

# Immunotherapy of Melanoma

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# Overview

- Metastatic Melanoma
- Adjuvant therapy for High-risk
- Practical Questions
- Future Directions

# Overview

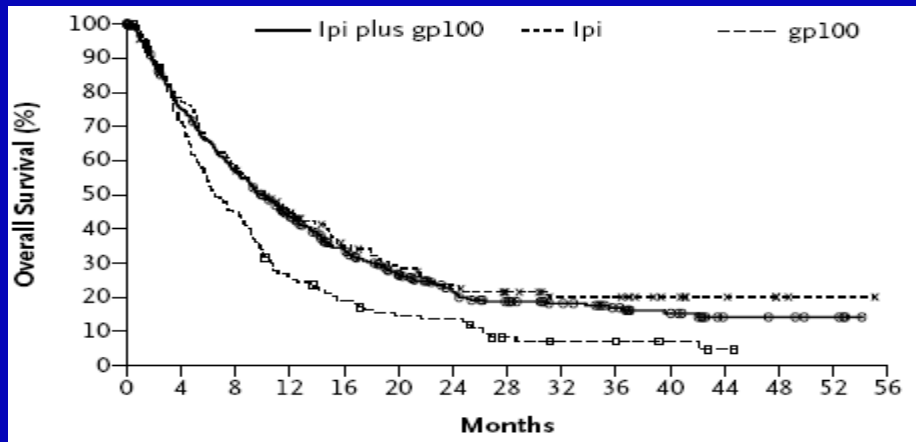
- **Metastatic Melanoma**
- Adjuvant therapy for High-risk
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Today's Immunotherapy  
=  
Checkpoint Inhibitors

# Check-Point Inhibitors Approved for Melanoma

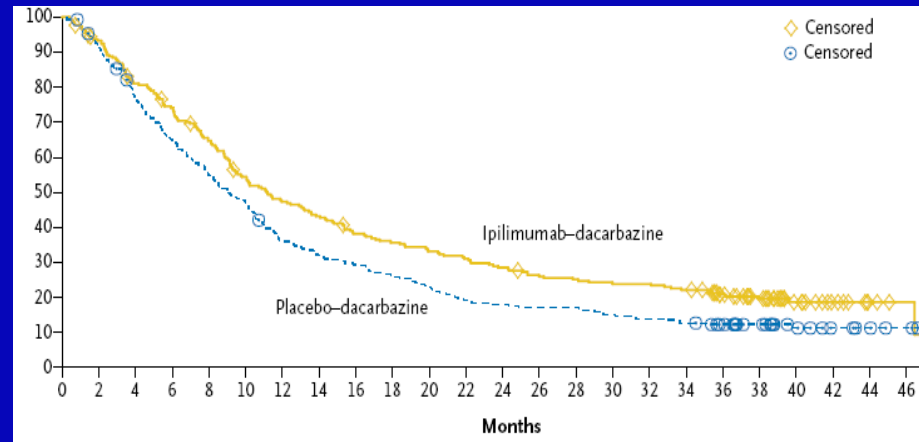
- Anti CTLA4 antibody: Ipilimumab
- Anti PD-1 inhibitors: pembrolizumab, nivolumab
- Combination anti CTLA-4 and anti-PD1 (ipilimumab and nivolumab)

# Clinical Results with Ipilimumab (2<sup>nd</sup> and 1st line) Ipilimumab vs vaccine and Ipi + DTIC vs DTIC



**HR: 0.66 and 0.68**  
**Pre-treated pts**  
**Ipi 3 mg/kg +/- gp100**

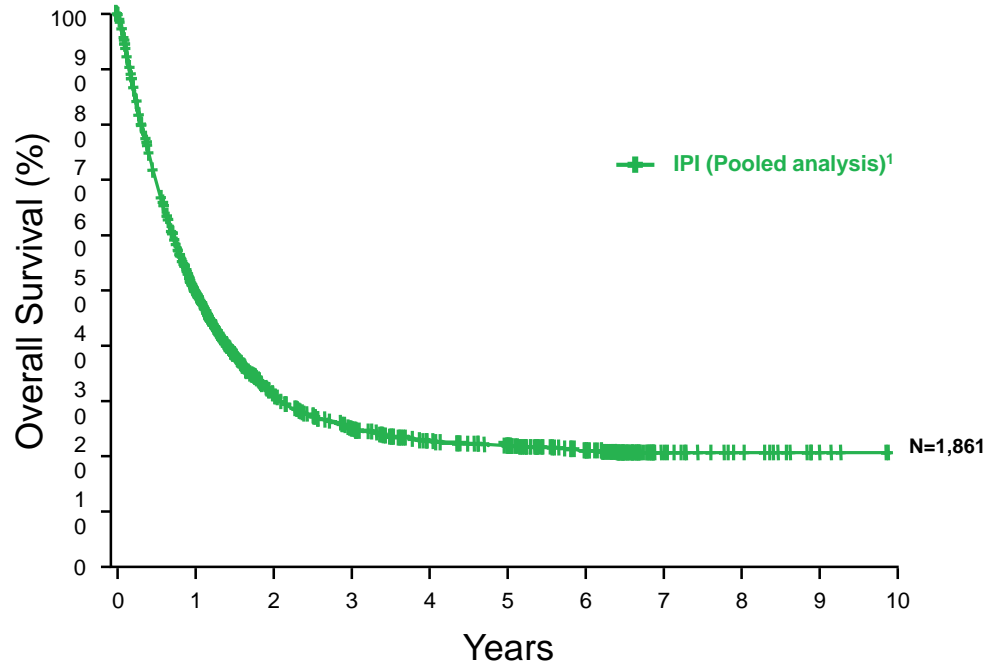
Hodi FS, et al. *N Engl J Med.* 2010;363:711-23.



**HR: 0.72**  
**First line**  
**Ipi 10 mg/kg + DTIC**

Robert C, et al. *N Engl J Med.* 2011;364:2517-26.

# Immune Checkpoint Inhibitors Provide Durable Long-term Survival for Patients with Advanced Melanoma



1. Schadendorf et al. *J Clin Oncol* 2015;33:1889-1894; 2. Current analysis; 3. Poster presentation by Dr. Victoria Atkinson at SMR 2015 International Congress.

# Keynote-006 Front-line Pembrolizumab vs Ipilimumab

## Patients

- Unresectable, stage III or IV melanoma
- ≤1 prior therapy, excluding anti-CTLA-4, PD-1, or PD-L1 agents
- Known *BRAF* status<sup>b</sup>
- ECOG PS 0-1
- No active brain metastases
- No serious autoimmune disease

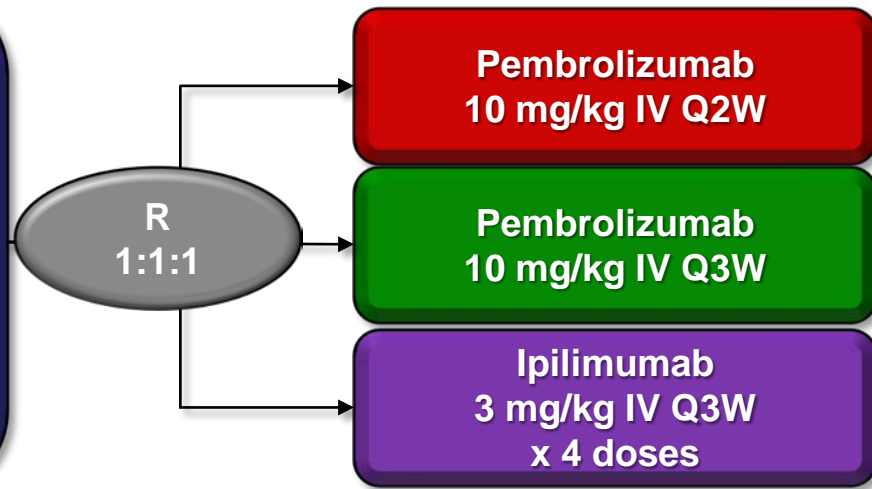
## Stratification factors:

- ECOG PS (0 vs 1)
- Line of therapy (first vs second)
- PD-L1 status (positive<sup>c</sup> vs negative)

<sup>a</sup>Patients enrolled from 83 sites in 16 countries.

<sup>b</sup>Prior anti-*BRAF* targeted therapy was not required for patients with normal LDH levels and no clinically significant tumor-related symptoms or evidence of rapidly progressing disease.

<sup>c</sup>Defined as membranous PD-L1 expression in ≥1% of tumor cells as assessed by IHC using the 22C3 antibody.



- **Primary end points: PFS and OS**
- **Secondary end points: ORR, duration of response, safety**



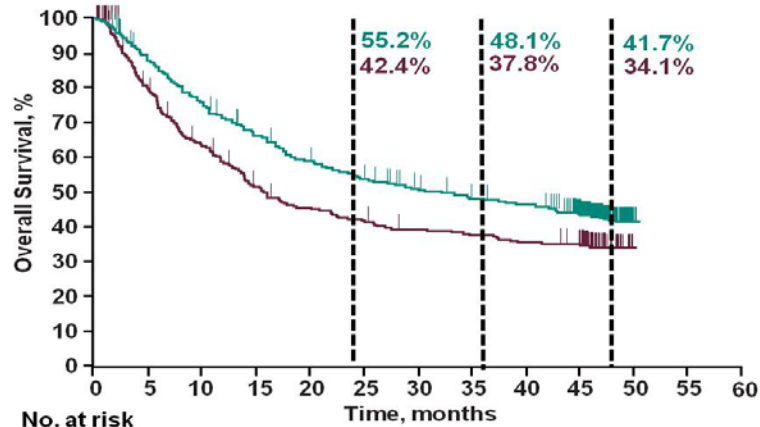
# Tumor Response (irRC, investigator)

	<b>Pembrolizumab N = 556</b>	<b>Ipilimumab N = 278</b>
ORR, % (95% CI)	42 (38-46)	16 (12-21)
Best overall response, % (95% CI)		
CR	13 (11-16)	3 (1-6)
PR	29 (25-33)	14 (10-18)
SD	21 (18-25)	25 (20 -31)
PD	29 (26-33)	39 (33-45)

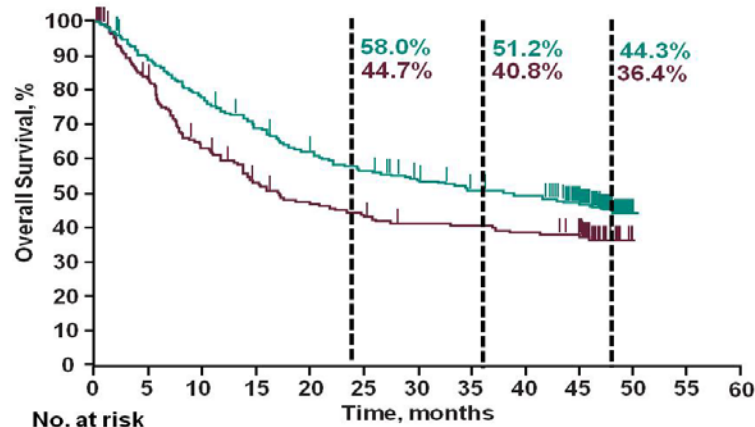
# Overall Survival

## Median Follow-Up 45.9 (0.3-50.0) Months

All Patients			
	Events, n	HR <sup>a</sup> (95% CI)	Median, <sup>b</sup> mo (95% CI)
Pembro	309	0.73 (0.61-0.89)	32.7 (24.5-41.6)
Ipi	164	-	15.9 (13.3-22.0)

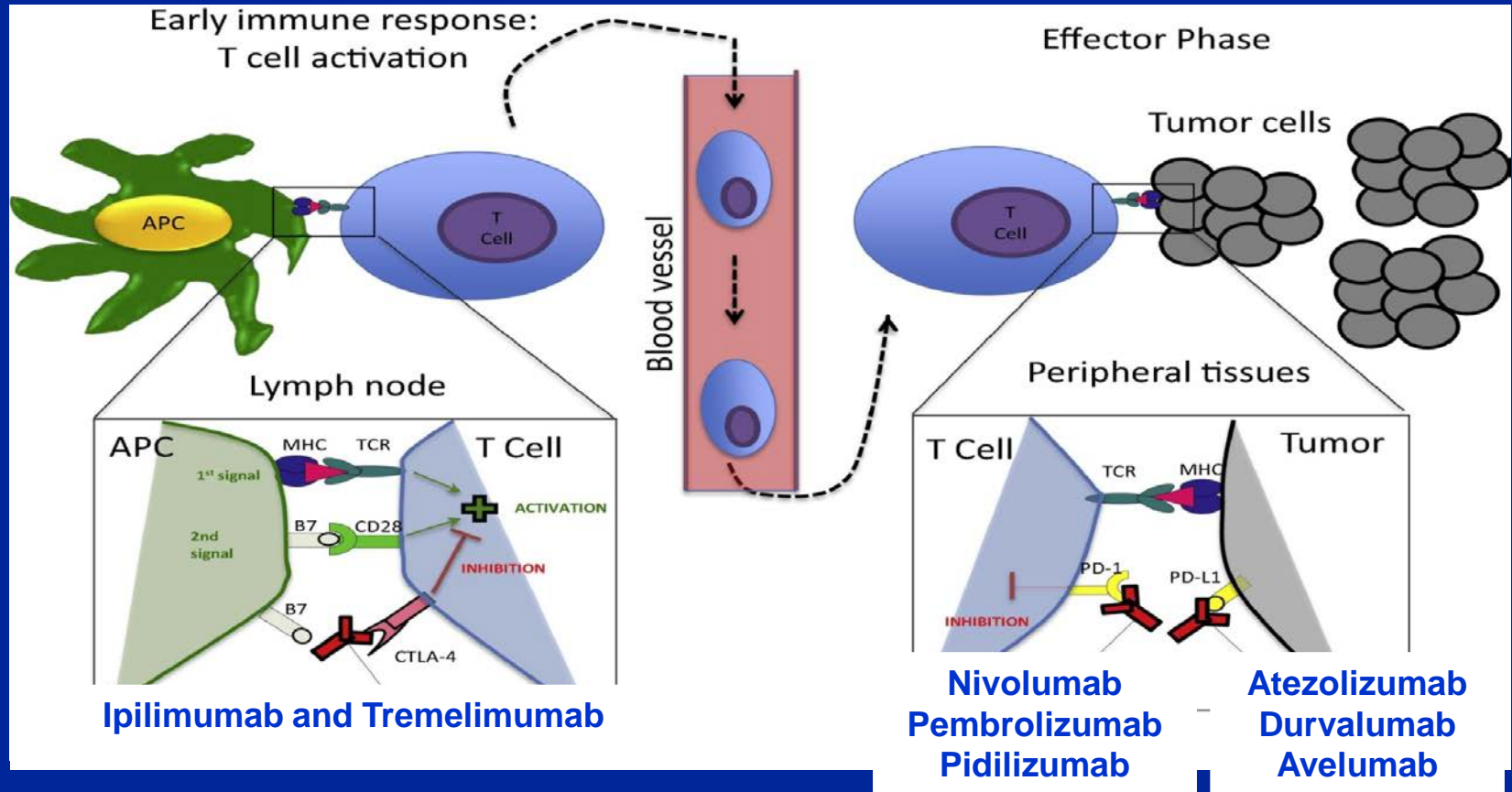


Treatment-Naive Patients			
	Events, n	HR <sup>a</sup> (95% CI)	Median, <sup>b</sup> mo (95% CI)
Pembro	193	0.73 (0.57-0.93)	38.7 (27.3-NR)
Ipi	104	-	17.1 (13.8-26.2)



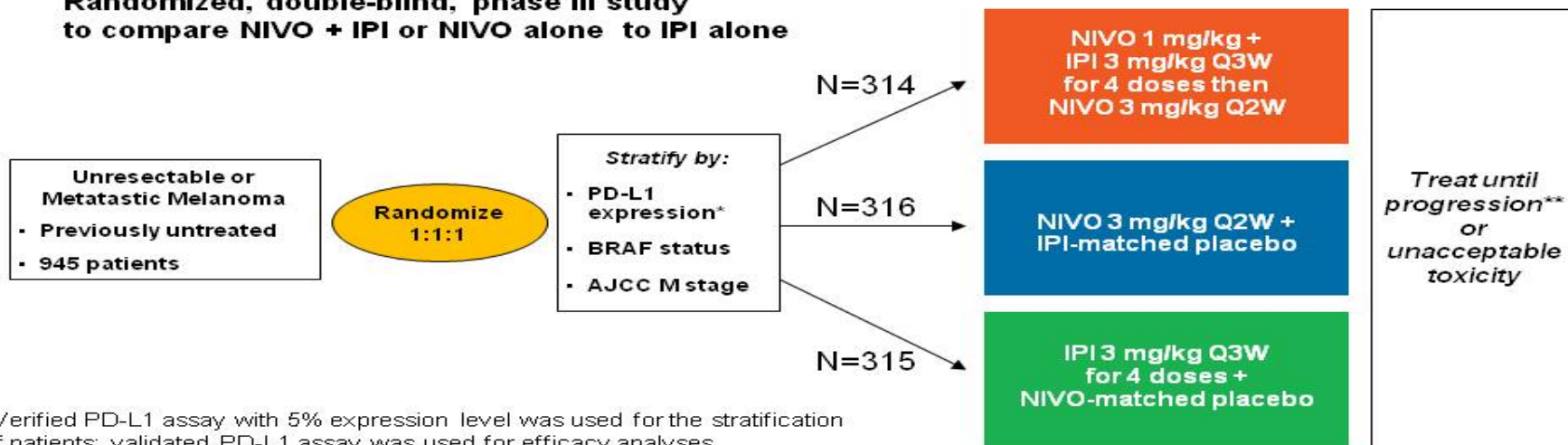
<sup>a</sup>Based on Cox regression model with treatment as covariate stratified by line of therapy (1st vs 2nd), PD-L1 status (positive vs negative), and ECOG (0 vs 1); if no patients are in one of the treatment groups involved in a comparison for a particular stratum, then that stratum was excluded from treatment comparison. <sup>b</sup>Derived by the product-limit (Kaplan-Meier) method for censored data. Data cutoff: Dec 4, 2017.

# Blocking CTLA-4 and PD-1



# CA209-067: Study Design

**Randomized, double-blind, phase III study  
to compare NIVO + IPI or NIVO alone to IPI alone**



\*Verified PD-L1 assay with 5% expression level was used for the stratification of patients; validated PD-L1 assay was used for efficacy analyses.

\*\*Patients could have been treated beyond progression under protocol-defined circumstances.

# Updated Response To Treatment

	<b>NIVO+IPI (N=314)</b>	<b>NIVO (N=316)</b>	<b>IPI (N=315)</b>
<b>ORR, % (95% CI)*</b>	<b>58.9</b> (53.3–64.4)	<b>44.6</b> (39.1–50.3)	<b>19.0</b> (14.9–23.8)
<b>Best overall response — %</b>			
Complete response	17.2	14.9	4.4
Partial response	41.7	29.7	14.6
Stable disease	11.5	9.8	21.3
Progressive disease	23.6	38.6	51.1
Unknown	6.1	7.0	8.6
<b>Median duration of response, months (95% CI)</b>	<b>NR</b> (NR–NR)	<b>31.1</b> (31.1–NR)	<b>18.2</b> (8.3–NR)

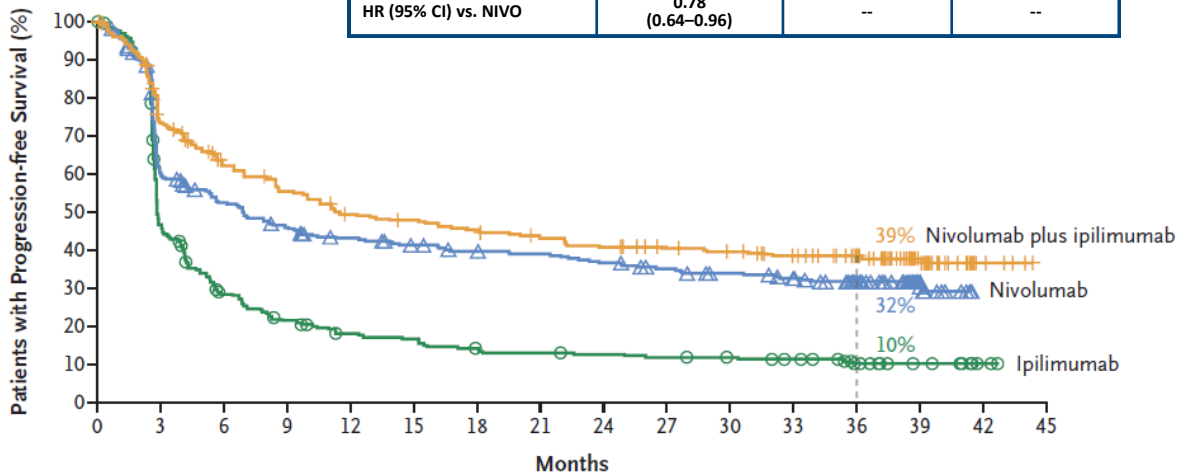
\*By RECIST v1.1; NR = not reached.

- At the 18-month DBL, the CR rate for NIVO+IPI, NIVO and IPI was 12.1%, 9.8% and 2.2%, respectively

# CM-67 Progression-Free Survival

	NIVO+IPI (N=314)	NIVO (N=316)	IPI (N=315)
Median PFS, mo (95% CI)	11.5 (8.7–19.3)	6.9 (5;1–9.7)	2.9 (2.8–3.2)
HR (95% CI) vs. IPI	0.43 (0.35–0.52)	0.55 (0.45–0.66)	--
HR (95% CI) vs. NIVO	0.78 (0.64–0.96)	--	--

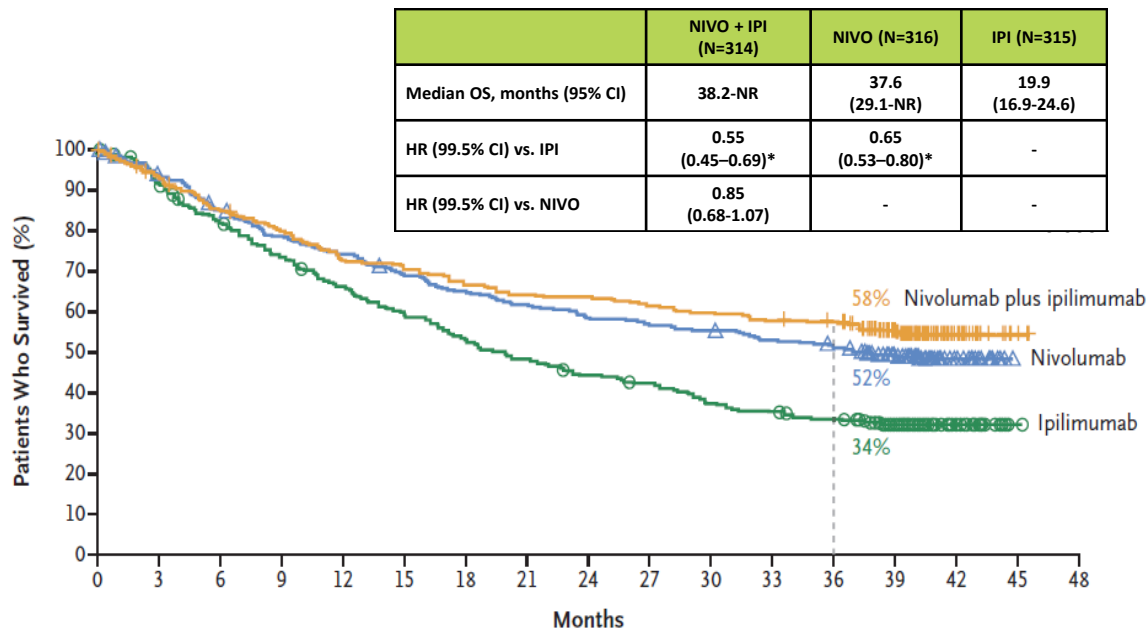
A Progression-free Survival



No. at Risk

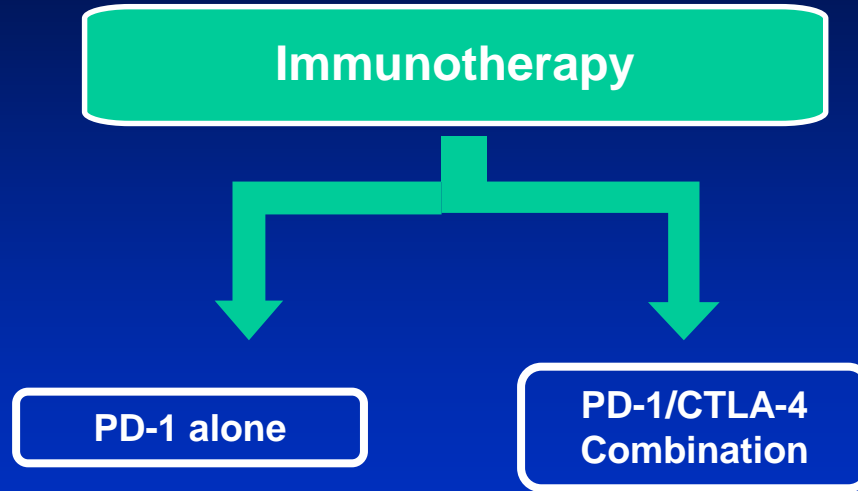
Nivolumab plus ipilimumab	314	218	175	155	136	131	124	117	110	104	100	92	75	29	5	0
Nivolumab	316	177	151	131	119	111	105	102	96	87	81	75	61	24	0	0
Ipilimumab	315	136	78	58	46	42	34	32	30	28	26	23	15	8	2	0

# CM-67 Overall Survival



No. at Risk	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
Nivolumab plus ipilimumab	314	292	265	247	226	221	209	200	198	192	186	180	177	131	27	3	0
Nivolumab	316	292	265	244	230	213	201	191	181	175	171	163	156	120	28	0	0
Ipilimumab	315	285	253	227	203	181	163	148	135	128	117	107	100	68	20	2	0

# Decision Point....





# Safety Summary

- With an additional 19 months of follow-up, safety was consistent with the initial report<sup>1</sup>

	NIVO+IPI (N=313)		NIVO (N=313)		IPI (N=311)	
	Any Grade	Grade 3-4	Any Grade	Grade 3-4	Any Grade	Grade 3-4
<b>Patients reporting event, %</b>						
<b>Treatment-related adverse event (AE)</b>	95.8	58.5	86.3	20.8	86.2	27.7
<b>Treatment-related AE leading to discontinuation</b>	39.6	31.0	11.5	7.7	16.1	14.1
<b>Treatment-related death, n (%)</b>	2 (0.6) <sup>a</sup>		1 (0.3) <sup>b</sup>		1 (0.3) <sup>b</sup>	

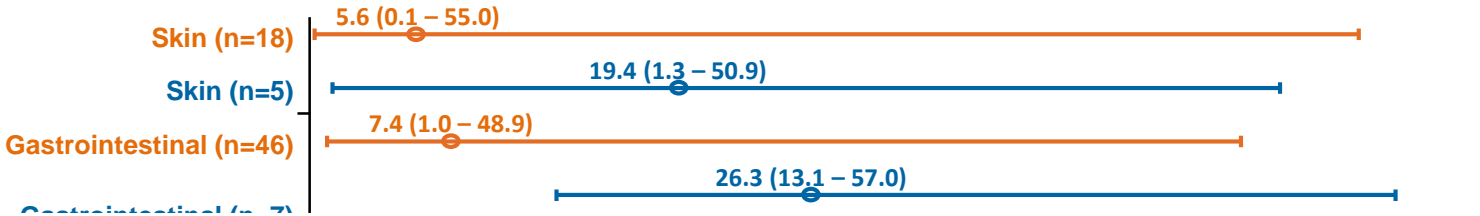
- Most select AEs were managed and resolved within 3-4 weeks (85–100% across organ categories)
- ORR was 70.7% for pts who discontinued NIVO+IPI due to AEs, with median OS not reached

<sup>a</sup>Cardiomyopathy (NIVO+IPI, n=1); Liver necrosis (NIVO+IPI, n=1). Both deaths occurred >100 days after the last treatment.

<sup>b</sup>Neutropenia (NIVO, n=1); colon perforation (IPI, n=1).<sup>1</sup>

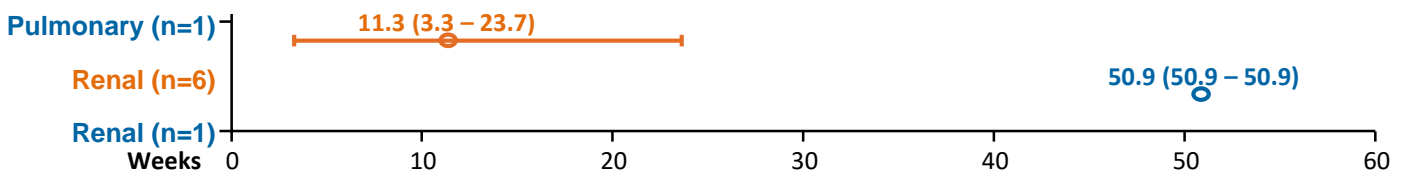
# Checkmate 067: Safety

## Onset Grade 3–4 Treatment-Related Select AEs



**Toxicity Earlier**

**Longer Time to Resolution** HPI

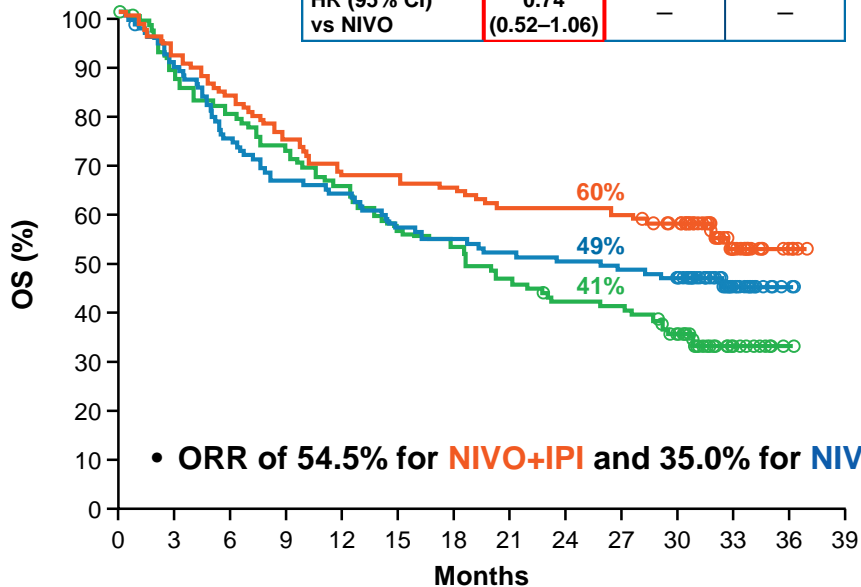


Circles represent medians; bars signify ranges

# OS by Tumor PDL-1 Expression at a 1% Cutoff

## PD-L1 Expression Level <1%

<1% PD-L1	NIVO+IPI	NIVO	IPI
Median OS, mo (95% CI)	NR (26.5–NR)	23.5 (13.0–NR)	18.6 (13.7–23.2)
HR (95% CI) vs NIVO	0.74 (0.52–1.06)	–	–

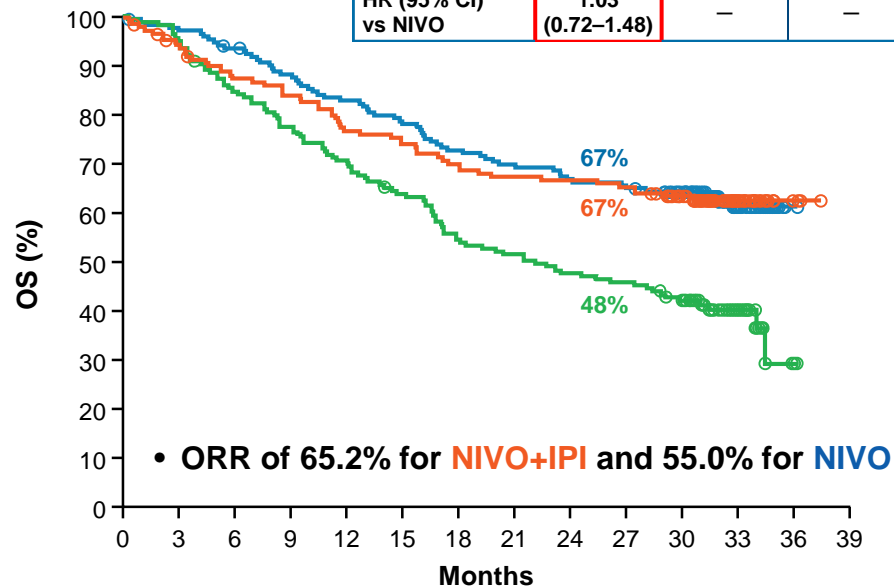


Patients at risk:

	0	3	6	9	12	15	18	21	24	27	30	33	36	39
NIVO+IPI	123	113	102	91	82	82	79	74	74	72	66	18	4	0
NIVO	117	103	86	76	73	65	62	59	57	55	50	16	2	0
IPI	113	96	87	79	71	61	57	50	44	43	32	10	1	0

## PD-L1 Expression Level ≥1%

≥1% PD-L1	NIVO+IPI	NIVO	IPI
Median OS, mo (95% CI)	NR	NR	22.1 (17.1–29.7)
HR (95% CI) vs NIVO	1.03 (0.72–1.48)	–	–



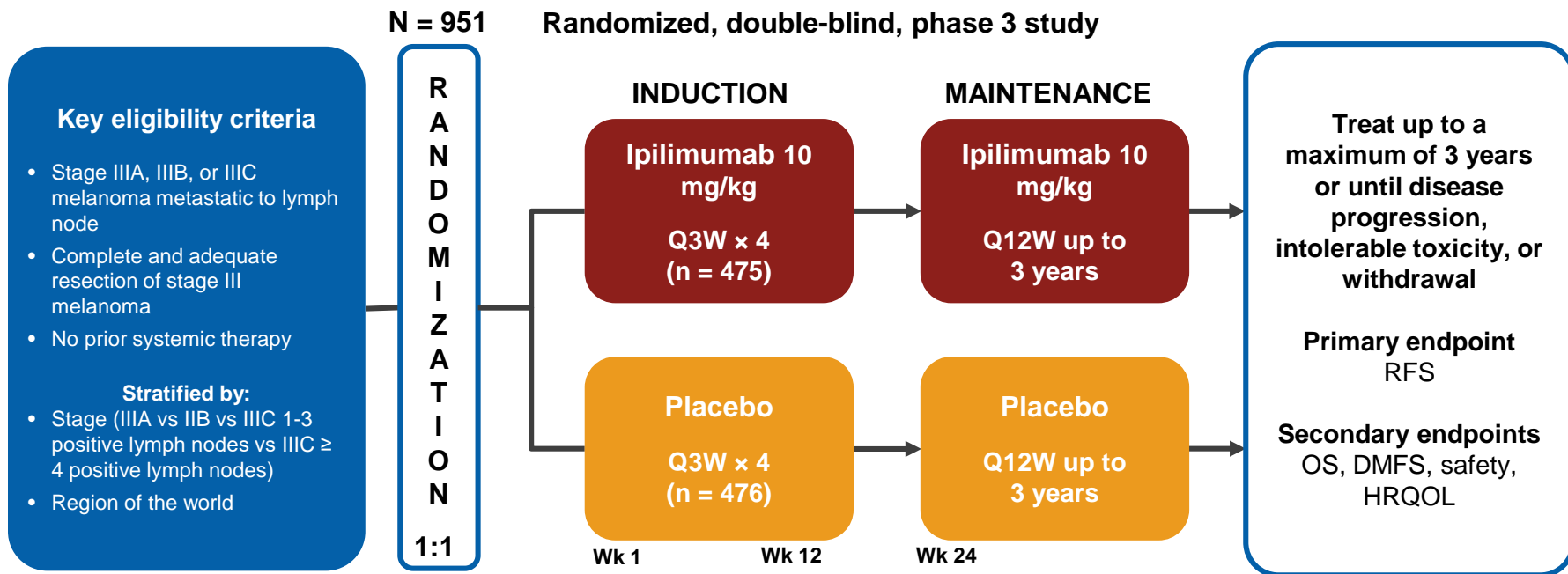
Patients at risk:

	0	3	6	9	12	15	18	21	24	27	30	33	36	39
NIVO+IPI	155	144	132	127	116	112	105	102	101	99	85	27	3	0
NIVO	171	165	158	148	139	131	122	117	112	109	98	36	1	0
IPI	164	155	138	126	115	102	89	83	77	74	64	21	2	0

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# EORTC 18071: phase 3 study design<sup>1,2</sup>



DMFS, distant metastasis-free survival; HRQOL, health-related quality of life; OS, overall survival; PFS, progression-free survival; Q3W, every 3 weeks; Q12W, every 12 weeks; RFS, relapse-free survival.

1. Eggermont AM, et al. *J Clin Oncol* 2014;32:5s(suppl); abstr LBA9008); 2. Eggermont A, et al. ESMO. 2016;[abstr LBA2\_PR].

# EORTC 18071 Ipilimumab vs Placebo

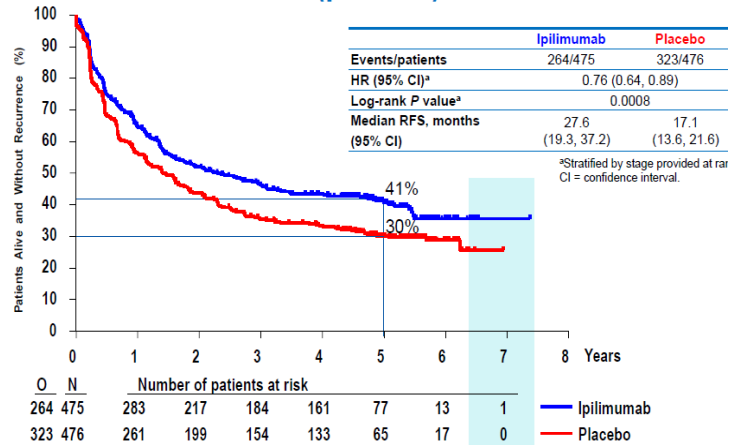
## Safety Summary

	Ipilimumab (n = 471)	
	Any Grade	Grade 3/4
Any AE, %	98.7	54.1
Treatment-related AE, %	94.1	45.4
Treatment-related AE leading to discontinuation, %	48.0	32.9
Any immune-related AE, %	90.4	41.6

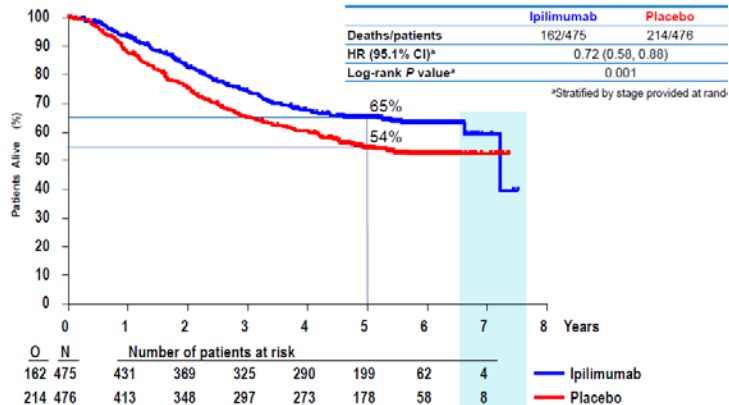
### Deaths due to drug-related AEs

- 5 patients (1.1%) in the ipilimumab group
  - 3 patients with colitis (2 with gastrointestinal perforations)
  - 1 patient with myocarditis
  - 1 patient had multiorgan failure with Guillain-Barré

### RFS (per IRC)



### OS



# CheckMate 238: Study Design

## Patients with:

- High-risk, completely resected stage IIIB/IIIC or stage IV (AJCC 7<sup>th</sup> edition) melanoma
- No prior systemic therapy
- ECOG 0-1

1:1

n = 453

n = 453

NIVO 3 mg/kg IV Q2W  
and  
IPI placebo IV  
Q3W for 4 doses  
then Q12W from week 24

IPI 10 mg/kg IV  
Q3W for 4 doses  
then Q12W from week 24  
and  
NIVO placebo IV Q2W

Follow-up

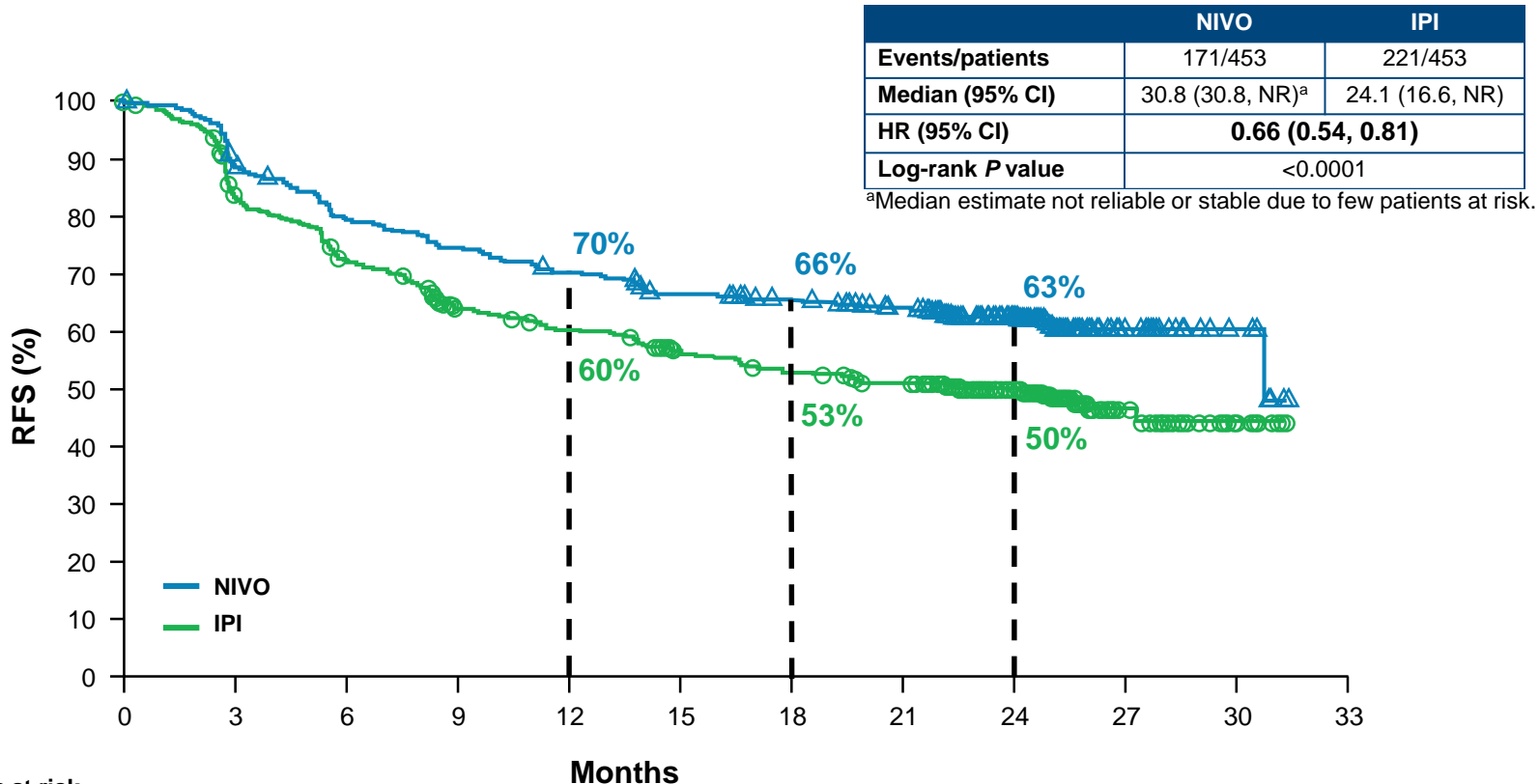
Maximum  
treatment  
duration of  
1 year

## Stratified by:

- 1) Disease stage: IIIB/C vs IV M1a-M1b vs IV M1c
- 2) PD-L1 status at a 5% cutoff in tumor cells

**Enrollment period:** March 30, 2015 to November 30, 2015

# Primary Endpoint: RFS in All Patients



Number of patients at risk

NIVO	453	394	353	331	311	291	280	264	205	28	7	0
IPI	453	363	314	270	251	230	216	204	149	23	5	0

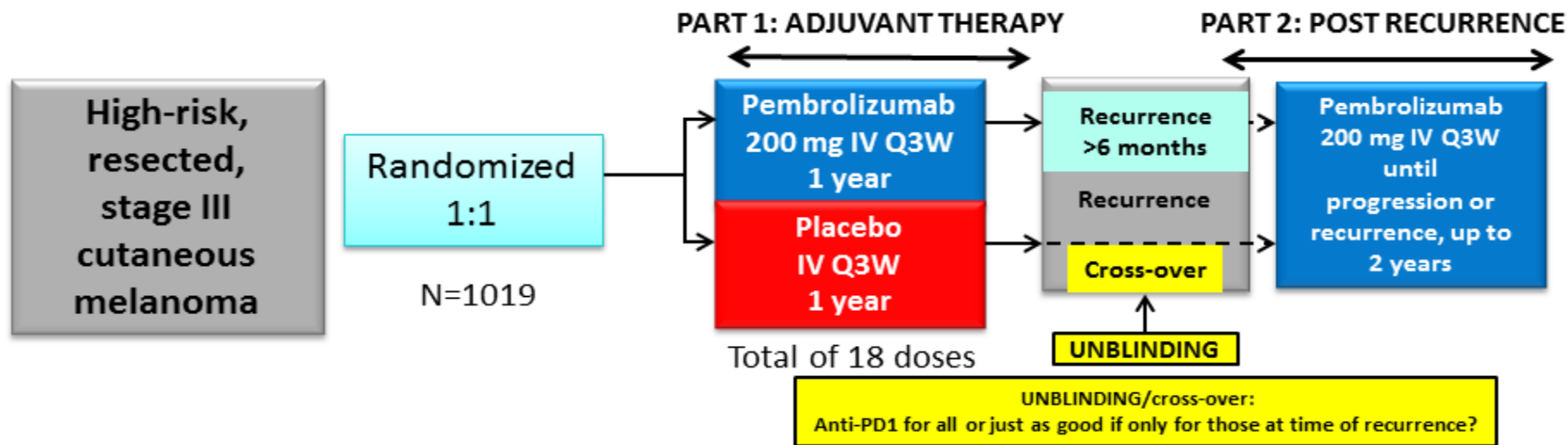


## Safety Summary

AE, n (%)	NIVO (n = 452)		IPI (n = 453)	
	Any grade	Grade 3/4	Any grade	Grade 3/4
<b>Any AE</b>	438 (97)	115 (25)	446 (98)	250 (55)
<b>Treatment-related AE</b>	385 (85)	65 (14)	434 (96)	208 (46)
<b>Any AE leading to discontinuation</b>	44 (10)	21 (5)	193 (43)	140 (31)
<b>Treatment-related AE leading to discontinuation</b>	35 (8)	16 (4)	189 (42)	136 (30)

- There were no treatment-related deaths in the NIVO group
- There were 2 (0.4%) treatment-related deaths in the IPI group (marrow aplasia and colitis), both >100 days after the last dose

# EORTC 1325/KEYNOTE-54: Study Design



## Stratification factors:

- ✓ **Stage:** IIIA (>1 mm metastasis) vs. IIIB vs. IIIC 1-3 positive lymph nodes vs. IIIC ≥4 positive lymph nodes
- ✓ **Region:** North America, European countries, Australia/New Zealand, other countries

## Primary Endpoints:

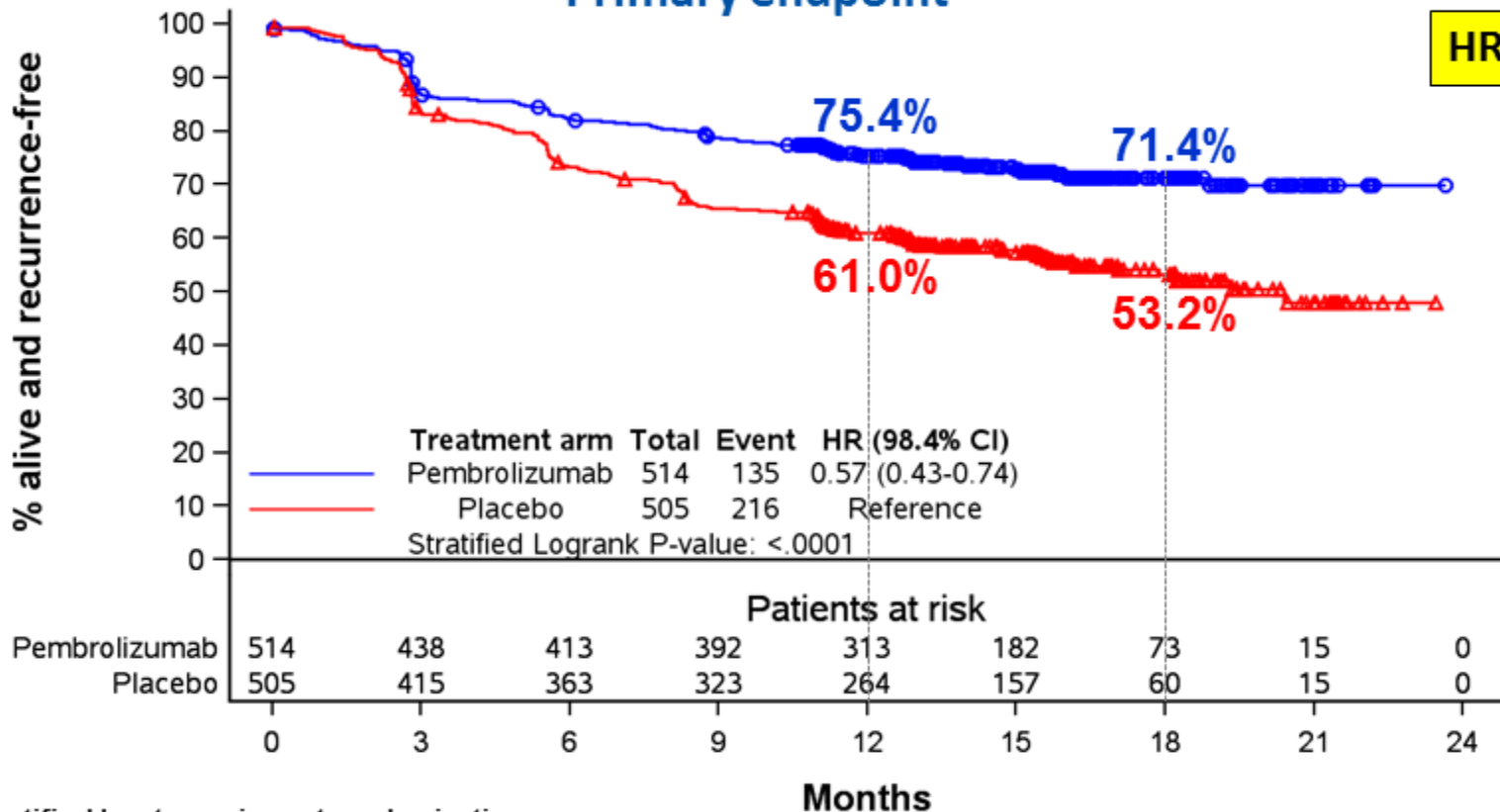
- RFS (per investigator) in overall population, and RFS in patients with PD-L1-positive tumors

## Secondary Endpoints:

- DMFS and OS in all patients, and in patients with PD-L1-positive tumors; **Safety, Health-related quality of life**

# Recurrence-Free Survival in the ITT Population

## Primary endpoint



\*Stratified by stage given at randomization

# Interferon



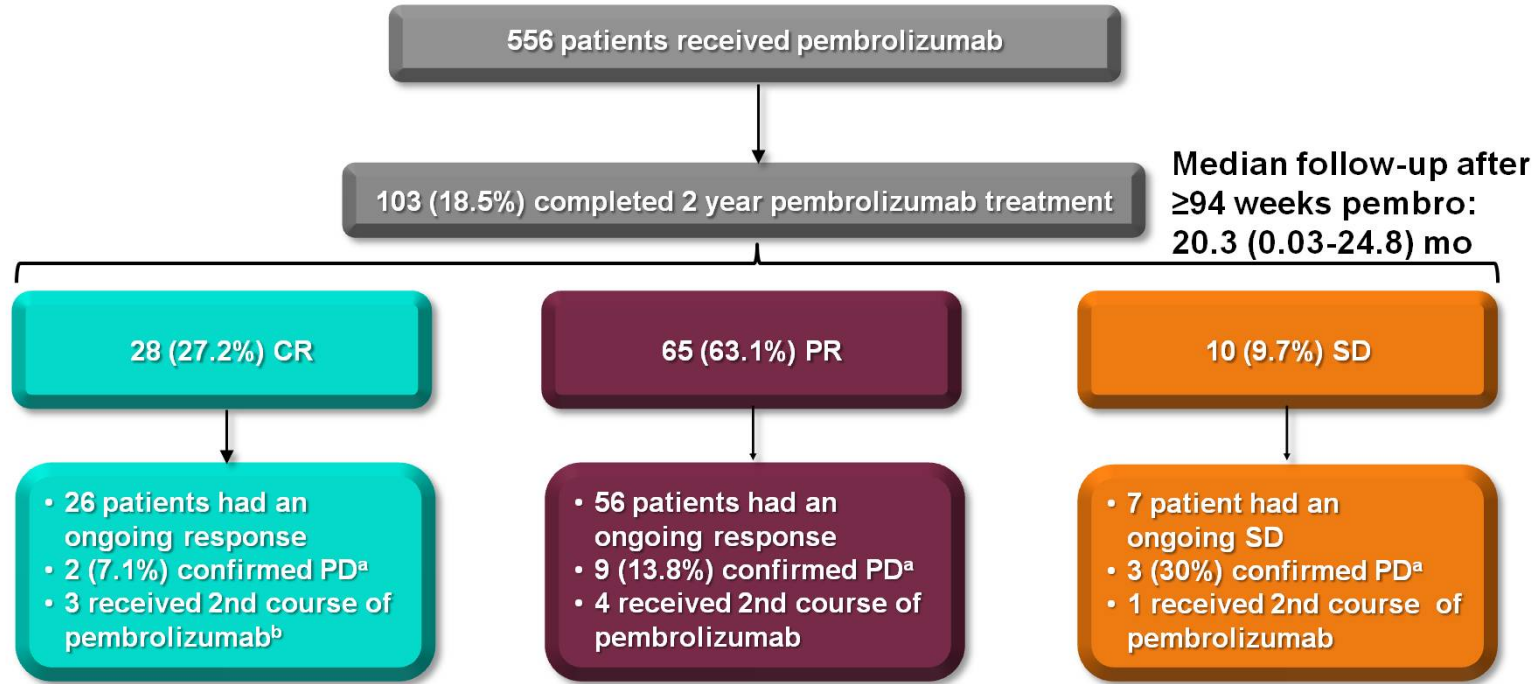
# Overview

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- **Practical Questions**
- Future Directions

# Practical Questions

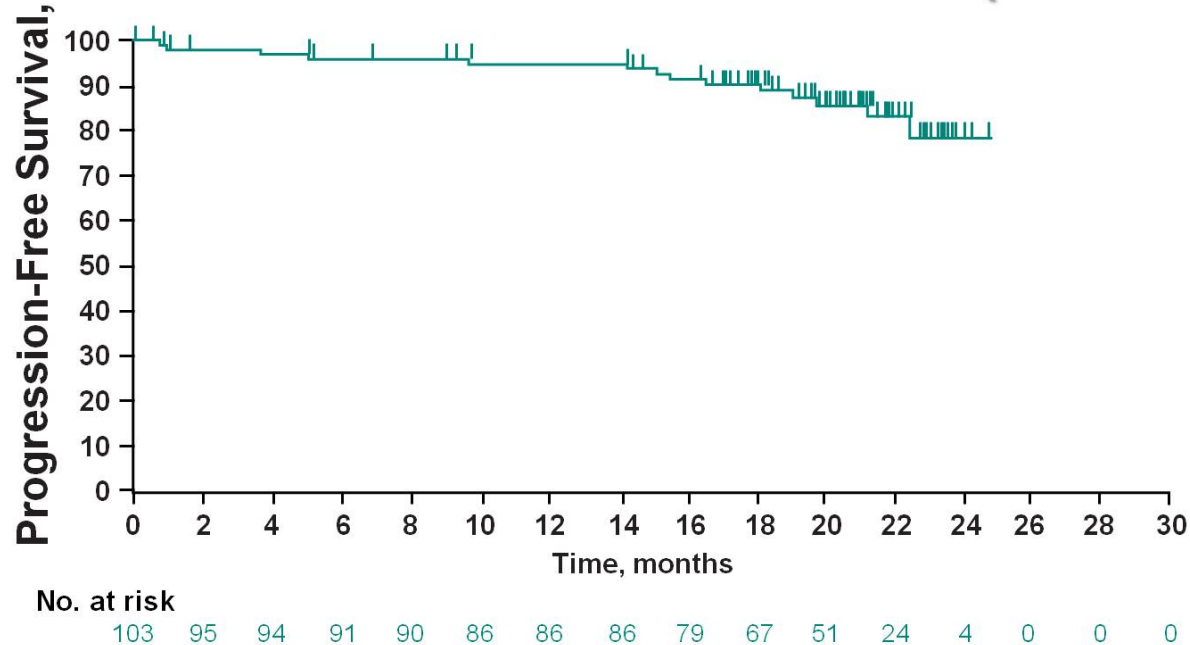
- What is the correct duration?
  - Are responses durable after stopping treatment?
- What is the correct first choice for BRAF+ patients?

# Disposition of Patients Completing $\geq 94$ Weeks of Pembrolizumab Treatment



<sup>a</sup>Confirmed PD by investigator per irRC (confirmatory scan or no subsequent scan or not evaluable). An additional 5 pts with unconfirmed progressive disease were observed. <sup>b</sup>Includes 1 patient who discontinued early with CR and then progressed. Data cutoff: Dec 4, 2017.

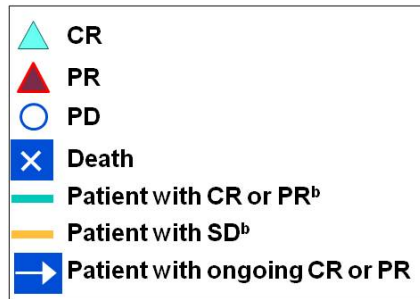
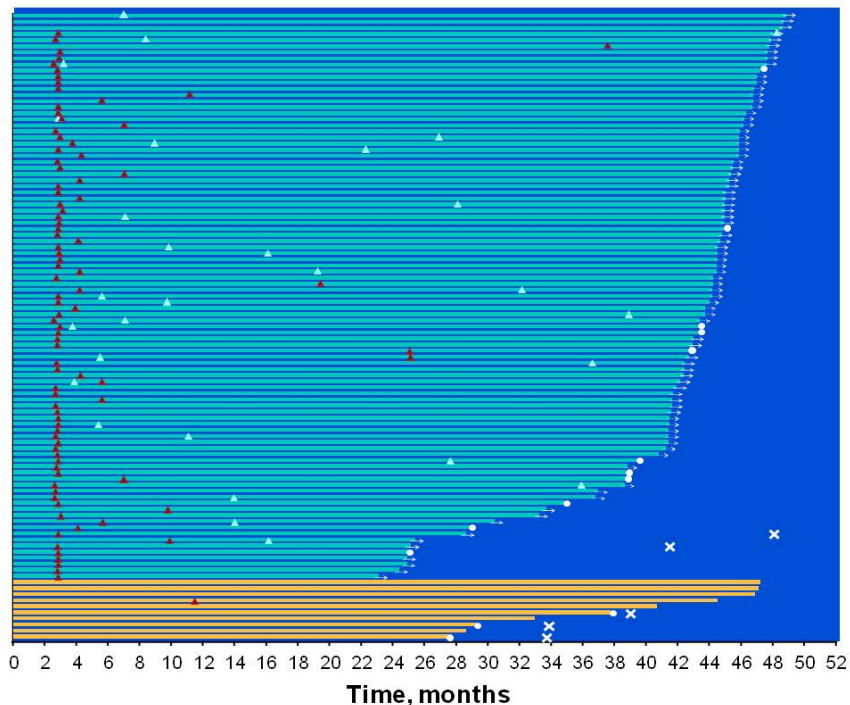
# PFS<sup>a</sup> in Patients Who Completed Protocol-Specified Time on Pembrolizumab (n = 103)



<sup>a</sup>Per immune-related response criteria by investigator review; time is measured from last dose of pembrolizumab. Data cutoff: Dec 4, 2017.



# Duration of Response in Patients With $\geq 94$ Weeks of Pembrolizumab<sup>a</sup> (n = 103)



- 89<sup>c</sup> (86%) patients who completed 2 years on pembrolizumab were progression-free at 20 months after end of therapy

<sup>a</sup>With SD, CR, or PR. <sup>b</sup>Length of each bar represents time to the last scan. <sup>c</sup>An additional 5 patients have unconfirmed progression. Data cutoff: Dec 4, 2017.

# Practical Questions

- What is the correct duration?
  - Are responses durable after stopping treatment?
- What is the correct first choice for BRAF+ patients?

# MAPK Pathway Targeted Therapy

## BRAF<sup>i</sup> (dabrafenib)

PFS HR, 0.37 vs DTIC<sup>1</sup>

Hyperproliferative skin AEs

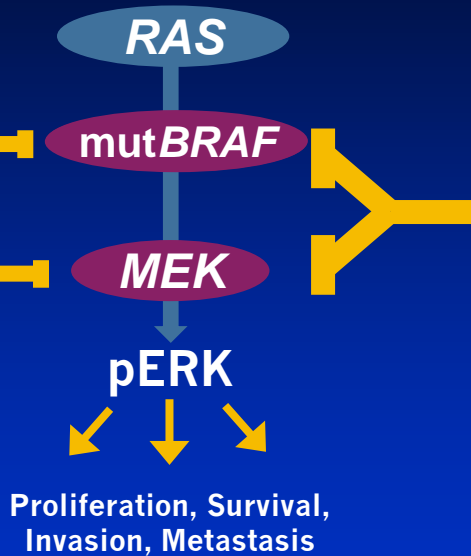
## BRAF<sup>i</sup> (vemurafenib)

PFS HR, 0.38 vs DTIC<sup>2</sup>

Hyperproliferative skin AEs

## MEK<sup>i</sup> (trametinib)

PFS HR, 0.45 vs chemotherapy<sup>3</sup>



## BRAF<sup>i</sup> + MEK<sup>i</sup> ph III studies

### Dabrafenib + trametinib (D + T)

PFS HR, 0.67 vs dabrafenib<sup>4</sup>

OS HR, 0.71 vs dabrafenib<sup>4</sup>

PFS HR, 0.56 vs vemurafenib<sup>5</sup>

OS HR, 0.69 vs vemurafenib<sup>5</sup>

### Vemurafenib + cobimetinib

PFS HR, 0.58 vs vemurafenib<sup>6</sup>

OS HR, 0.70 vs vemurafenib<sup>6</sup>

Decreased hyperproliferative skin AEs<sup>4,5,6</sup>

1. Hauschild A, et al. *Lancet*. 2012;380(9839):358-365.

2. McArthur GA, et al. *Lancet Oncol*. 2014;15(3):323-332.

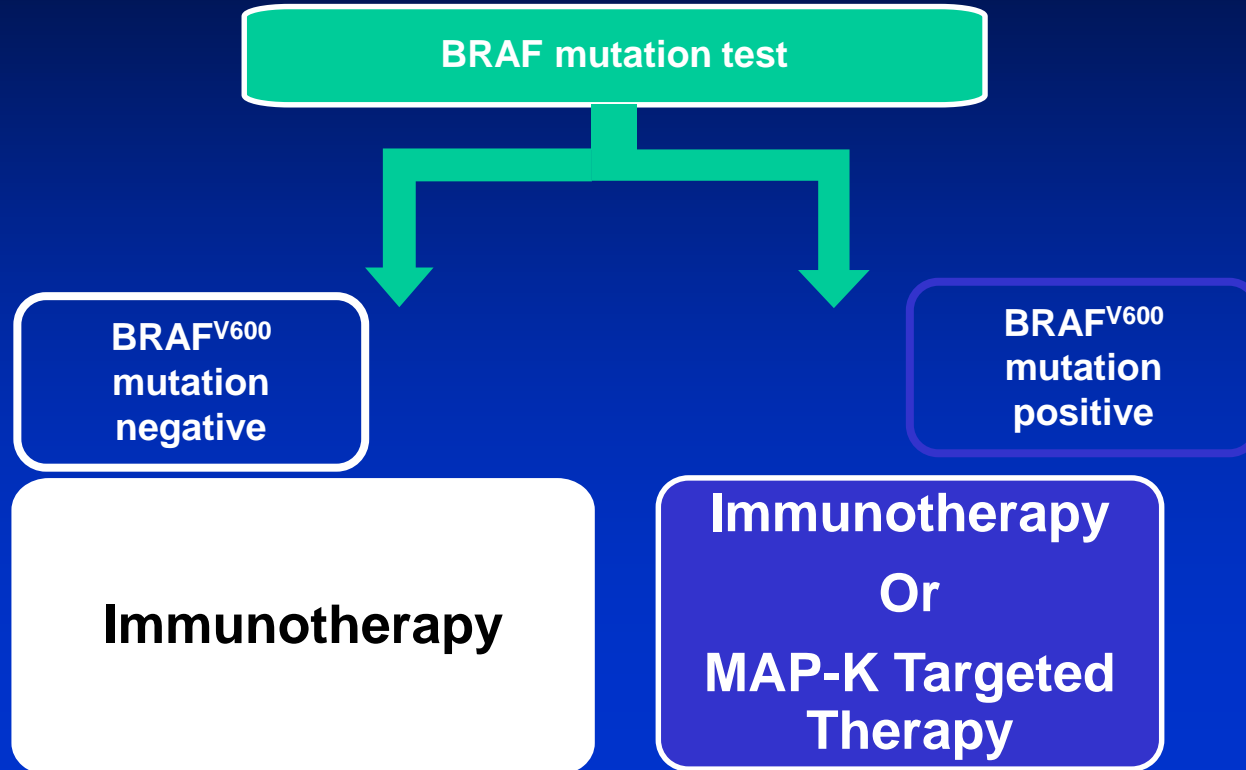
3. Flaherty KT, et al. *N Engl J Med*. 2012;367(2):107-114.

4. Long GV, et al. *Lancet*. 2015;386(9992):444-451.

5. Robert C, et al. *N Engl J Med*. 2015;372(1):30-39.

6. Atkinson V, et al. Presented at: Society for Melanoma Research 2015 Congress.

# Decision Point....

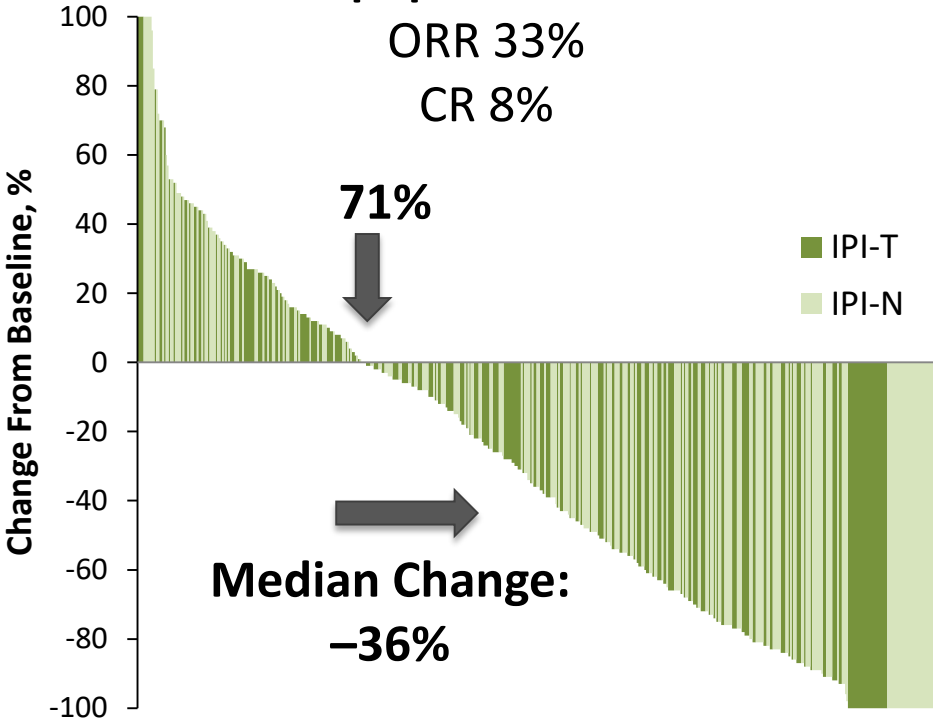


# KEYNOTE-001: Phase I

## RECIST Response (v1.1)

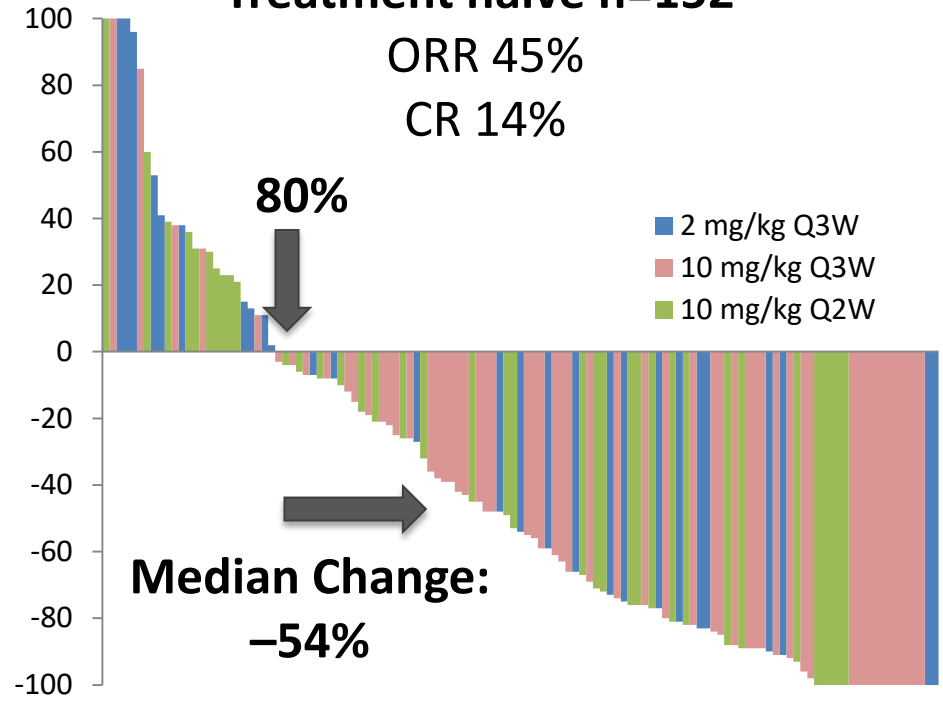
Total population n=581

ORR 33%  
CR 8%



Treatment naïve n=152

ORR 45%  
CR 14%



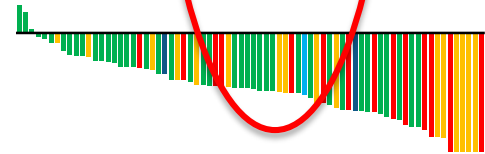
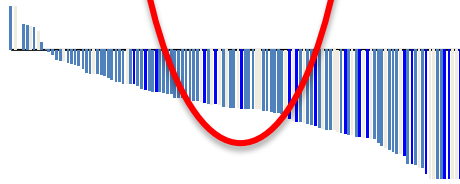
# BRAF Inhibitors

Second line

Vemurafenib<sup>1</sup>

Dabrafenib<sup>2</sup>

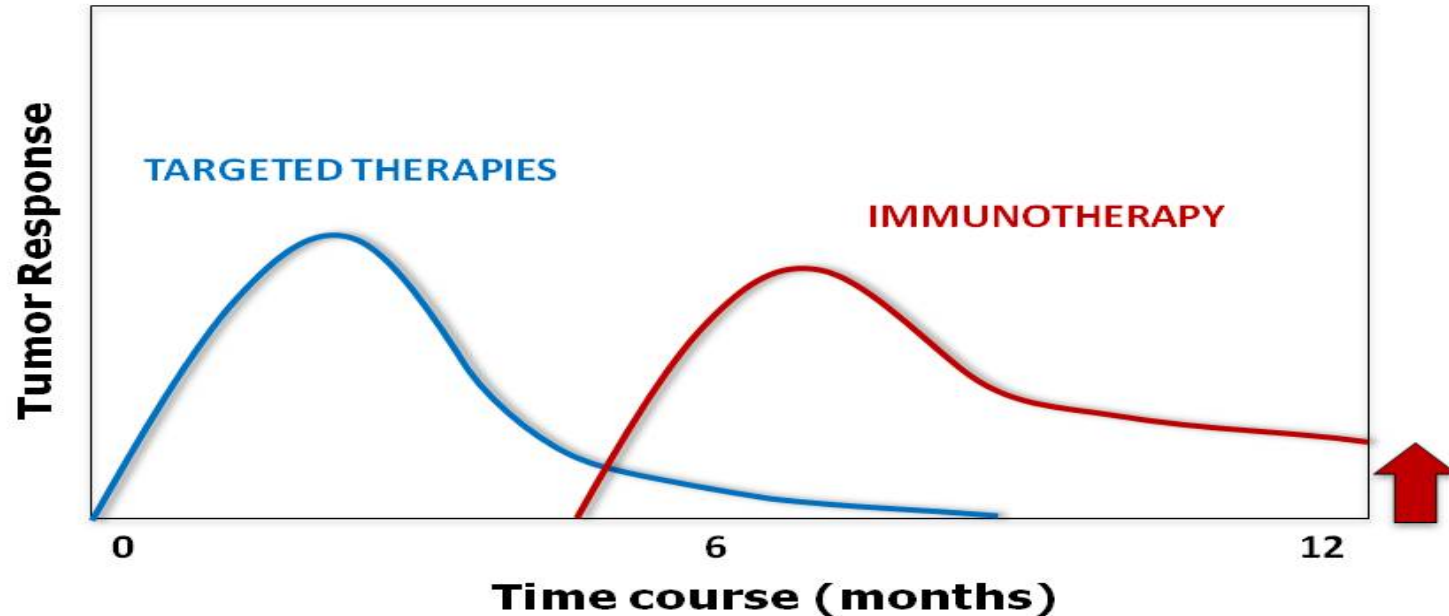
Phase	1	2	3	1	2	3
RR	56%	57%	57%	56%	59%	59%
PFS		6.7	6.9	5.5	6.3	6.9
OS	13.8	15.9	13.6		13.1	18.2



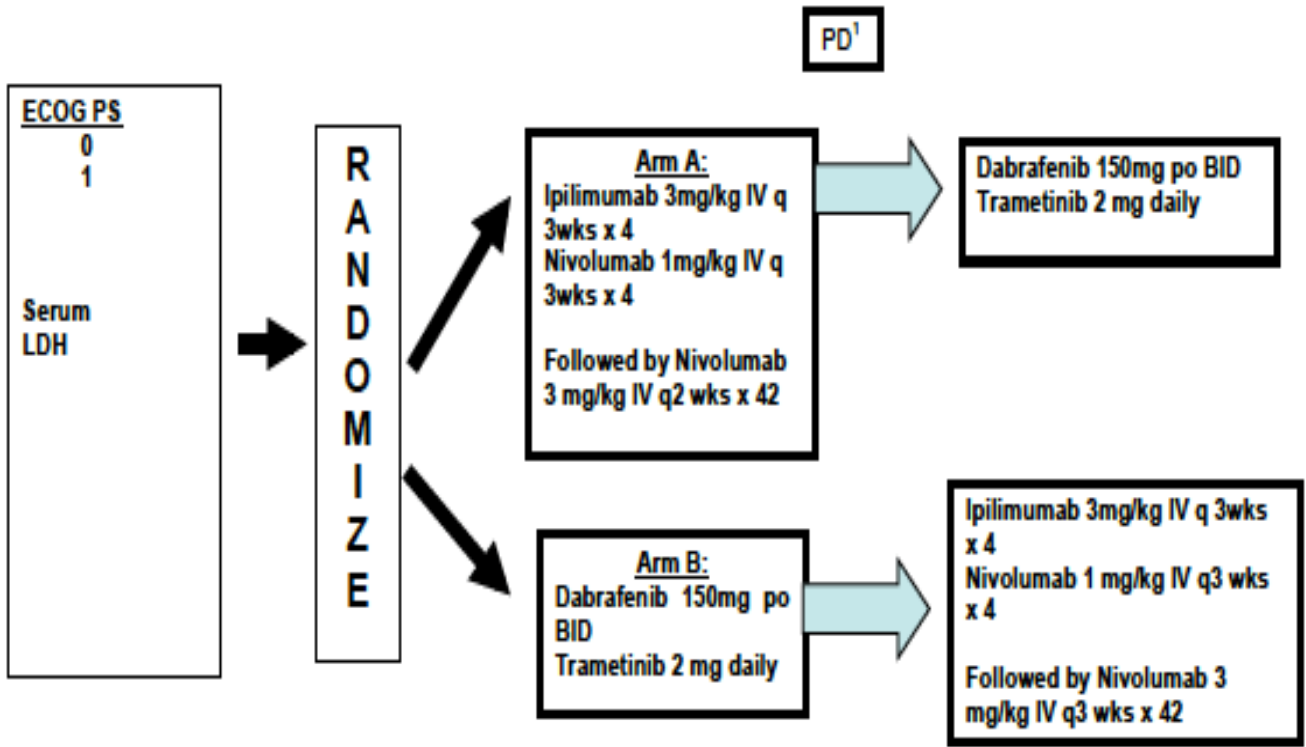
1. Chapman PB, et al. *N Engl J Med* 2011;364:2507–2516 (updated Chapman et al. ASCO 2012); Sosman JA, et al. *N Engl J Med* 2012;366:707–714;

2. Hauschild A, et al. *Lancet* 2012;380:358–365 (updated Hauschild et al. ASCO 2013); Ascierto PA, et al. *J Clin Oncol* 2013; 31:3205–3211.

# Antitumoral response: Targeted therapies vs. Immunotherapies (CTLA-4 antibodies)



# EA6134

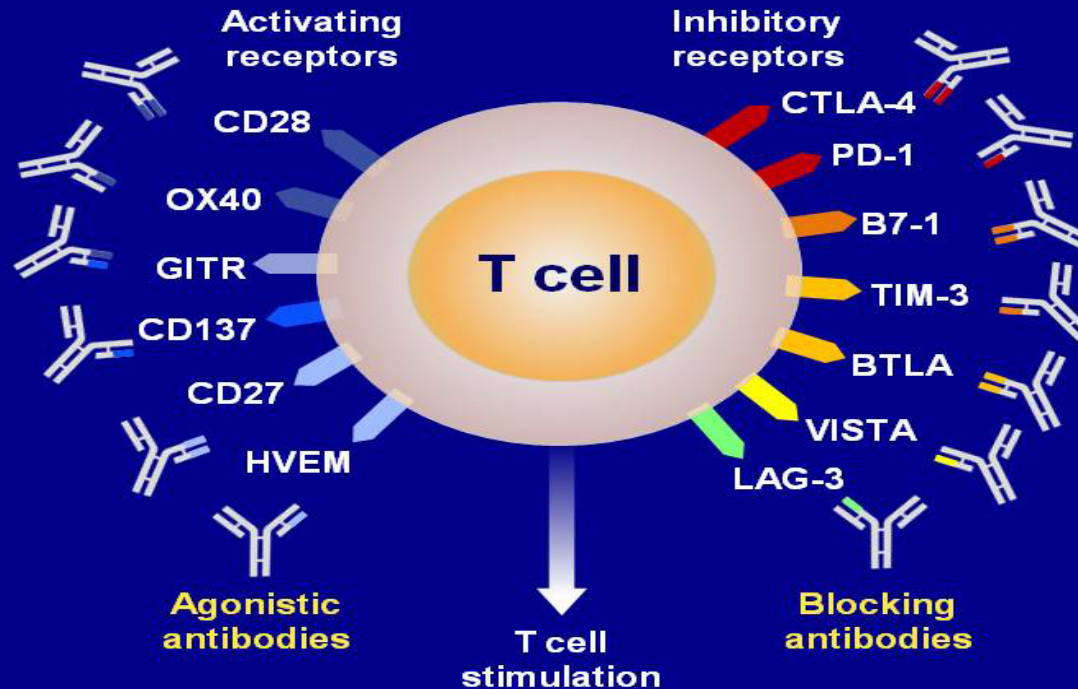




# Overview

- Metastatic Melanoma
- Adjuvant therapy for High-risk
- Practical Questions
- Future Directions

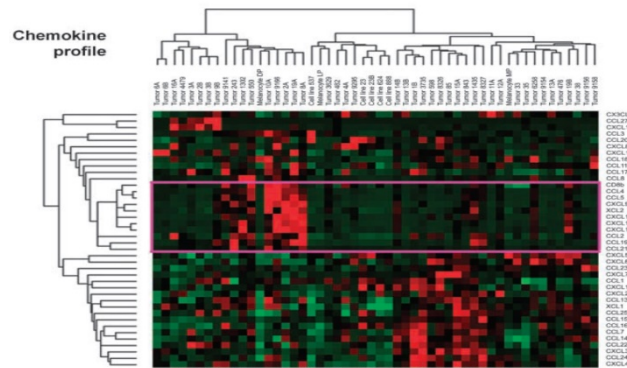
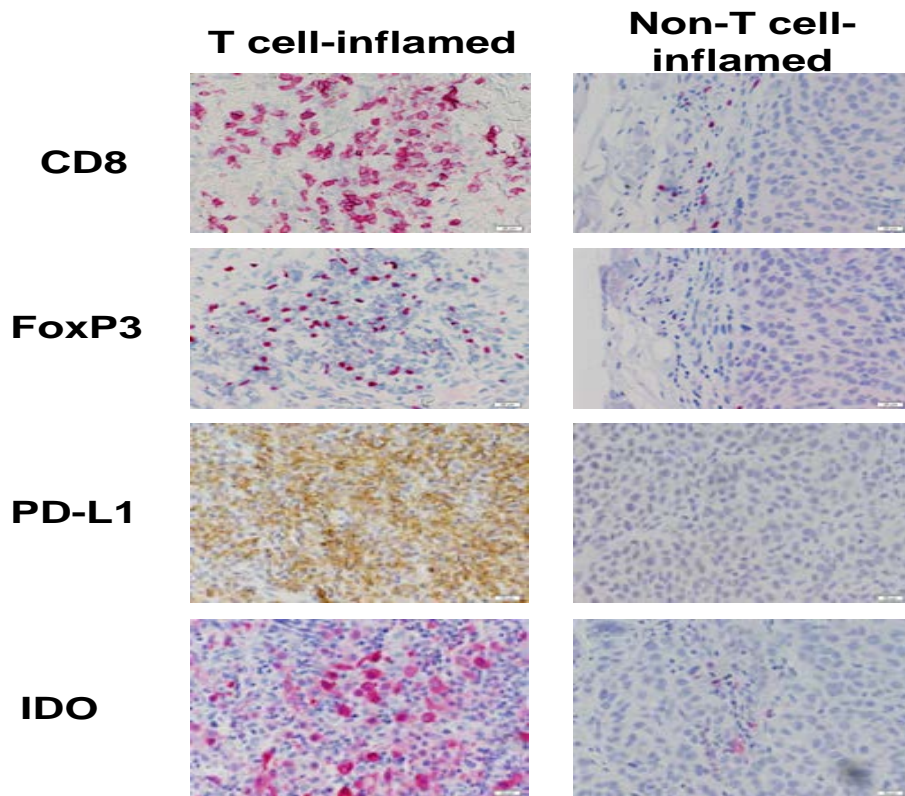
# T-Cell Immune Checkpoints



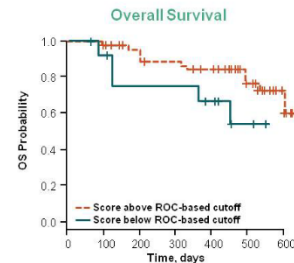
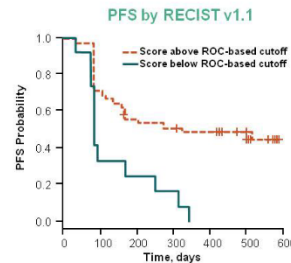
Mellman I et al. *Nature*. 2011;480:481–489.

Presented By Scott Gettinger at 2014 ASCO Annual Meeting

# The T Cell-Inflamed Tumor Microenvironment is Characterized by Expression of Immune-Inhibitory Pathways and Predicts Outcomes to Immunotherapy



**PFS and OS in Patients With Melanoma and IFN $\gamma$  Signature Score Above and Below the Cutoff**



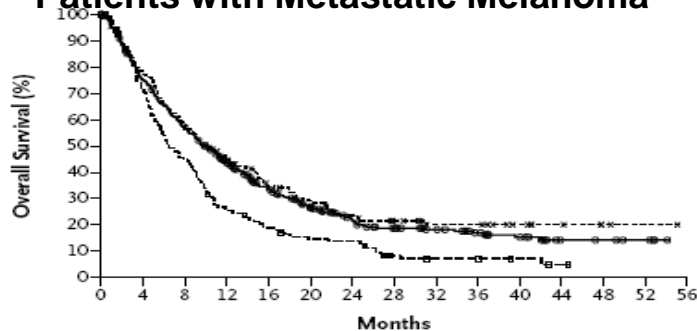
Spranger *et al.*, Science Trans. Med. 2013

Harlin *et al.* Clin Can Res 2009

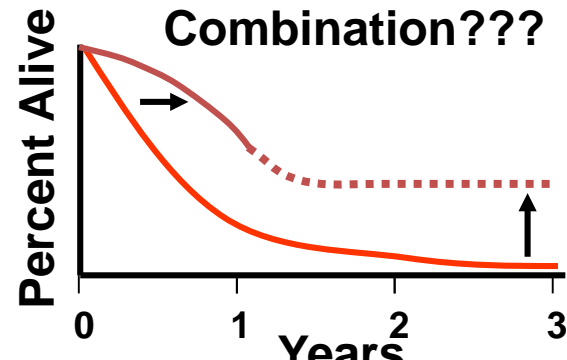
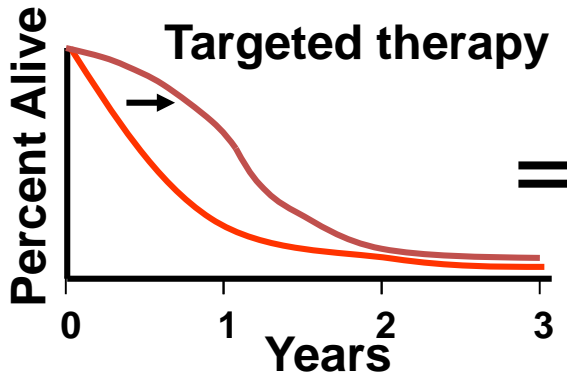
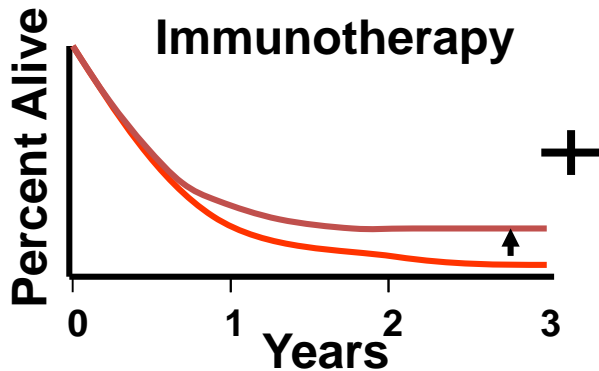
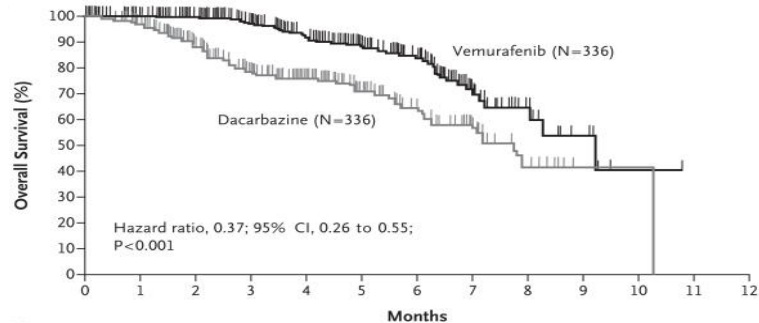
Ribas *et al.* J Clin Oncol 33, 2015 (suppl; abstr 3001)

# Combining Immunotherapy and Targeted Therapy for Melanoma?

Improved Survival With Ipilimumab in Patients with Metastatic Melanoma<sup>1</sup>



Improved Survival With Vemurafenib in Melanoma With BRAF V600E Mutation<sup>2</sup>



Modified from: Ribas A, et al. *Clin Cancer Res.* 2012;18(2):336-341.

1. Hodi FS, et al. *N Engl J Med.* 2010;363(8):711-723. 2. Chapman PB, et al. *N Engl J Med.* 2011;364(26):2507-2516.

# Targeted-Immuno Triplets: BRAF + MEK + PD1/L1

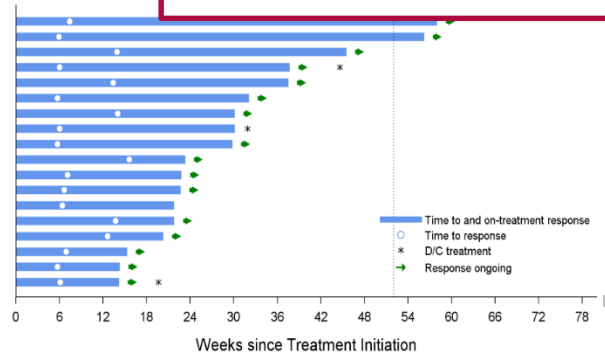
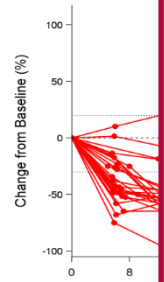
Dabrafenib+Trametinib  
+Durvalumab

Dabrafenib+Trametinib  
+Pembrolizumab

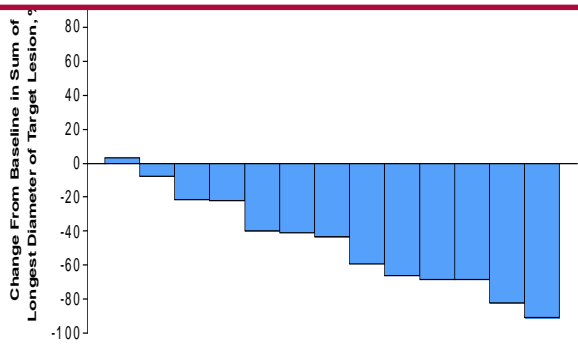
Vemurafenib+Cobimetinib  
+Atezolizumab

**Multiple Triplet Combinations Launching Into Phase III:**

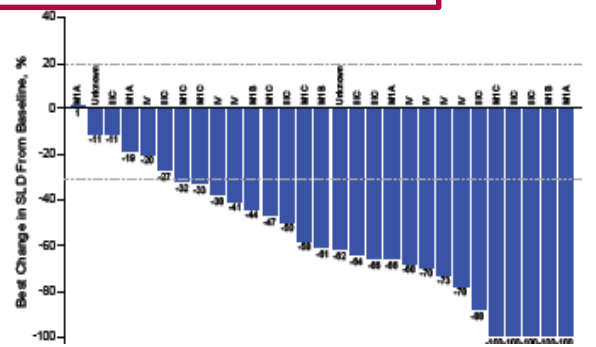
- Dabrafenib + Trametinib + Pembrolizumab
- Dabrafenib + Trametinib + PDR-001
- Vemurafenib + Cobimetinib + Atezolizumab



Ribas *et al.* ASCO 2015



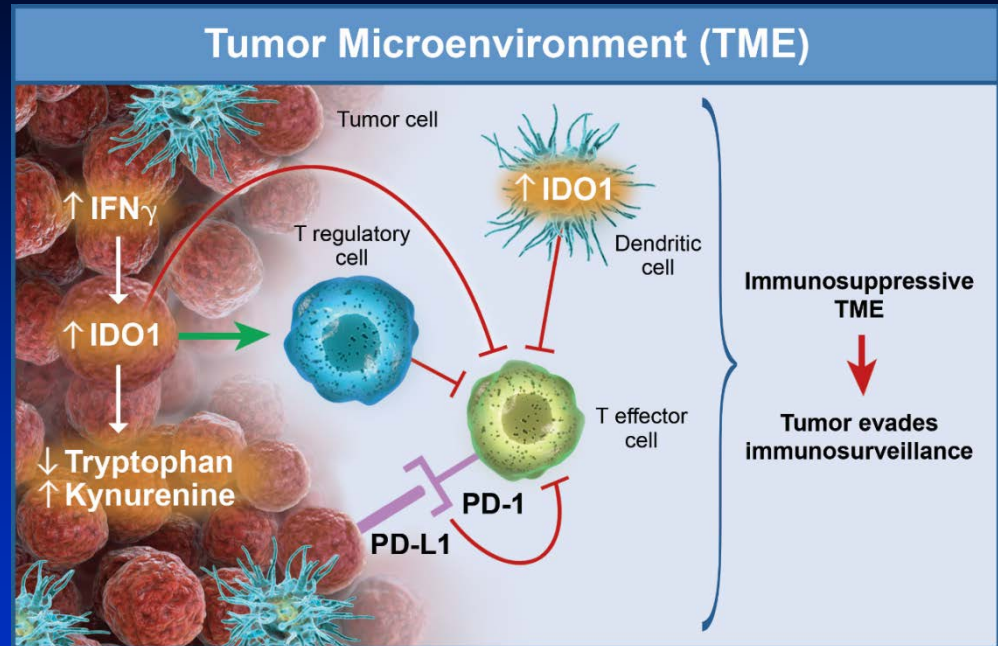
Ribas *et al.* ASCO 2016



Hwu *et al.* ECCO 2016

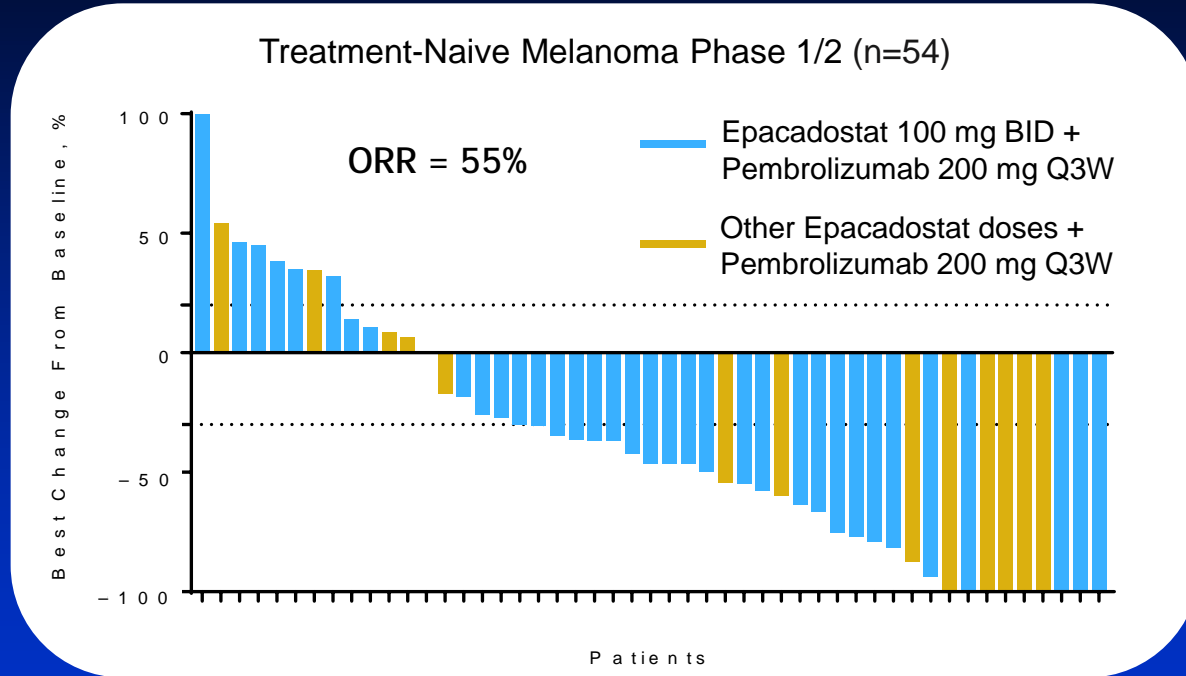
# IDO Inhibitors: Background

- Upregulation of IDO1 is a potential mechanism to evade immunosurveillance
  - ↓ Tryptophan    ↑ Kynurenine
  - ↓ T<sub>eff</sub> and NK cells
  - ↑ T<sub>reg</sub> cells, MDSCs, TAMs
- Epacadostat: IDO1 enzyme inhibitor
- Pembrolizumab: anti-PD-1 humanized antibody



IDO1, indoleamine 2,3 dioxygenase 1; IFN $_{\gamma}$ , interferon gamma; MDSC, myeloid-derived suppressor cell; NK, natural killer; PD-1, programmed death 1; PD-L1, programmed death ligand-1; TAM, tumor-associated macrophage; T<sub>eff</sub>, effector T cell; T<sub>reg</sub>, regulatory T cell.

# Phase I/II Combination Epacadostat + Pembrolizumab



## ECHO-202 / KEYNOTE-037

- Phase 1: Epacadostat 50, 100, or 300 mg PO BID + Pembrolizumab 200 mg IV Q3W
- MTD of epacadostat not reached
- Phase 2: Epacadostat 100 mg PO BID
- Phase 1/2 efficacy in treatment-naive melanoma:
  - ORR = 55%
  - Median PFS = 22.8 mo (12.4 mo all melanoma)

BID, twice daily; MTD, maximally tolerated dose; PD-L1, programmed death ligand-1; Q3W, every 3 weeks.  
Hamid O, et al. *Ann Oncol.* 2017;28(suppl 5):1214O.

# Phase III Randomized Placebo Controlled Trial

## Key Eligibility Criteria

- Unresectable stage III or IV melanoma, advanced/metastatic disease
  - Patients with *BRAF* mutation could have received prior BRAF/MEK therapy
  - Prior anti-CTLA-4 or interferon in adjuvant setting permitted
- ECOG performance status 0–1
- No active CNS metastases

## Stratification

- PD-L1 status (positive<sup>a</sup> vs negative)
- *BRAF* mutation status
  - Wild type
  - Mutant with prior *BRAF*-directed therapy
  - Mutant without prior *BRAF*-directed therapy

N=706  
R 1:1

Epacadostat 100 mg PO BID  
+  
Pembrolizumab 200 mg IV  
Q3W  
n=354

Placebo  
+  
Pembrolizumab 200 mg IV  
Q3W  
n=352

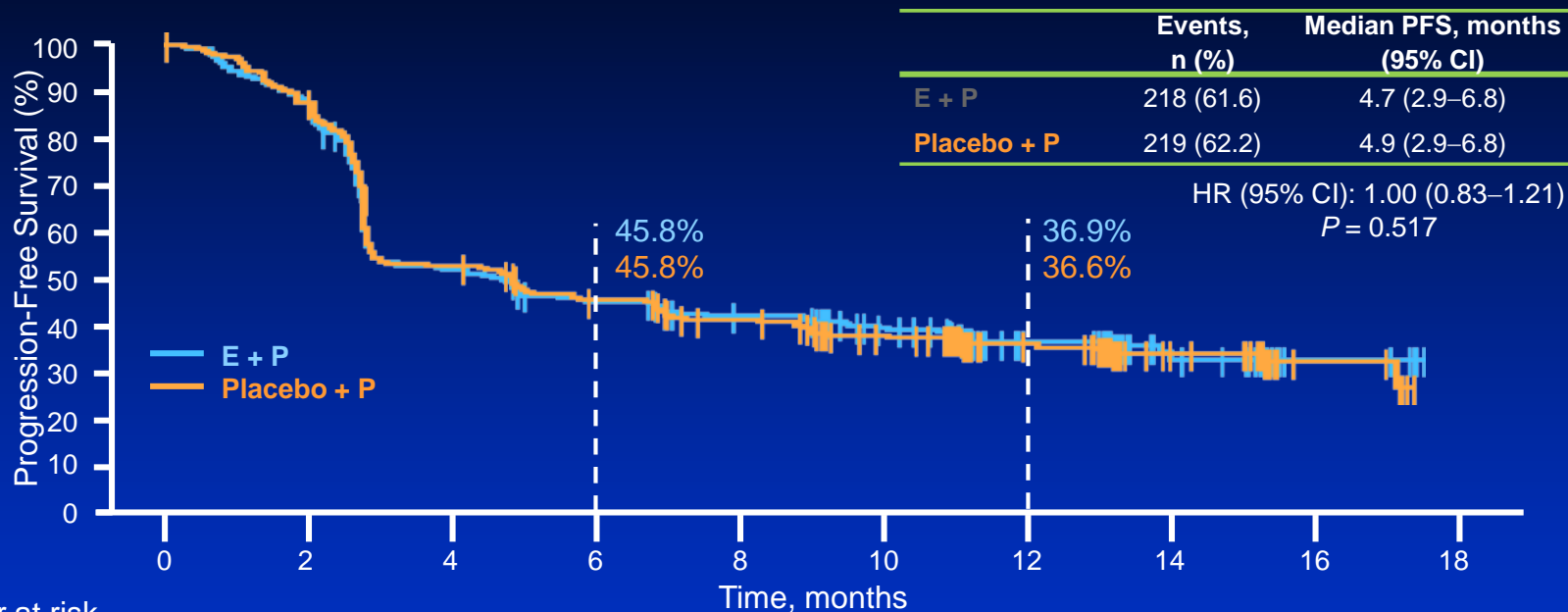
- **Primary endpoints:** PFS (RECIST v1.1) and OS
- **Secondary endpoints:** ORR (RECIST v1.1), DOR, safety

BID, twice daily; DOR, duration of response; ECOG, Eastern Cooperative Oncology Group; ORR, objective response rate; OS, overall survival; PD-L1, programmed death-ligand 1; PFS, progression-free survival; Q3W, every 3 weeks; RECIST, Response Evaluation Criteria In Solid Tumors.

<sup>a</sup>≥1% staining in tumor and adjacent immune cells as assessed by IHC (22C3 antibody).



# Progression-Free Survival



## Number at risk

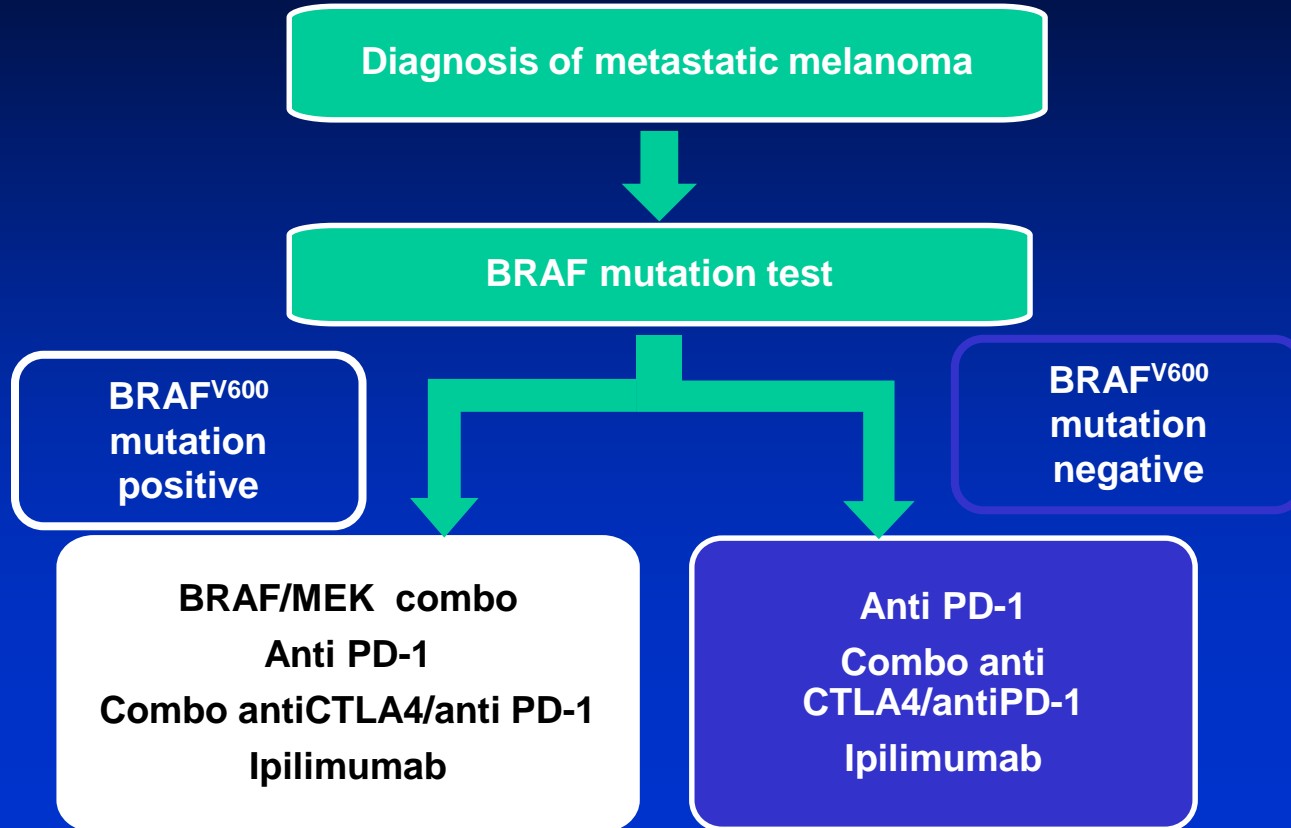
	0	2	4	6	8	10	12	14	16	18
E + P	354	309	181	155	137	114	57	25	5	0
Placebo + P	352	304	181	151	132	109	65	28	7	0

BICR, blinded independent central review; CI, confidence interval; E, epacadostat; HR, hazard ratio; P, pembrolizumab; PFS, progression-free survival; RECIST, Response Evaluation Criteria In Solid Tumors. PFS defined as time from randomization to disease progression or death, whichever occurred first.

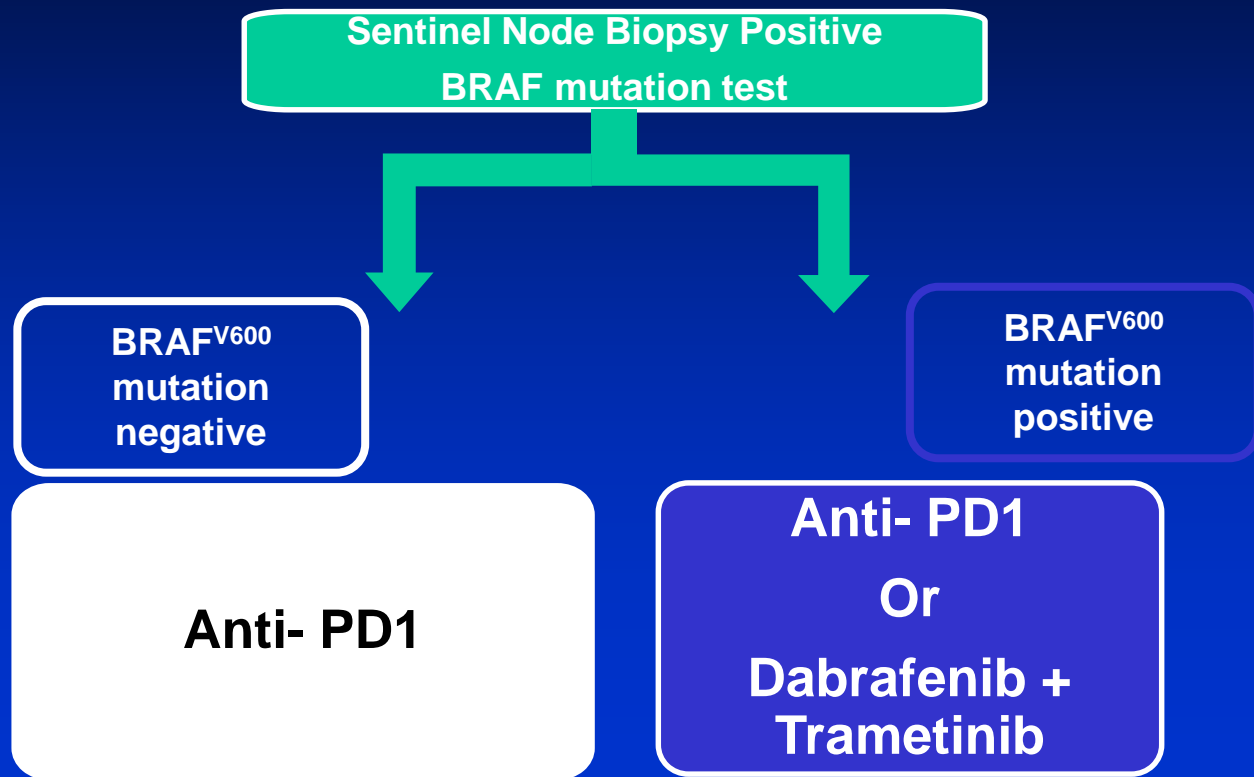
# Summary & Conclusions

- Immunotherapy with checkpoint inhibitors is standard of care for most patients
  - Single agent PD1
  - Combination PD-1/CTLA-4
- For BRAF+ patients the choice is based on clinical judgment
- It has recently been approved for adjuvant therapy
- Future therapies will address better combinations and overcoming resistance

# How I Treat Metastatic Melanoma



# How I treat High Risk Melanoma Adjuvant Therapy



**Clinical Trials!**