients**	**p-interaction**
Race/Ethnicity								
NH Black/African-American	1.13 (1.01-1.27)	--	--		1.14 (1.01-1.27)	--	--	
NH White	1 (Ref)	--	--		1 (Ref)	--	--	
Age at first LOT start (years)				0.41				0.56
<65	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
65 to <74	1.17 (1.04-1.33)	1.18 (0.93-1.50)	1.19 (1.03-1.38)		1.18 (1.04-1.35)	1.18 (0.92-1.52)	1.20 (1.03-1.40)	
≥75	1.88 (1.67-2.12)	1.69 (1.32-2.16)	1.95 (1.70-2.24)		1.91 (1.69-2.16)	1.73 (1.34-2.24)	1.97 (1.70-2.27)	
Sex				0.38				0.44
Female	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
Male	1.10 (1.00-1.20)	1.20 (0.99-1.46)	1.07 (0.97-1.18)		1.10 (1.01-1.21)	1.20 (0.99-1.47)	1.08 (0.97-1.20)	
Practice type				0.84				0.85
Academic	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
Community	1.01 (0.87-1.17)	0.98 (0.69-1.38)	1.01 (0.85-1.20)		1.01 (0.86-1.18)	0.96 (0.68-1.37)	1.01 (0.85-1.21)	
Academic + community	1.02 (0.71-1.47)	0.89 (0.34-2.30)	1.05 (0.71-1.57)		1.04 (0.72-1.50)	0.90 (0.35-2.35)	1.07 (0.71-1.59)	
M-protein type				0.77				0.77
IgG	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
IgA	1.03 (0.92-1.15)	1.13 (0.87-1.47)	1.01 (0.89-1.14)		1.03 (0.91-1.15)	1.14 (0.86-1.50)	1.00 (0.88-1.14)	
Light chain	1.06 (0.94-1.19)	1.08 (0.84-1.40)	1.05 (0.92-1.21)		1.07 (0.95-1.21)	1.10 (0.84-1.44)	1.07 (0.93-1.22)	
Other/missing	1.45 (1.17-1.81)	1.66 (1.07-2.55)	1.41 (1.09-1.81)		1.52 (1.22-1.90)	1.79 (1.15-2.78)	1.45 (1.11-1.88)	
ISS stage at diagnosis				0.07				0.08
Stage I	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
Stage II	1.47 (1.27-1.70)	1.48 (1.09-2.03)	1.48 (1.25-1.75)		1.48 (1.27-1.72)	1.46 (1.06-2.01)	1.49 (1.26-1.78)	
Stage III	1.78 (1.53-2.07)	2.11 (1.52-2.93)	1.74 (1.46-2.07)		1.81 (1.55-2.11)	2.16 (1.54-3.04)	1.77 (1.48-2.11)	
Missing	1.58 (1.38-1.81)	1.41 (1.08-1.84)	1.66 (1.42-1.95)		1.60 (1.40-1.84)	1.41 (1.07-1.85)	1.70 (1.45-2.00)	
ECOG PS				0.36				0.28
0	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
1	1.23 (1.07-1.40)	1.11 (0.84-1.46)	1.27 (1.09-1.47)		1.24 (1.08-1.42)	1.09 (0.82-1.46)	1.28 (1.10-1.50)	
≥2	1.79 (1.54-2.07)	1.99 (1.47-2.70)	1.71 (1.44-2.03)		1.80 (1.55-2.10)	2.02 (1.48-2.75)	1.72 (1.45-2.05)	
Missing	1.23 (1.08-1.40)	1.16 (0.88-1.52)	1.24 (1.07-1.44)		1.23 (1.08-1.41)	1.16 (0.88-1.53)	1.26 (1.08-1.46)	

Supplementary Table 3, continued. MV-adjusted Cox models (primary and sensitivity analyses) for rwPFS, overall and for all subgroups examined.

	MV-adjusted model (primary analysis)				MV-adjusted model (sensitivity analysis)			
Comparison, HR (95% CI)	**All patients**	**NH Black/African American patients**	**NH White patients**	**p-interaction**	**All patients**	**NH Black/African American patients**	**NH White patients**	**p-interaction**
Cytogenetic risk				0.65				0.69
High risk*	1.22 (1.06-1.40)	1.30 (0.96-1.75)	1.21 (1.04-1.41)		1.23 (1.07-1.42)	1.31 (0.95-1.79)	1.21 (1.04-1.42)	
Standard risk	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
Missing	0.97 (0.87-1.09)	1.02 (0.79-1.31)	0.97 (0.85-1.10)		0.97 (0.86-1.09)	1.05 (0.81-1.36)	0.95 (0.83-1.09)	
1q21+†				0.74				0.74
Present	1.29 (1.15-1.46)	1.34 (1.02-1.76)	1.27 (1.11-1.46)		1.28 (1.13-1.45)	1.34 (1.01-1.77)	1.26 (1.09-1.45)	
Absent	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
Missing	1.16 (1.04-1.30)	1.11 (0.87-1.41)	1.17 (1.03-1.32)		1.17 (1.04-1.31)	1.11 (0.87-1.43)	1.17 (1.03-1.34)	
eGFR‡ (mL/min/1.73 m^2)				0.97				0.97
<60	1.11 (1.00-1.23)	1.07 (0.85-1.36)	1.10 (0.98-1.24)		1.11 (1.00-1.24)	1.06 (0.82-1.35)	1.11 (0.98-1.25)	
≥60	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
Missing	1.02 (0.89-1.17)	1.07 (0.81-1.43)	1.00 (0.86-1.18)		1.01 (0.88-1.17)	1.10 (0.81-1.49)	1.00 (0.85-1.17)	
Time from diagnosis to first LOT				0.68				0.66
<Median	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
≥Median	0.99 (0.91-1.09)	1.12 (0.92-1.35)	0.98 (0.88-1.08)		1.00 (0.91-1.09)	1.13 (0.93-1.38)	0.98 (0.88-1.09)	
Insurance type				0.97				0.98
Commercial health plan	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
Medicare and Medicare+	1.04 (0.92-1.17)	0.97 (0.73-1.29)	1.06 (0.92-1.21)		1.04 (0.92-1.18)	0.99 (0.74-1.32)	1.05 (0.91-1.20)	
Patient assistance program	0.96 (0.80-1.16)	1.01 (0.70-1.47)	0.96 (0.78-1.19)		0.98 (0.81-1.18)	1.12 (0.76-1.65)	0.96 (0.77-1.18)	
Other	1.09 (0.95-1.25)	1.16 (0.88-1.52)	1.08 (0.92-1.27)		1.10 (0.95-1.27)	1.18 (0.89-1.57)	1.09 (0.92-1.29)	
Missing	0.94 (0.83-1.08)	0.97 (0.73-1.29)	0.94 (0.80-1.09)		0.95 (0.83-1.09)	0.97 (0.72-1.31)	0.95 (0.81-1.11)	
Region				0.18				0.18
South	1 (Ref)	1 (Ref)	1 (Ref)		1 (Ref)	1 (Ref)	1 (Ref)	
Non-South (Northeast, Midwest, or West)	1.05 (0.95-1.16)	1.19 (0.94-1.50)	1.01 (0.90-1.13)		1.06 (0.95-1.17)	1.20 (0.94-1.52)	1.01 (0.90-1.14)	

*High-risk cytogenetics were defined as the presence of ≥1 of del(17p), t(4;14), or t(14;16). †1q21+ was defined as gain (3 copies) or amplification (≥4 copies) of 1q21. ‡Assessed using the MDRD equation.

CI: confidence interval; ECOG: Eastern Cooperative Oncology Group; eGFR: estimated glomerular filtration rate; HR: hazard ratio; Ig: immunoglobulin; ISS: International Staging System; LOT: line of therapy; MDRD: Modification of Diet in Renal Disease; MV: multivariable; NH: non-Hispanic; PS: performance status; Ref: reference; rwPFS: real-world progression-free survival.

Supplementary Table 4. Unadjusted and age-adjusted Cox models for rwOS, overall and for all subgroups examined.

	Unadjusted Cox model			Age-adjusted Cox model		
rwOS comparison, HR (95% CI)	**All patients**	**NH Black/African American patients**	**NH White patients**	**All patients**	**NH Black/African American patients**	**NH White patients**
Race/Ethnicity						
NH Black/African-American	0.95 (0.83-1.07)	--	--	1.06 (0.94-1.21)	--	--
NH White	1 (Ref)	--	--	1 (Ref)	--	--
Age at first LOT start (years)						
<65	1 (Ref)	1 (Ref)	1 (Ref)	--	--	--
65 to <74	1.52 (1.31-1.77)	1.73 (1.29-2.32)	1.47 (1.23-1.74)	--	--	--
≥75	3.00 (2.61-3.45)	3.16 (2.37-4.23)	2.97 (2.52-3.48)	--	--	--
Sex						
Female	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Male	1.09 (0.99-1.22)	1.10 (0.88-1.38)	1.09 (0.96-1.22)	1.06 (0.94-1.21)	1.16 (0.93-1.45)	1.15 (1.02-1.30)
Practice type						
Academic	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Community	1.53 (1.30-1.81)	1.41 (0.97-2.05)	1.57 (1.31-1.88)	1.39 (1.18-1.63)	1.39 (0.95-2.03)	1.38 (1.15-1.66)
Academic + community	0.56 (0.30-1.03)	0.32 (0.04-2.34)	0.61 (0.32-1.16)	0.59 (0.32-1.09)	0.39 (0.05-2.87)	0.62 (0.33-1.18)
M-protein type						
IgG	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
IgA	1.24 (1.08-1.41)	1.28 (0.94-1.74)	1.22 (1.05-1.42)	1.20 (1.05-1.37)	1.32 (0.97-1.80)	1.19 (1.02-1.37)
Light chain	1.31 (1.14-1.50)	1.17 (0.87-1.59)	1.34 (1.15-1.56)	1.33 (1.16-1.52)	1.16 (0.85-1.57)	1.38 (1.18-1.60)
Other/missing	2.36 (1.91-2.92)	2.55 (1.65-3.94)	2.31 (1.82-2.95)	2.43 (1.96-3.00)	2.47 (1.59-3.83)	2.43 (1.91-3.11)
ISS stage at diagnosis						
Stage I	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Stage II	2.09 (1.71-2.55)	2.02 (1.34-3.06)	2.11 (1.68-2.65)	1.92 (1.57-2.34)	1.90 (1.25-2.88)	1.95 (1.55-2.45)
Stage III	3.58 (2.97-4.31)	4.41 (3.03-6.40)	3.41 (2.76-4.23)	3.22 (2.67-3.87)	3.95 (2.71-5.75)	3.11 (2.51-3.85)
Missing	2.95 (2.47-3.52)	2.51 (1.77-3.57)	3.10 (2.52-3.80)	2.61 (2.18-3.11)	2.18 (1.53-3.10)	2.75 (2.24-3.38)
ECOG PS						
0	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
1	1.62 (1.37-1.91)	1.26 (0.88-1.79)	1.73 (1.44-2.09)	1.46 (1.24-1.72)	1.14 (0.80-1.63)	1.56 (1.29-1.88)
≥2	3.03 (2.55-3.60)	3.20 (2.26-4.52)	2.98 (2.44-3.64)	2.71 (2.28-3.23)	2.91 (2.05-4.12)	2.65 (2.17-3.24)
Missing	1.47 (1.26-1.72)	1.37 (0.99-1.89)	1.50 (1.26-1.79)	1.43 (1.22-1.67)	1.38 (0.99-1.90)	1.44 (1.21-1.72)

Supplementary Table 4, continued. Unadjusted and age-adjusted Cox models for rwOS, overall and for all subgroups examined.

	Unadjusted Cox model			Age-adjusted Cox model		
rwOS comparison, HR (95% CI)	**All patients**	**NH Black/African American patients**	**NH White patients**	**All patients**	**NH Black/African American patients**	**NH White patients**
Cytogenetic risk						
High risk*	1.46 (1.25-1.70)	1.86 (1.33-2.60)	1.37 (1.14-1.63)	1.54 (1.32-1.80)	1.96 (1.40-2.74)	1.45 (1.21-1.72)
Standard risk	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Missing	1.08 (0.95-1.22)	1.10 (0.84-1.46)	1.07 (0.93-1.23)	1.09 (0.96-1.23)	1.13 (0.85-1.49)	1.08 (0.94-1.24)
1q21+†						
Present	1.51 (1.32-1.74)	1.64 (1.22-2.22)	1.48 (1.26-1.73)	1.48 (1.29-1.71)	1.55 (1.15-2.10)	1.47 (1.25-1.72)
Absent	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Missing	1.24 (1.10-1.39)	1.18 (0.91-1.53)	1.25 (1.09-1.44)	1.21 (1.07-1.37)	1.14 (0.88-1.48)	1.23 (1.07-1.41)
eGFR‡ (mL/min/1.73 m^2)						
<60	1.78 (1.59-1.99)	2.06 (1.61-2.63)	1.70 (1.50-1.94)	1.51 (1.35-1.70)	1.70 (1.32-2.18)	1.47 (1.29-1.67)
≥60	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Missing	1.31 (1.12-1.53)	1.40 (1.00-1.95)	1.28 (1.08-1.52)	1.27 (1.09-1.49)	1.35 (0.97-1.89)	1.25 (1.05-1.49)
Time from diagnosis to first LOT						
<Median	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
≥Median	0.91 (0.82-1.01)	1.18 (0.94-1.48)	0.84 (0.75-0.95)	0.91 (0.82-1.01)	1.12 (0.89-1.40)	0.85 (0.76-0.96)
Insurance type						
Commercial health plan	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Medicare & Medicare +	1.24 (1.08-1.42)	1.11 (0.80-1.54)	1.27 (1.09-1.47)	1.05 (0.91-1.20)	0.89 (0.64-1.24)	1.09 (0.93-1.27)
Patient assistance program	1.15 (0.93-1.43)	0.84 (0.52-1.34)	1.28 (1.01-1.63)	1.06 (0.86-1.32)	0.78 (0.49-1.26)	1.16 (0.91-1.48)
Other	1.21 (1.03-1.43)	1.32 (0.96-1.81)	1.18 (0.97-1.42)	1.22 (1.04-1.44)	1.24 (0.90-1.71)	1.20 (0.99-1.45)
Missing	1.00 (0.86-1.16)	0.99 (0.72-1.36)	1.00 (0.84-1.19)	1.06 (0.91-1.23)	1.08 (0.79-1.49)	1.06 (0.89-1.26)
Region						
South	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)	1 (Ref)
Non-South (Northeast, Midwest, or West)	0.95 (0.85-1.05)	1.01 (0.80-1.28)	0.91 (0.81-1.03)	0.92 (0.83-1.02)	0.97 (0.77-1.22)	0.91 (0.81-1.03)

*High-risk cytogenetics were defined as the presence of ≥1 of del(17p), t(4;14), or t(14;16). †1q21+ was defined as gain (3 copies) or amplification (≥4 copies) of 1q21. ‡Assessed using the MDRD equation.

CI: confidence interval; ECOG: Eastern Cooperative Oncology Group; eGFR: estimated glomerular filtration rate; HR: hazard ratio; Ig: immunoglobulin; ISS: International Staging System; LOT: line of therapy; MDRD: Modification of Diet in Renal Disease; NH: non-Hispanic; PS: performance status; Ref: reference; rwOS: real-world overall survival.

Supplementary Table 5. MV-adjusted Cox models for rwOS (with p-interaction values), overall and for all subgroups examined.

	MV-adjusted Cox model			
rwOS comparison, HR (95% CI)	**All patients**	**NH Black/African American patients**	**NH White patients**	**p-interaction**
Race/Ethnicity				
NH Black/African-American	1.12 (0.98-1.28)	--	--	
NH White	1 (Ref)	--	--	
Age at first LOT start (years)				
<65	1 (Ref)	1 (Ref)	1 (Ref)	0.61
65 to <74	1.37 (1.17-1.60)	1.67 (1.23-2.27)	1.31 (1.09-1.57)	
≥75	2.52 (2.17-2.92)	2.63 (1.93-3.59)	2.46 (2.07-2.91)	
Sex				
Female	1 (Ref)	1 (Ref)	1 (Ref)	0.67
Male	1.21 (1.09-1.35)	1.30 (1.03-1.64)	1.19 (1.06-1.35)	
Practice type				
Academic	1 (Ref)	1 (Ref)	1 (Ref)	0.90
Community	1.41 (1.17-1.70)	1.55 (1.00-2.41)	1.35 (1.09-1.66)	
Academic + community	0.59 (0.32-1.09)	0.58 (0.08-4.33)	0.57 (0.30-1.10)	
M-protein type				
IgG	1 (Ref)	1 (Ref)	1 (Ref)	0.32
IgA	1.09 (0.95-1.24)	1.14 (0.83-1.56)	1.09 (0.93-1.26)	
Light chain	1.25 (1.09-1.43)	0.93 (0.68-1.27)	1.33 (1.14-1.55)	
Other/missing	2.12 (1.71-2.63)	2.37 (1.50-3.74)	2.06 (1.61-2.64)	
ISS stage at diagnosis				
Stage I	1 (Ref)	1 (Ref)	1 (Ref)	0.25
Stage II	1.75 (1.43-2.14)	1.59 (1.04-2.44)	1.80 (1.43-2.27)	
Stage III	2.58 (2.12-3.14)	2.79 (1.83-4.24)	2.54 (2.03-3.19)	
Missing	2.22 (1.85-2.66)	1.96 (1.36-2.83)	2.36 (1.91-2.92)	
ECOG PS				
0	1 (Ref)	1 (Ref)	1 (Ref)	0.35
1	1.38 (1.17-1.63)	1.19 (0.83-1.71)	1.45 (1.20-1.75)	
≥2	2.46 (2.07-2.93)	2.80 (1.95-4.02)	2.36 (1.93-2.89)	
Missing	1.44 (1.23-1.70)	1.46 (1.04-2.06)	1.42 (1.18-1.71)	

Supplementary Table 5, continued. MV-adjusted Cox models for rwOS (with p-interaction values), overall and for all subgroups examined.

	MV-adjusted Cox model			
rwOS comparison, HR (95% CI)	**All patients**	**NH Black/African American patients**	**NH White patients**	**p-interaction**
Cytogenetic risk				
High risk*	1.33 (1.14-1.56)	1.67 (1.17-2.39)	1.26 (1.06-1.51)	0.28
Standard risk	1 (Ref)	1 (Ref)	1 (Ref)	
Missing	1.00 (0.87-1.15)	1.14 (0.84-1.56)	0.97 (0.83-1.13)	
1q21+†				
Present	1.40 (1.21-1.61)	1.28 (0.93-1.76)	1.40 (1.19-1.64)	0.62
Absent	1 (Ref)	1 (Ref)	1 (Ref)	
Missing	1.20 (1.05-1.37)	0.98 (0.73-1.32)	1.24 (1.07-1.45)	
eGFR‡ **(mL/min/1.73 m^2)**				
<60	1.21 (1.07-1.37)	1.40 (1.04-1.87)	1.18 (1.02-1.35)	0.65
≥60	1 (Ref)	1 (Ref)	1 (Ref)	
Missing	1.08 (0.92-1.26)	1.20 (0.84-1.72)	1.06 (0.88-1.27)	
Time from diagnosis to first LOT				
<Median	1 (Ref)	1 (Ref)	1 (Ref)	0.081
≥Median	1.00 (0.90-1.11)	1.24 (0.98-1.58)	0.93 (0.82-1.04)	
Insurance type				
Commercial health plan	1 (Ref)	1 (Ref)	1 (Ref)	0.52
Medicare & Medicare +	1.06 (0.92-1.22)	0.82 (0.59-1.15)	1.11 (0.95-1.30)	
Patient assistance program	1.03 (0.83-1.28)	0.84 (0.52-1.35)	1.12 (0.87-1.43)	
Other	1.12 (0.95-1.32)	1.16 (0.83-1.62)	1.13 (0.93-1.36)	
Missing	1.00 (0.86-1.17)	1.00 (0.72-1.39)	1.01 (0.84-1.21)	
Region				
South	1 (Ref)	1 (Ref)	1 (Ref)	0.36
Non-South (Northeast, Midwest, or West)	1.04 (0.92-1.17)	1.18 (0.90-1.55)	1.00 (0.88-1.14)	

*High-risk cytogenetics were defined as the presence of ≥1 of del(17p), t(4;14), or t(14;16). †1q21+ was defined as gain (3 copies) or amplification (≥4 copies) of 1q21. ‡Assessed using the MDRD equation.

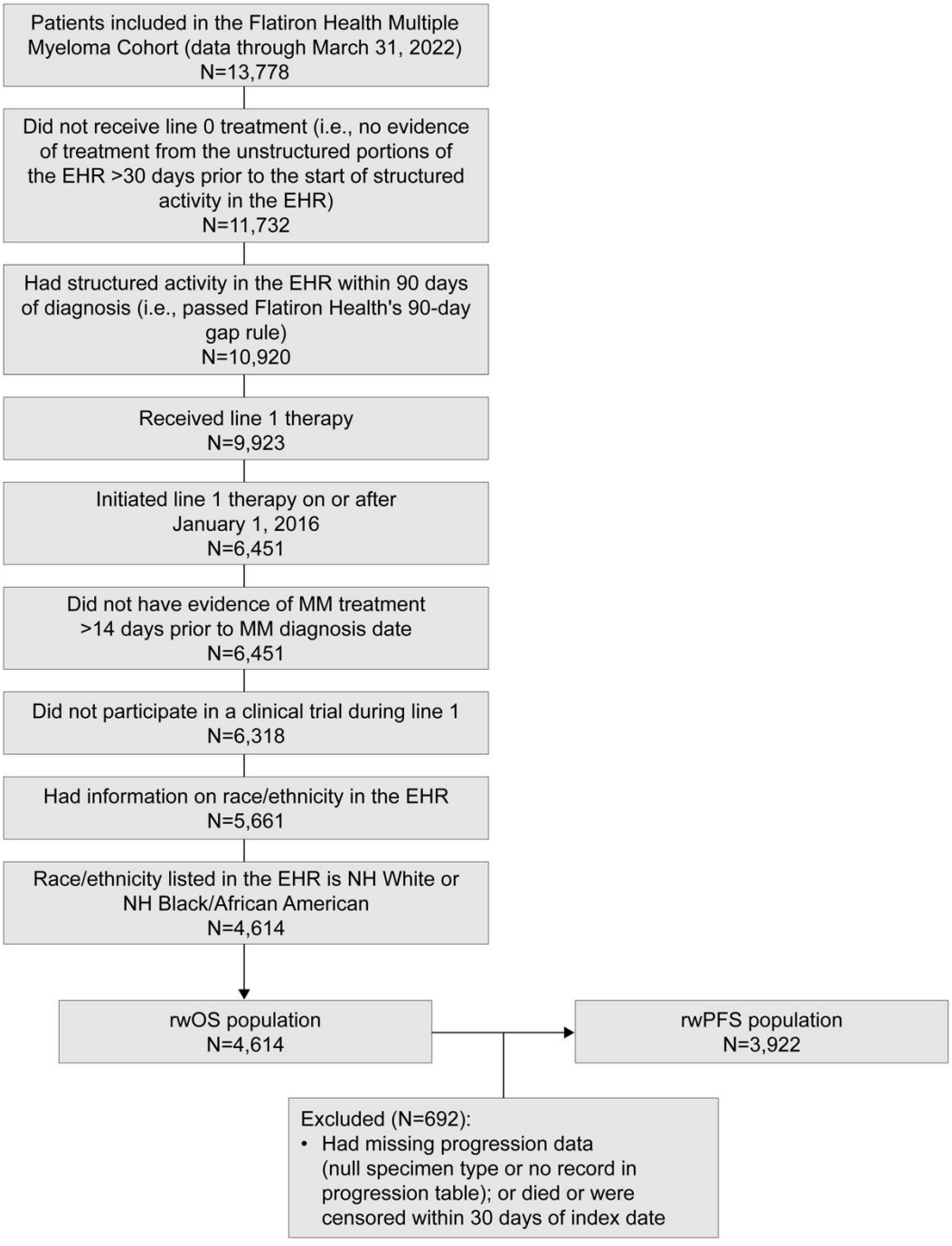
CI: confidence interval; ECOG: Eastern Cooperative Oncology Group; eGFR: estimated glomerular filtration rate; HR: hazard ratio; Ig: immunoglobulin; ISS: International Staging System; LOT: line of therapy; MDRD: Modification of Diet in Renal Disease; MV: multivariable; NH: non-Hispanic; PS: performance status; Ref: reference; rwOS: real-world overall survival.

Supplementary Table 6. eGFR* at the start of first LOT and during first LOT, by race/ethnicity.

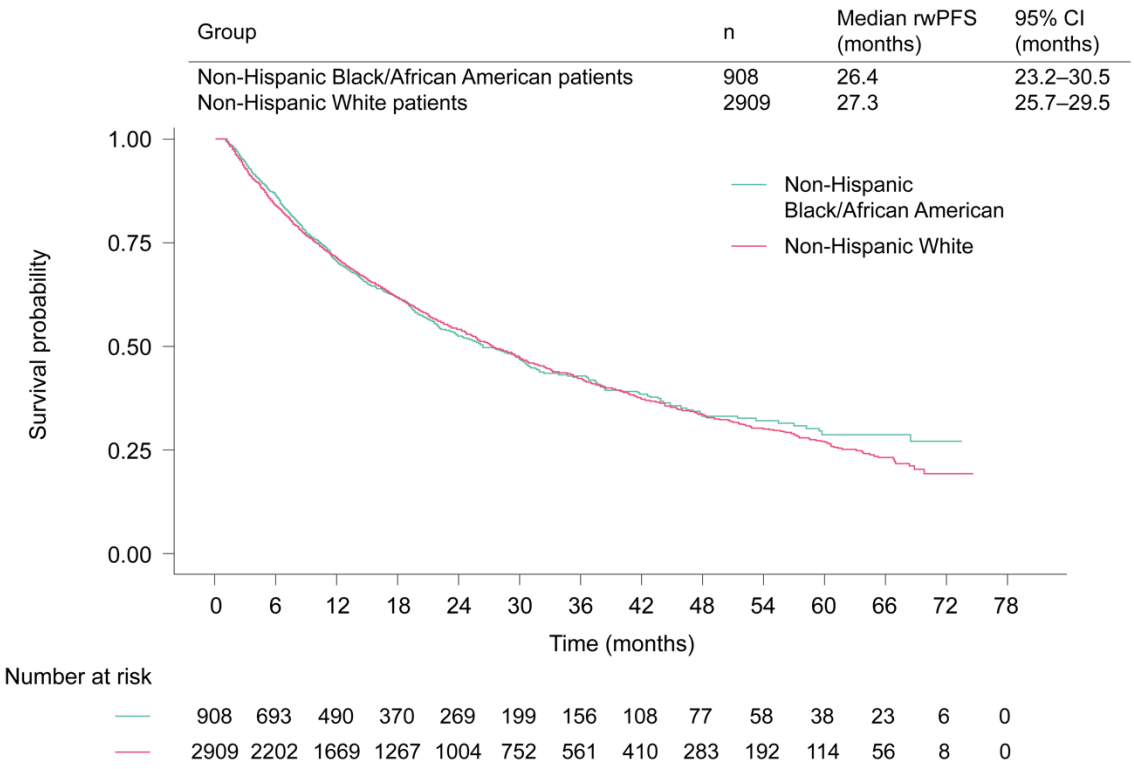
eGFR* value (mL/min/1.73 m^2), n (%)	All patients (N=4,614)	NH Black/African American patients (n=1,077)	NH White patients (n=3,537)
Value at start of first LOT			
<50	1,266 (27.4)	280 (26.0)	986 (27.9)
50-59	511 (11.1)	101 (9.4)	410 (11.6)
≥60	2,081 (45.1)	527 (48.9)	1,554 (43.9)
Missing	756 (16.4)	169 (15.7)	587 (16.6)
Greatest value during first LOT			
<50	761 (16.5)	177 (16.4)	584 (16.5)
50-59	300 (6.5)	58 (5.4)	242 (6.8)
≥60	3,184 (69.0)	756 (70.2)	2,428 (68.7)
Missing	369 (8.0)	86 (8.0)	283 (8.0)
Greatest value during first LOT, by value at start of first LOT			
<50 at start of LOT	1,266 (27.4)	280 (26.0)	986 (27.9)
<50	618 (13.4)	142 (13.2)	476 (13.5)
50-59	181 (3.9)	37 (3.4)	144 (4.1)
≥60	419 (9.1)	85 (7.9)	334 (9.4)
Missing	48 (1.0)	16 (1.5)	32 (0.9)
50-59 at start of LOT	511 (11.1)	101 (9.4)	410 (11.6)
<50	14 (0.3)	<5 (<0.5)	12 (0.3)
50-59	76 (1.7)	10 (0.9)	66 (1.9)
≥60	410 (8.9)	87 (8.1)	323 (9.1)
Missing	11 (0.2)	<5 (<0.5)	9 (0.3)
≥60 at start of LOT	2,081 (45.1)	527 (48.9)	1,554 (43.9)
<50	<5 (<0.1)	0 (0.0)	<5 (<0.5)
50-59	9 (0.2)	<5 (<0.5)	6 (0.2)
≥60	2,008 (43.5)	508 (47.2)	1,500 (42.4)
Missing	61 (1.3)	16 (1.5)	45 (1.3)
Missing at start of LOT	756 (16.4)	169 (15.7)	587 (16.6)
<50	126 (2.7)	33 (3.1)	93 (2.6)
50-59	34 (0.7)	8 (0.7)	26 (0.7)
≥60	347 (7.5)	76 (7.1)	271 (7.7)
Missing	249 (5.4)	52 (4.8)	197 (5.6)

*Assessed using the MDRD equation.
eGFR: estimated glomerular filtration rate; LOT: line of therapy; MDRD: Modification of Diet in Renal Disease; NH: Non-Hispanic.

Supplementary Figure 1. Attrition diagram.



Supplementary Figure 2. Sensitivity analysis*: rwPFS from start of first LOT by race/ethnicity.



*Sensitivity analysis excluded patients with a gap of >180 days between the date of progression event and the previous lab test.

CI: confidence interval; LOT: line of therapy; rwPFS: real-world progression-free survival.