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Results From the 208-Week (4-Year) Follow-up of the RESPONSE Trial, a Phase 3 Study Comparing Ruxolitinib (Rux) With Best Available Therapy (BAT) for the Treatment of Polycythemia Vera (PV)

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Disclosures

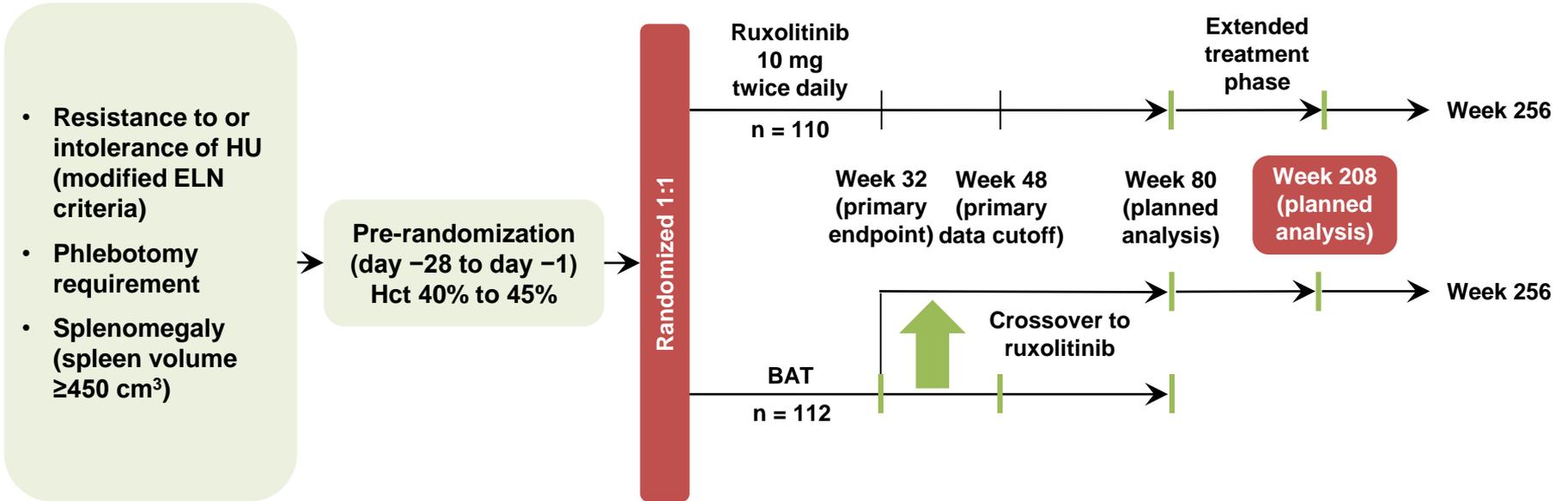
- Novartis, membership on an entity's Board of Directors or Advisory Committees and Research Funding.
- AOP Orphan, membership on an entity's Board of Directors or Advisory Committees and Research Funding.
- Celgene, membership on an entity's Board of Directors or Advisory Committees.
- Study sponsored by Novartis and Incyte.
- Medical Writing support provided by Novartis.

Introduction

- RESPONSE (NCT01243944) is a global, multicenter, open-label, Phase 3 trial comparing the efficacy and safety of ruxolitinib with best available therapy in patients with polycythemia vera (PV) who are resistant to or intolerant of hydroxyurea.¹
- The primary endpoint of the RESPONSE study was achieved demonstrating that ruxolitinib was superior to best available therapy in controlling hematocrit and reducing spleen volume at week 32.¹
- This preplanned analysis of the RESPONSE study was conducted to evaluate the long-term safety and durability of efficacy of ruxolitinib after a follow-up of 208 weeks (after last patient has been followed for 208 weeks [4 years]).
 - The study is currently ongoing.

1. Vannucchi AM et al. *N Engl J Med*. 2015;372(5):426-435.

RESPONSE Study Design



- Patients randomized to BAT were permitted to cross over to ruxolitinib at week 32, if they did not meet the primary endpoint or after week 32 in case of phlebotomy eligibility or splenomegaly progression.

BAT; best available therapy; ELN, European LeukemiaNet; Hct, hematocrit; HU, hydroxyurea.

Endpoints

Durability of Efficacy

- Durability of efficacy in the ruxolitinib arm, including durability of the primary response, primary response components (hematocrit control and spleen volume reduction), and overall clinicohematologic response (CLHM).
 - Primary endpoint was a composite of (1) hematocrit control and (2) a $\geq 35\%$ reduction in spleen volume as measured by magnetic resonance imaging at Week 32.
 - Complete hematologic response (CHR) was a key secondary endpoint defined as hematocrit control, platelet count $\leq 400 \times 10^9/L$, and white blood cell count $\leq 10 \times 10^9/L$.
 - Overall CLHM was a key secondary endpoint defined CHR and spleen volume reduction $\geq 35\%$ by imaging.
- Overall survival was an exploratory endpoint.

Safety

- Adverse events, regardless of causality, were summarized.

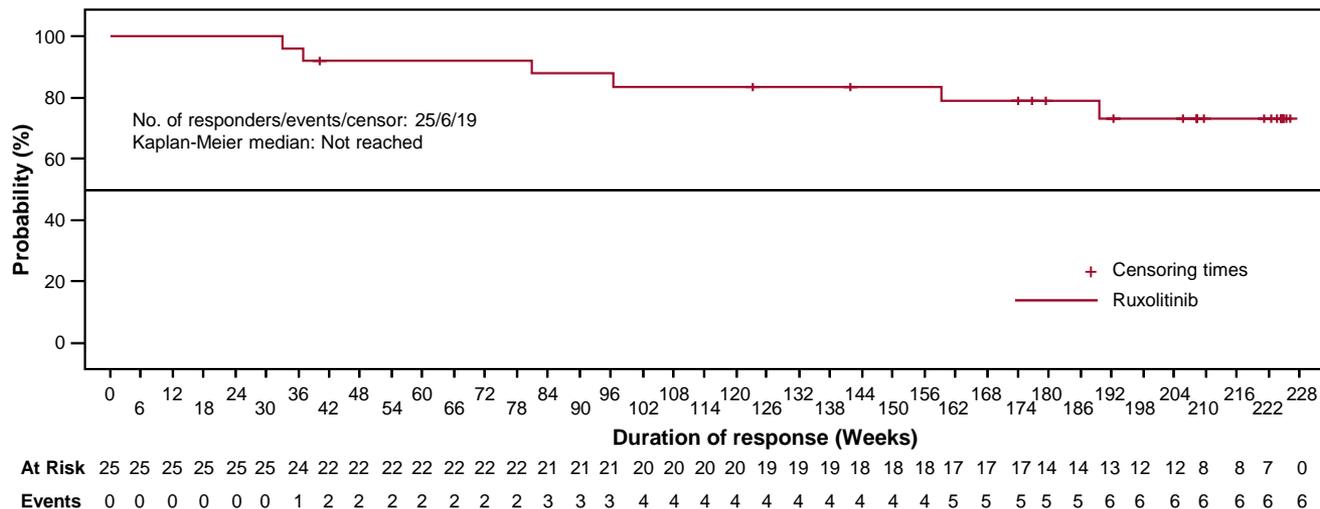
Patient Disposition

	Ruxolitinib (n = 110)	BAT* (n = 112)	Ruxolitinib Crossover (n = 98)
Ongoing treatment at database lock, n (%)	41 (37)	0	37 (38)
Completed treatment period	32 (29)	1 (1)	30 (31)
Reasons for discontinuation of treatment, n (%)			
Adverse event	15 (14)	2 (2)	14 (14)
Disease progression	12 (11)	1 (1)	8 (8)
Patient decision	6 (6)	5 (5)	6 (6)
Lack of efficacy	0	100 (89)	0
Others (protocol deviation, lost to follow-up, and physician decision)	3 (3)	2 (2)	3 (3)
Death [†]	1 (1)	0	0
Median treatment exposure, weeks	225	34	189
* Initial BAT included HU (n = 66), IFN/pegylated IFN (n = 13), anagrelide (n = 8), IMiDs (n = 5), pipobroman (n = 2), and observation (n = 17). For patients who were randomized to BAT and then crossed over to ruxolitinib, the reasons for end of BAT are reported in the "BAT" column.			
[†] One patient, determined by the Investigator to have discontinued the study treatment due to AEs, died afterwards.			

BAT, best available therapy; HU, hydroxyurea; IFN, interferon; IMiDs, immunomodulators.



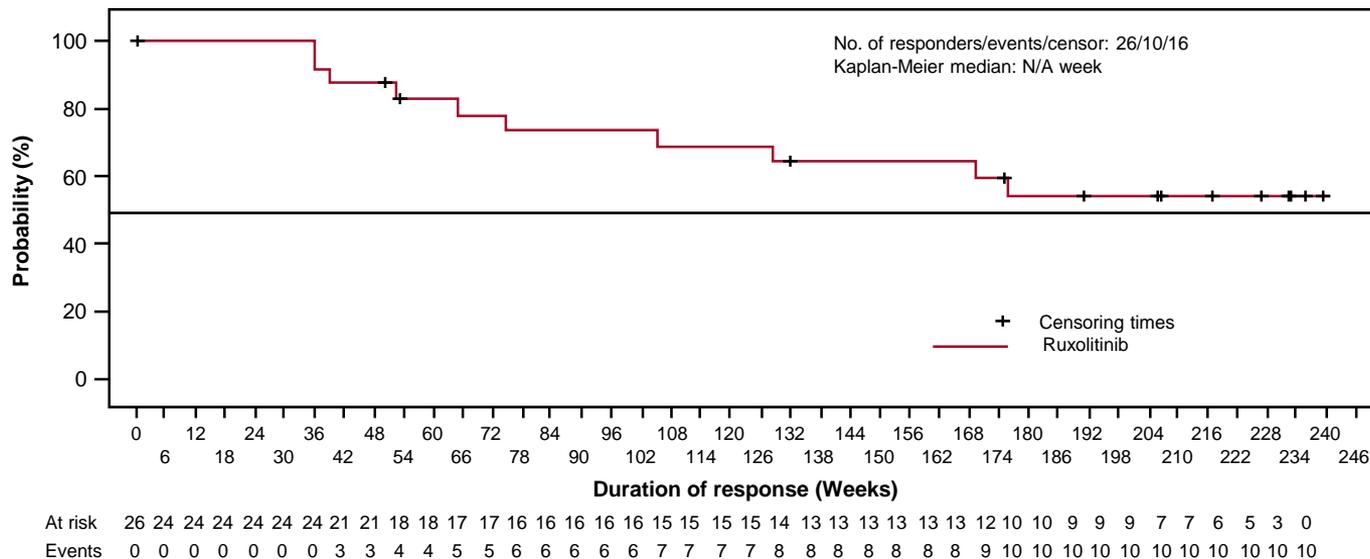
Durability of Primary Response With Ruxolitinib



- At the time of analysis in the ruxolitinib arm, 6 of 25 primary responders have progressed.
- The K-M estimate of duration of maintaining primary response for 208 weeks (4 years) was 0.73 (95% CI: 0.49, 0.87).
 - The K-M estimates of duration of hematocrit control for 208 weeks was 0.73 (95% CI: 0.60, 0.83).
 - The K-M estimates of duration of at least 35% reduction in the spleen volume was 0.86 (95% CI: 0.61, 0.95).
- Median duration of primary response has not been reached.

CI, confidence interval; K-M, Kaplan–Meier.

Durability of Complete Hematologic Remission With Ruxolitinib

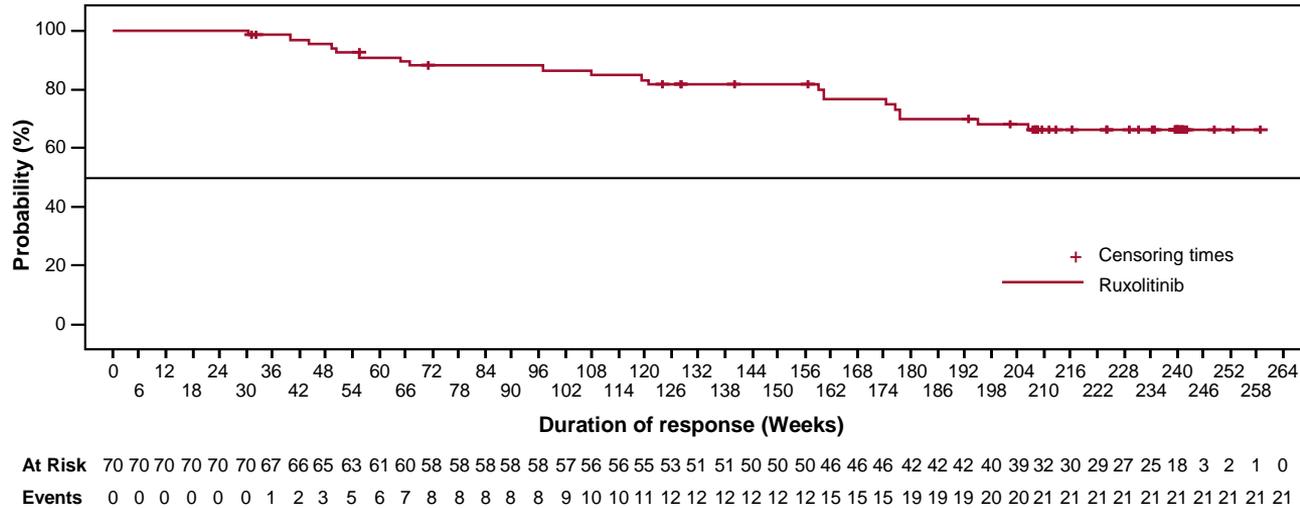


- The K-M estimate of duration of CHR (hematocrit control, platelet count $\leq 400 \times 10^9/L$, and WBC count $\leq 10 \times 10^9/L$) for 208 weeks (4 years) was 0.54 (95% CI: 0.31, 0.72).
 - Of 87 patients with WBC $> 10 \times 10^9/L$ at baseline, 42 (48.3%) achieved WBC $\leq 10 \times 10^9/L$ at week 208.
 - Of 54 patients with platelet count $> 400 \times 10^9/L$ at baseline, 26 (48.1%) achieved platelet count $\leq 400 \times 10^9/L$ at week 208 .

CHR, complete hematologic remission; CI, confidence interval; K-M, Kaplan-Meier



Durability of Overall Clinicohematologic Response With Ruxolitinib

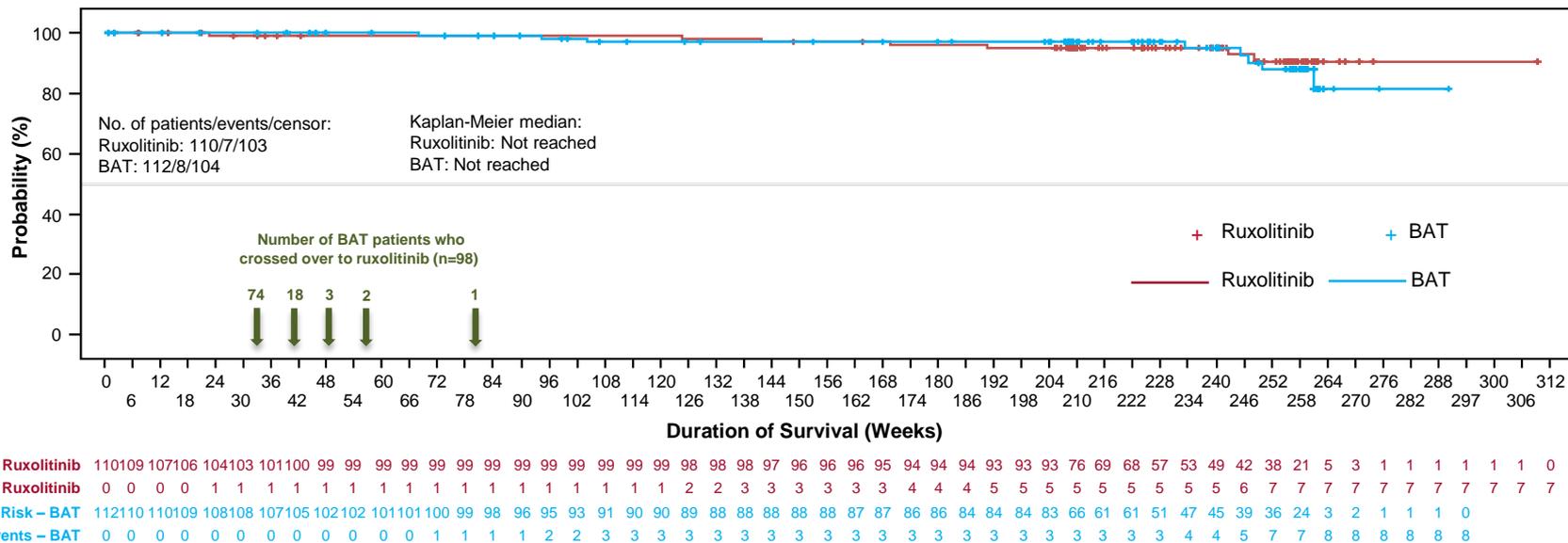


- Of the 70 patients (63.6%) who achieved an overall CLHM response at week 32, twenty-one had progressed by week 208.
- The K-M estimate of duration of maintaining CLHM for 208 weeks (4 years) was 0.67 (95% CI: 0.54, 0.77).
 - Median duration of CLHM response has not been reached.

CLHM, clinicohematologic response; CI, confidence interval; K-M, Kaplan-Meier



Overall Survival Analysis in the Intent-to-Treat Population



- In the ITT analysis not accounting for crossover, the K-M estimates for overall survival at 5 years was 90.6% (95% CI: 80.1, 95.7) in the ruxolitinib arm and 87.7% (95% CI: 74.8, 94.3) in the BAT arm.
- Patients were allowed to cross over from BAT to ruxolitinib at or after week 32, no patient remained on randomized BAT treatment after week 80.

BAT, best available therapy; CI, confidence interval; CO, crossover; K-M, Kaplan-Meier; ITT, intent-to-treat.



Adverse Events

(Adjusted for Patient-Year Exposure, Regardless of Study Drug Relationship [All Grades, Rate \geq 5 in Either Arm])

	208-Week (4-Year) Analysis			
	Ruxolitinib n = 110 Exposure, Patient-Years = 409		Crossover n = 98 Exposure, Patient-Years = 310	
Rate per 100 Patient-Years of Exposure	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4
Hematologic adverse events				
Anemia	9.3	1.0	9.4	0.6
Thrombocytopenia	4.6	1.0	1.3	0.3
Non-hematologic adverse events				
All infections	19.6	3.7	19.7	6.5
Herpes zoster infection	4.9	0.5	4.2	0.6
Pruritus	7.3	0.5	5.8	0
Diarrhea	7.1	0.2	3.2	0
Headache	6.1	0.5	5.5	0
Fatigue	5.1	0.2	4.2	0
Increased weight	5.6	0.7	4.2	0.3
Arthralgia	5.9	0.2	3.2	0.3
Muscle spasms	5.4	0.2	3.2	0
Dizziness	4.2	0.0	6.1	0

Adverse Events

(Adjusted for Patient-Year Exposure, Regardless of Study Drug Relationship [All Grades, Rate \geq 5 in Either Arm])

	208-Week (4-Year) Analysis				80-Week Analysis			
	Ruxolitinib n = 110 Exposure, Patient-Years = 409		Crossover n = 98 Exposure, Patient-Years = 310		Ruxolitinib n = 110 Exposure, Patient-Years = 227.7		Crossover n = 98 Exposure, Patient-Years = 147.6	
Rate per 100 Patient-Years of Exposure	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4
Hematologic adverse events								
Anemia	9.3	1.0	9.4	0.6	13.2	0.9	14.9	1.4
Thrombocytopenia	4.6	1.0	1.3	0.3	6.1	1.8	2.7	0.7
Non-hematologic adverse events								
All infections	19.6	3.7	19.7	6.5	29.4	4.0	27.8	5.4
Herpes zoster infection	4.9	0.5	4.2	0.6	5.3	0.9	5.4	0.7
Pruritus	7.3	0.5	5.8	0	9.7	0.4	8.8	0
Diarrhea	7.1	0.2	3.2	0	9.7	0	5.4	0
Headache	6.1	0.5	5.5	0	10.5	0.9	8.8	0
Fatigue	5.1	0.2	4.2	0	8.3	0.4	6.8	0
Increased weight	5.6	0.7	4.2	0.3	7.5	0.4	6.8	0
Arthralgia	5.9	0.2	3.2	0.3	6.1	0	4.7	0
Muscle spasms	5.4	0.2	3.2	0	7.9	0.4	3.4	0
Dizziness	4.2	0.0	6.1	0	7.5	0	7.5	0



Thromboembolic Adverse Events (SMQ)

(Adjusted for Patient-Year Exposure, Regardless of Study Drug Relationship [All Grades, Rate \geq 0.2 in Either Arm])

	208-Week (4-Year) Analysis			
	Ruxolitinib n = 110 Exposure, Patient-Years = 409		Crossover n = 98 Exposure, Patient-Years = 310	
n (Rate per 100 Patient-Years of Exposure)	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4
All thromboembolic events^a	5 (1.2)	3 (0.7)	9 (2.9)	5 (1.6)
Cerebral infarction	1 (0.2)	1 (0.2)	0	0
Ischemic stroke	1 (0.2)	0	1 (0.3)	1 (0.3)
Transient ischemic attack	0	0	2 (0.6)	2 (0.6)
Portal vein thrombosis	1 (0.2)	1 (0.2)	0	0
Pulmonary embolism	1 (0.2)	1 (0.2)	0	0
Retinal vascular thrombosis	1 (0.2)	0	0	0
Myocardial infarction	0	0	2 (0.6)	1 (0.3)
Deep vein thrombosis	0	0	1 (0.3)	0
Thrombophlebitis	0	0	1 (0.3)	0
Thrombosis	0	0	1 (0.3)	0
Bone infarction	0	0	1 (0.3)	0
Coronary artery occlusion	0	0	1 (0.3)	0
Disseminated intravascular coagulation	0	0	1 (0.3)	1 (0.3)

- While on BAT, the rates of all grade and grade 3/4 thromboembolic events per 100 patient-years of exposure were 8.2 (n = 6) and 2.7 (n = 2), respectively.

^aMedDRA version 19.1 was used to code the events. BAT; best available therapy; SMQ, standardized medical dictionary for regulatory activities (MedDRA) query.



Thromboembolic Adverse Events (SMQ)

(Adjusted for Patient-Year Exposure, Regardless of Study Drug Relationship [All Grades, Rate ≥ 0.2 in Either Arm])

	208-Week (4-Year) Analysis				80-Week Analysis			
	Ruxolitinib n = 110 Exposure, Patient-Years = 409		Crossover n = 98 Exposure, Patient-Years = 310		Ruxolitinib n = 110 Exposure, Patient-Years = 227.7		Crossover n = 98 Exposure, Patient-Years = 147.6	
n (Rate per 100 Patient-Years of Exposure)	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4	All Grades	Grade 3 or 4
All thromboembolic events^a	5 (1.2)	3 (0.7)	9 (2.9)	5 (1.6)	4 (1.8)	2 (0.9)	6 (4.1)	4 (2.7)
Cerebral infarction	1 (0.2)	1 (0.2)	0	0	1 (0.4)	1 (0.4)	0	0
Ischemic stroke	1 (0.2)	0	1 (0.3)	1 (0.3)	1 (0.4)	0	0	0
Transient ischemic attack	0	0	2 (0.6)	2 (0.6)	0	0	2 (1.4)	2 (1.4)
Portal vein thrombosis	1 (0.2)	1 (0.2)	0	0	1 (0.4)	1 (0.4)	0	0
Pulmonary embolism	1 (0.2)	1 (0.2)	0	0	0	0	0	0
Retinal vascular thrombosis	1 (0.2)	0	0	0	1 (0.4)	0	0	0
Myocardial infarction	0	0	2 (0.6)	1 (0.3)	0	0	2 (1.4)	1 (0.7)
Deep vein thrombosis	0	0	1 (0.3)	0	0	0	0	0
Thrombophlebitis	0	0	1 (0.3)	0	0	0	0	0
Thrombosis	0	0	1 (0.3)	0	0	0	1 (0.7)	0
Bone infarction	0	0	1 (0.3)	0	0	0	1 (0.7)	0
Coronary artery occlusion	0	0	1 (0.3)	0	0	0	1 (0.7)	0
Disseminated intravascular coagulation	0	0	1 (0.3)	1 (0.3)	0	0	1 (0.7)	1 (0.7)

- While on BAT, the rates of all grade and grade 3/4 thromboembolic events per 100 patient-years of exposure were 8.2 (n = 6) and 2.7 (n = 2), respectively.

^aMedDRA version 19.1 was used to code the events. BAT; best available therapy; SMQ, standardized medical dictionary for regulatory activities (MedDRA) query.



Other Adverse Events of Interest

(Adjusted for Patient-Year Exposure, Regardless of Study Drug Relationship [All Grades, Rate \geq 0.5 in Either Arm])

	208-Week (4-Year) Analysis	
	Ruxolitinib n = 110 Exposure, Patient-Years = 409 n (Rates)	Crossover n = 98 Exposure, Patient-Years = 310 n (Rates)
Disease Progression		
Acute myeloid leukemia	1 (0.2)	1 (0.3)
Myelofibrosis	9 (2.2)	6 (1.9)
Other Malignancies		
Prostate cancer	1 (0.2)	2 (0.6)
Breast cancer	1 (0.2)	0
Chronic myelomonocytic leukemia	1 (0.2)	1 (0.3)
Malignant fibrous histiocytoma	0	0

- While on BAT, no patient progressed to acute myeloid leukemia or myelofibrosis.

BAT; best available therapy.



Other Adverse Events of Interest

(Adjusted for Patient-Year Exposure, Regardless of Study Drug Relationship [All Grades, Rate \geq 0.5 in Either Arm])

	208-Week (4-Year) Analysis		80-Week Analysis	
	Ruxolitinib n = 110 Exposure, Patient-Years = 409 n (Rates)	Crossover n = 98 Exposure, Patient-Years = 310 n (Rates)	Ruxolitinib n = 110 Exposure, Patient-Years = 227.7 n (Rates)	Crossover n = 98 Exposure, Patient-Years = 147.6 n (Rates)
Disease Progression				
Acute myeloid leukemia	1 (0.2)	1 (0.3)	1 (0.4)	1 (0.7)
Myelofibrosis	9 (2.2)	6 (1.9)	3 (1.3)	3 (2.0)
Other Malignancies				
Prostate cancer	1 (0.2)	2 (0.6)	0	2 (1.4)
Breast cancer	1 (0.2)	0	2 (0.9)	0
Chronic myelomonocytic leukemia	1 (0.2)	1 (0.3)	0	1 (0.7)
Malignant fibrous histiocytoma	0	0	0	1 (0.7)

- While on BAT, no patient progressed to acute myeloid leukemia or myelofibrosis.

BAT; best available therapy.



Other Adverse Events of Interest

(Nonmelanoma Skin Cancer Adjusted for Patient-Year Exposure)

n (Rate per 100 Patient-Years of Exposure)	208-Week (4-Year) Analysis				80-Week Analysis			
	Ruxolitinib n = 110 Exposure, Patient-Years = 409		Crossover n = 98 Exposure, Patient-Years = 310		Ruxolitinib n = 110 Exposure, Patient-Years = 227.7		Crossover n = 98 Exposure, Patient-Years = 147.6	
Prior history of Nonmelanoma Skin Cancer	No	Yes	No	Yes	No	Yes	No	Yes
Total events	13 (3.6)	8 (18.6)	6 (2.1)	2 (9.5)	4 (2.0)	6 (24.2)	2 (1.4)	1 (10.6)
Basal cell carcinoma	10 (2.7)	7 (16.3)	4 (1.4)	1 (4.7)	3 (1.5)	5 (20.2)	1 (0.7)	1 (10.6)
Squamous cell carcinoma of skin	4 (1.1)	4 (9.3)	3 (1.0)	0	1 (0.5)	2 (8.1)	0	0
Bowen's disease	1 (0.3)	1 (2.3)	0	0	0	1 (4.0)	0	0
Carcinoma in situ of skin	0	2 (4.7)	0	0	0	1 (4.0)	0	0
Metastatic squamous cell carcinoma	0	2 (4.7)	0	0	0	1 (4.0)	0	0
Keratoacanthoma	1 (0.3)	0	0	0	0	0	0	0
Squamous cell carcinoma*	2 (0.5)	3 (7.0)	2 (0.7)	2 (9.5)	1 (0.5)	4 (16.1)	1 (0.7)	0

*Categorized as non-skin squamous cell carcinoma cases.

Deaths

- Since week 80, there were 2 new on-treatment deaths in the **ruxolitinib** arm.
 - Adenocarcinoma gastric (n = 1): The investigator assessed the event to be related to study drug.
 - Neoplasm malignant (n = 1): The investigator assessed the event not related to study drug.
- In the **crossover population**, 4 patients had fatal adverse events leading to 4 on-treatment deaths. These deaths were assessed as not related to ruxolitinib treatment.
 - Pneumonia (n = 2)
 - Central nervous system hemorrhage (n = 1)
 - Hypovolemic shock (n = 1)

Discussion

- In the RESPONSE study, patients with PV who were resistant to or intolerant of hydroxyurea had durable hematocrit control and clinicohematologic response.
 - In both the ruxolitinib arm and crossover population, 66% of patients completed 5 years of study treatment (29%) or were still on treatment (37%).
- With an additional 120 weeks (30 months) of follow-up, the overall safety profile remains unchanged from the 80-week analysis.
- Taken together, these results support ruxolitinib as an effective long-term treatment option for patients with PV who have had an inadequate response to or are intolerant of hydroxyurea.

PV, polycythemia vera.



Acknowledgements

- We thank the patients and investigators of the RESPONSE study, and Incyte Corporation for their contributions to conduct this study.

Argentina

Dr Beatriz Moiraghi
Dr Ana Ines Varela

Australia

Prof Simon Durrant
Dr Ashish Bajel
Prof Ehtesham Abdi

Belgium

Dr Laurent Knoops
Dr Timothy Devos
Dr. Jan Van Droogenbroeck
Dr Pierre Zachee

Canada

Dr Jeannie Callum
Dr Vikas Gupta
Dr Brian Leber
Dr Jaroslav Prchal

China

Dr Jianyong Li
Dr Daobin Zhou
Dr Jie Jin

France

Dr Jean Jacques Kiladjian
Dr Jean Christophe Ianotto
Dr Nathalie Cambier
Dr Borhane Slama
Dr Dana Ranta
Dr Viviane Dubruille
Dr Frederic Bauduer

Hungary

Dr Laszlo Janos Ivanyi
Dr Zita Borbenyi
Dr Gabor Pajkos
Dr Tamas Masszi
Dr Arpad Batai

Germany

Dr Eva Lengfelder
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Dr Giorgina Specchia
Dr Francesco Nobile
Dr Vittorio Rosti
Dr Giovanni Barosi
Dr Alessandro Rambaldi
Dr Michele Cavo
Dr Michele Baccarani
Dr Francesco Passamonti
Dr Fabrizio Pane
Dr Ester Pungolino

Korea

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Dr Jimmie Harvey
Dr Eyal Meiri
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Dr Carole Miller
Dr Bart Scott
Dr Maria Scouras
Dr Colin Spears
Dr Howard Terebello
Dr Srdan Verstovsek
Dr Allen Yeilding
Dr Steven Young
Dr Stephen Oh
Dr Lawrence Afrin
Dr Vandana Agarwal
Dr Brady Stein
Dr Jesus Berdeja
Dr Michael Scola
Dr Mojtaba Akhtari
Dr Sandeep Rajan
Dr Michael Jay McCleod
Dr Luis Meza
Dr Ali Khojasteh
Dr Naeem Latif
Dr Alfred Saleh
Dr Helen Ryan
Dr David Witt
Dr Paul Roda
Dr Edward Lee
Dr Jay Walls
Dr Kerry Pulver
Dr Pedro Sanz-Altamira

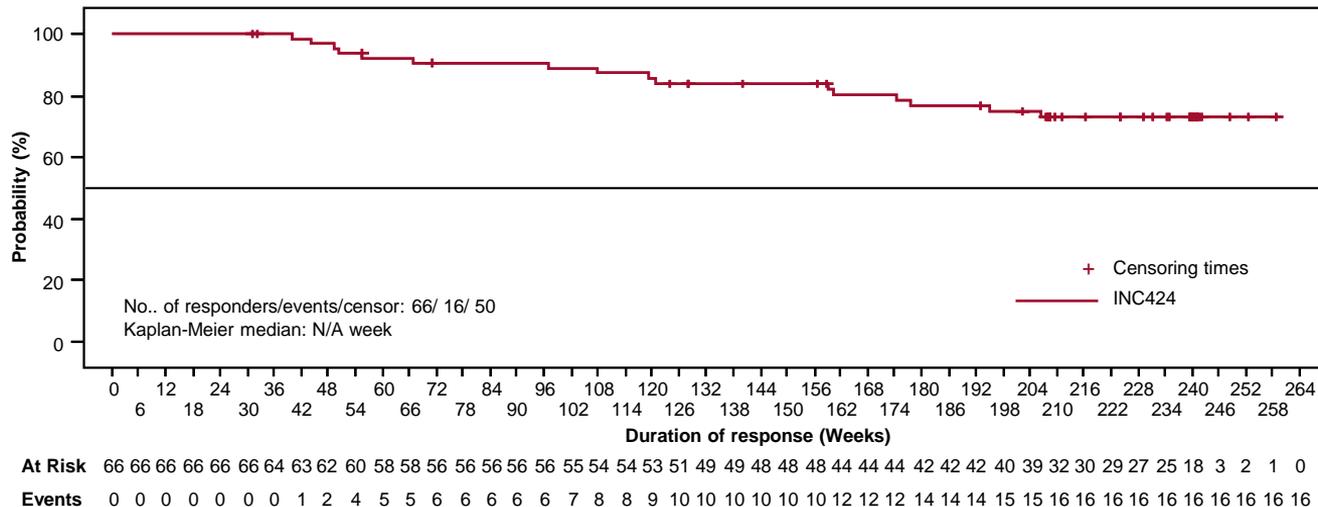
- Thanks to Mary Laughlin and Monika Wroclawska of Novartis for contribution to the study.



Back-up Slides

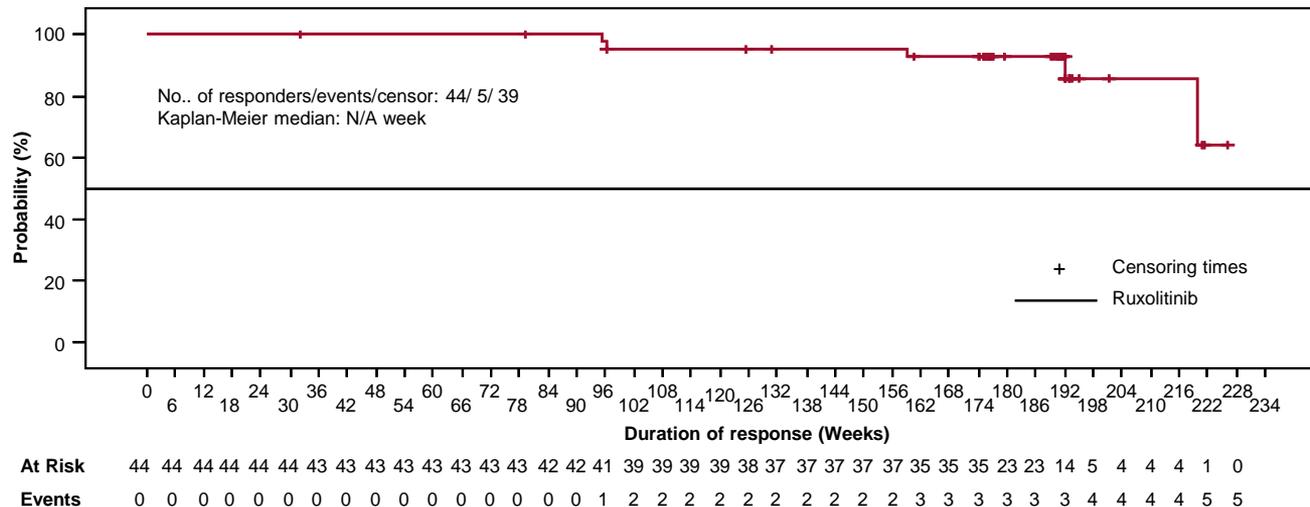


Duration of Absence of Phlebotomy Eligibility With Ruxolitinib



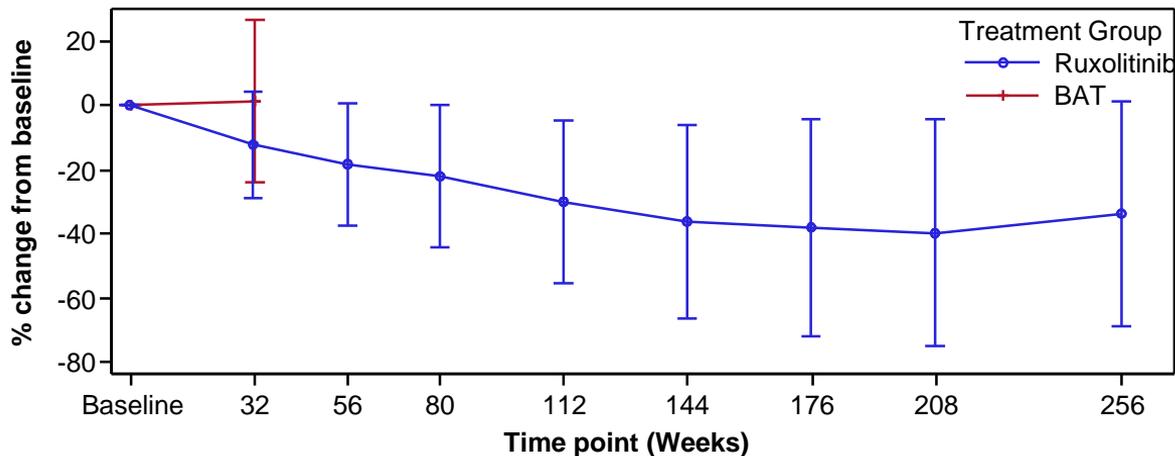
- The K-M estimates of duration of absence of phlebotomy eligibility for 208 weeks was 0.73 (95% CI: 0.60, 0.83).

Duration of Spleen Volume Reduction with Ruxolitinib



- The K-M estimates of duration of at least 35% reduction in the spleen volume for 208 weeks was 0.86 (95% CI: 0.61, 0.95).

Percentage change from baseline in *JAK2V617F* allele burden



Number of patients

Ruxolitinib	104	92	89	84	83	78	74	64	30
BAT	107	80							

- The mean *JAK2 V617F* allele burden decreased consistently over time, similar to that observed at Week 80 and Week 48 analysis.
 - In the ruxolitinib arm, the median percent change from baseline in allele burden was -35.99% (range: -100 to 15.6, n = 64) at week 208 vs -18.35% (range: -94 to 30.0, n = 84) at week 80.
 - In the crossover population, the median percent change from baseline in allele burden was -11.83% (range: -97.4 to 114.3, n = 26) at week 224 vs -7.99% (range: -94.9 to 166.7, n = 78) at week 80.

