# HER-2 Disease: Neo-, Adjuvant, Metastatic Setting

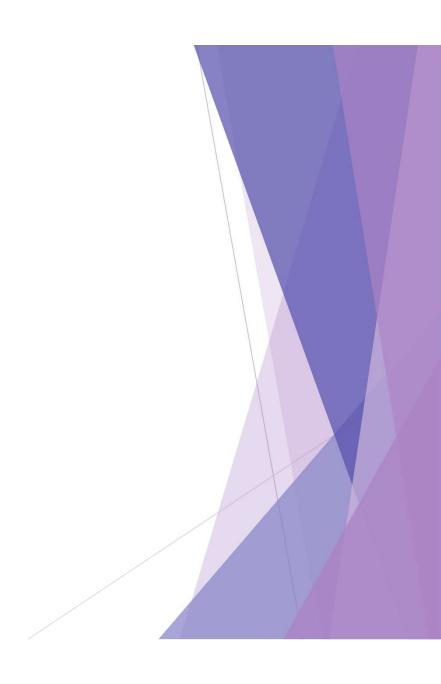
Noridza Rivera-Rodriguez, MD Hematologist & Medical Oncologist Assistant Professor UPR School of Medicine



#### **Disclosures**

Speaker Bureau: Merck, BMS, AbbVie, Eisai

Research Support: AbbVie



# Adjuvant/Neoadjuvant Treatment

#### Trastuzumab improves outcomes...

			DFS		os	
Study	Follow-up (yrs)	N	HR	p value	HR	p value
	1	3387	0.54	< 0.0001	0.76	0.26
	2	3401	0.64	< 0.0001	0.66	0.0115
HERA¹-⁴ CT±RT→T vs. CT±RT	4	3401	0.76	< 0.0001	0.85	0.1087
	8	3399	0.76	< 0.0001	0.76	0.0005
	11	3399	0.76	< 0.0001	0.74	< 0.0001
	2	3351	0.48	< 0.0001	-	-
NCCTG N9831/ NSABP B-31 <sup>5-7</sup>	4	4045	0.52	< 0.001	0.61	< 0.001
AC→Tax+T→T vs. AC→Tax	8.4	4046	0.60	< 0.0001	0.63	< 0.0001
	10	4046	0.60	< 0.001	0.63	< 0.001
BCIRG 006 <sup>8</sup>						
AC→Tax + T vs. AC→Tax	E 4	2000	0.64	< 0.001	0.63	< 0.001
Tax+Cb→T vs. AC→Tax	5.4	3222	0.75	0.04	0.77	0.04
AC→Tax + T vs. AC→Tax	10.3	3222	0.72	< 0.001	0.63	< 0.001
Tax+Cb→T vs. AC→Tax			0.77	0.0011	0.76	0.0075

AC, doxorubicin and cyclophosphamide; Cb, carboplatin; CT, chemotherapy; DFS, disease-free survival; HR, hazard ratio; OS, overall survival; RT, radiotherapy; T, trastuzumab; Tax, taxane.

#### Evolving Landscape: More or Less?



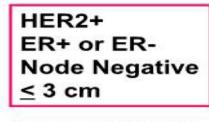
#### **Escalate Treatment:**

- Node positive
- LABC/Inflammatory
- no pCR

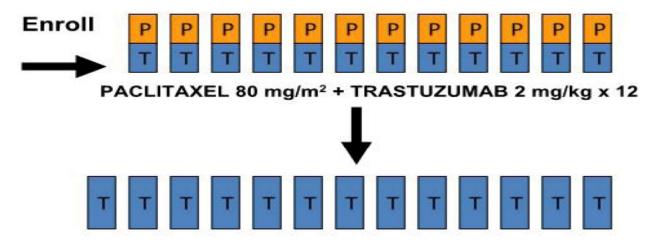
#### **De-escalation of Treatment**

- T1a/T1b/T1c
- Node Negative
- Patients achieving pCR

#### **APT Trial: Study Design**



Planned N=400



FOLLOWED BY 13 EVERY 3 WEEK DOSES
OF TRASTUZUMAB (6 mg/kg)\*

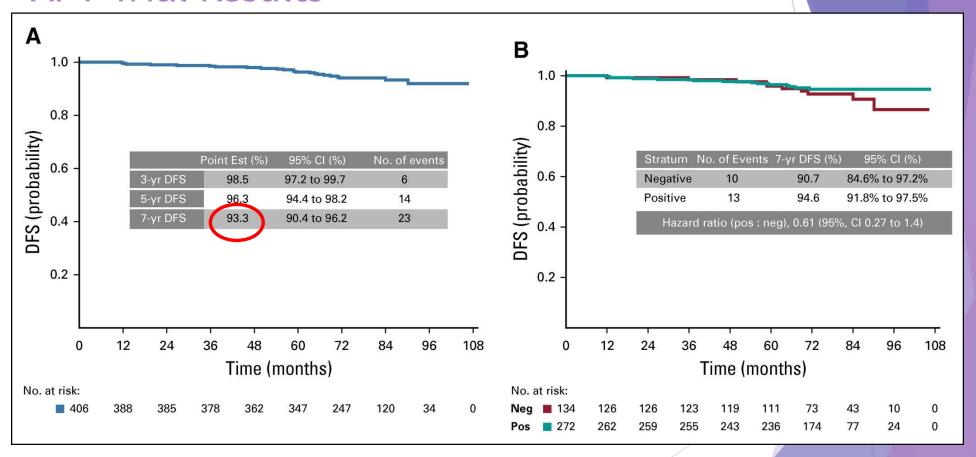
APT, adjuvant paclitaxel and trastuzumab

Tolaney SM, et al. N Engl J Med. 2015;372(2):134-141.

<sup>\*</sup>Dosing could alternatively be 2 mg/kg IV weekly for 40 weeks

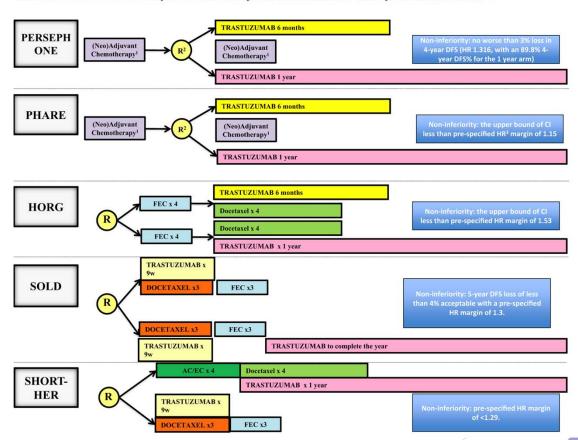
<sup>\*\*</sup>Radiation and hormonal therapy was initaited after completion of paclitaxel

#### **APT Trial Results**



#### **Duration of Trastuzumab**

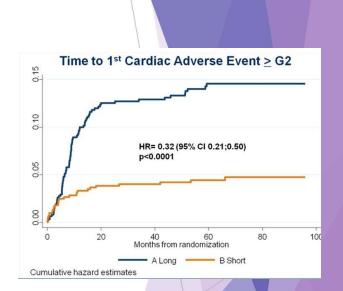
rom: PERSEPHONE: are we ready to de-escalate adjuvant trastuzumab for HER2-positive breast cancer?



Pondé, N., Gelber, R.D. & Piccart, M. npj Breast Cancer 5, 1 (2019).

Trial	Duration of trial <sup>a</sup>	Timing of randomization	Patient characteristics	Chemotherapy with anthracyclines and taxanes	Concomitant trastuzumab with chemotherapy	Patients (n)	Efficacy (short arm versus long arm) <sup>b</sup>	Notable Subgroup analysis favouring 1 year
6 months vs 12 m	onths							
PERSEPHONE <sup>8,15</sup>	8 years	Within first 6 months	N-: 59% ER+: 69%	48%	47%	4089	11.6% vs 11.2% 4-year DFS events HR 1.07 (0.93– 1.24)	Taxane-only concurrent chemothers and trend in ER-
PHARE <sup>4</sup>	6 years	At 6 months	N-: 55% ER+: 60%	74%	56%	3380	8.9% vs 6.2% 3.5-year DFS events: HR 1.28 (1.05- 1.56)	Tumour size >2 cm and sequential chemothera trastuzuma
SOLD <sup>6</sup>	9 years	Previously to treatment	N-: 60% ER+: 66%	100%	100%	2,176	12.0% vs 9.5% 5-year DFS events: HR 1.39 (1.12– 1.72)	lower docetaxel dose, trend ER- and LN of benefit in year arm
SHORT-HER <sup>7</sup>	9 years	Previously to treatment	N-: 51% ER+: 67%	100%	100%	1,253	14.6% vs 12.5% 5-year DFS events: HR 1.15 (0.91– 1.46)	Stage III and N2/N3 significantly benefit from year

<sup>&</sup>lt;sup>a</sup>From first patient in to initial presentation of results



<sup>&</sup>lt;sup>b</sup>The confidence intervals are, respectively, 95% (HORG, PHARE) and 90% (SOLD, SHORT-HER, PERSEPHONE) Pondé, N., Gelber, R.D. & Piccart, M. *npj Breast Cancer* **5**, 1 (2019).

# KATHERINE STUDY: For Patients with noPCR after Neoadjuvant Therapy

#### **KATHERINE Study Design**

- cT1-4/N0-3/M0 at presentation (cT1a-b/N0 excluded)
- Centrally confirmed HER2-positive breast cancer
- · Neoadjuvant therapy must have consisted of
  - Minimum of 6 cycles of chemotherapy
    - · Minimum of 9 weeks of taxane
    - · Anthracyclines and alkylating agents allowed
    - · All chemotherapy prior to surgery
  - Minimum of 9 weeks of trastuzumab
    - · Second HER2-targeted agent allowed
- Residual invasive tumor in breast or axillary nodes
- Randomization within 12 weeks of surgery

# T-DM1 3.6 mg/kg IV Q3W 14 cycles N=1486 Trastuzumab 6 mg/kg IV Q3W 14 cycles

Radiation and endocrine therapy per protocol and local guidelines

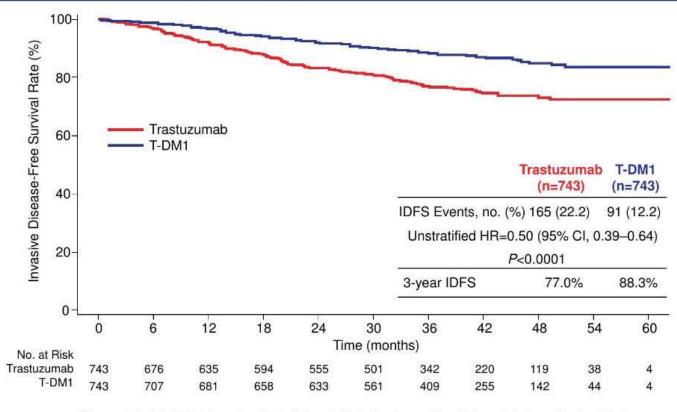
#### Stratification factors:

- Clinical presentation: Inoperable (stage cT4 or cN2-3) vs operable (stages cT1-3N0-1)
- Hormone receptor: ER or PR positive vs ER negative and PR negative/unknown
- Preoperative therapy: Trastuzumab vs trastuzumab plus other HER2-targeted therapy
- Pathological nodal status after neoadjuvant therapy: Positive vs negative/not done

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#### Katherine Study Results

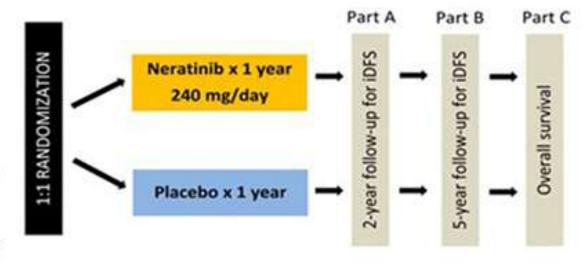
#### **Invasive Disease-Free Survival**



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#### **ExteNet Trial**

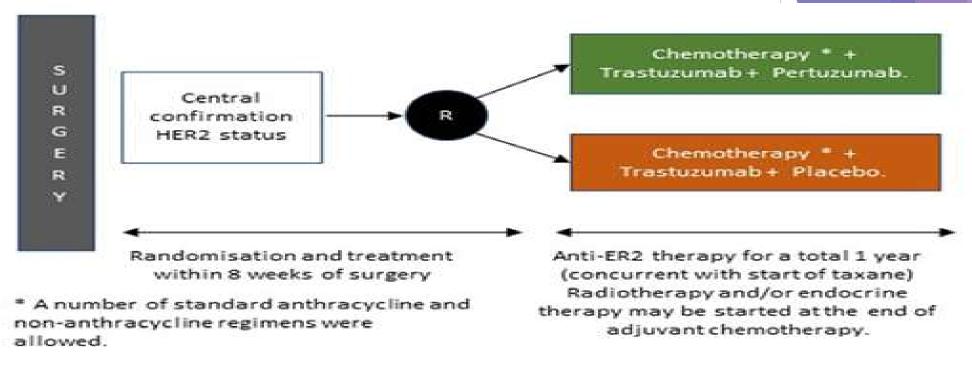
- HER2+ Breast Cancer (local) by IHC3+ or ISH amplification
- Prior adjuvant trastuzumab and chemotherapy completed 1 y prio study entry.
- Residual invasive disease after neoadujant therapy , +/- lymph node.
- N= 2840



Primary End point: invasive disease-free survival (iDFS)

Secondary endpoint: DFS-DCIS, time to distant recurrence, distant DFS, CNS metastases, overall survival, safety.

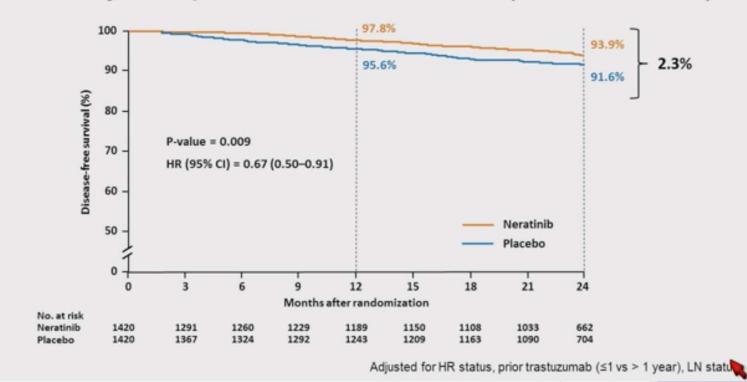
#### **Aphinity Trial**



Primary endpoint: invasive-disease-free survival iDFS Secondary endpoints: Overall survival, DFS (including DCIS), relapse-free interval, distant-relapse-free-interval, safety, health-related quality of life.

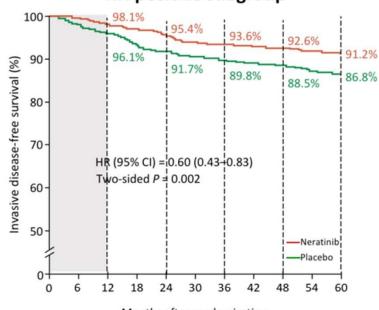
#### **ExteNet Trial Results**

#### Primary endpoint: invasive DFS (ITT: n=2840)



#### **ExteNET: iDFS by hormone receptor status**



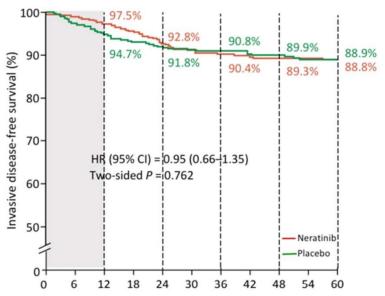


#### Months after randomization No. at risk

Neratinib 816 757 731 705 642 571 565 558 554 544 523
Placebo 815 779 750 719 647 581 567 556 551 542 525

Intention-to-treat population. Cut-off date: March 1, 2017

#### **HR-negative subgroup**

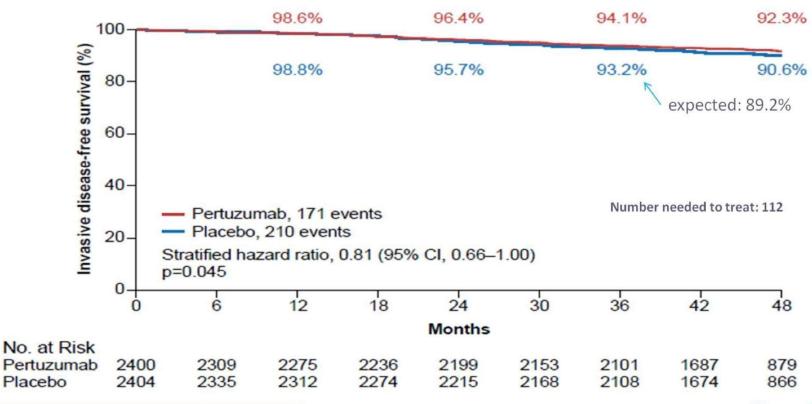


Months after randomization

No. at risk

Neratinib 604 559 541 520 464 407 400 391 384 376 362 Placebo 605 575 548 529 495 448 444 435 427 416 402

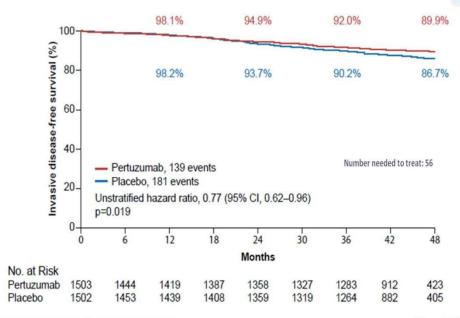
## APHINITY: Intent-to-Treat Primary Endpoint Analysis Invasive Disease-free Survival



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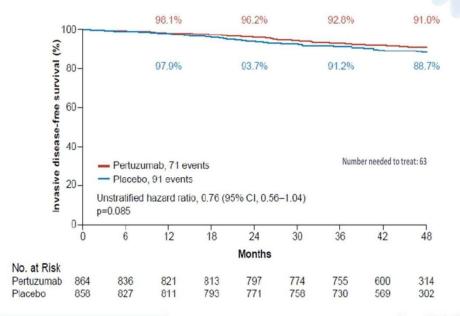
#### **APHINITY: Node-positive Subgroup**



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#### **APHINITY: Hormone Receptor-negative Subgroup**



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#### Adjuvant Dual Her2 Blockade

Patient characteristic	Neratinib	Pertuzumab
DFS	95.2 (HR+) vs 91.2% (HR-) DFS@ 2 years	92 vs 90% 3 years iDFS
Node positive	HR 0.70 in node + similar to ITT population <sup>a</sup>	1.8% Absolute DFS improvement
HR+	HR 0.51 for HR+ (improved outcome)	HR 0.81 (overall); 0.77 in high-risk node positive
HR-	No benefit	1.6% Absolute DFS improvement
Mechanism	PAN HER inhibition, MAPK, ERK, AKT downregulation	HER2 inhibition
Biomarker candidates	RB1CC1, HER3, FOXO3a, NR3C1, CCND1	CD8 TIL, anti-HER2 CD4+ T helper, high HER2 protein, HER2 and HER3 mRNA levels, PD1 for addition of IO
Ideal patient	High risk, node positive, HR+	High risk, node positive, HR-
Absolute DFS improvement	2.3% Absolute DFS improvement @ 2 years	0.9% Absolute iDFS improvement @ 3 years <sup>a</sup>
Cost (USD)	\$120,000/year	\$70,000/year

Ideal patient candidates for adjuvant neratinib vs pertuzumab in clinical setting outside of a clinical trial given no comparative studies between the drugs. These are considerations in HER2-positive high-risk patients.

HR, hormone receptor; DFS, disease-free survival; ITT, intention to treat; TIL, tumor-infiltrating lymphocytes; iDFS, invasive disease-free survival.

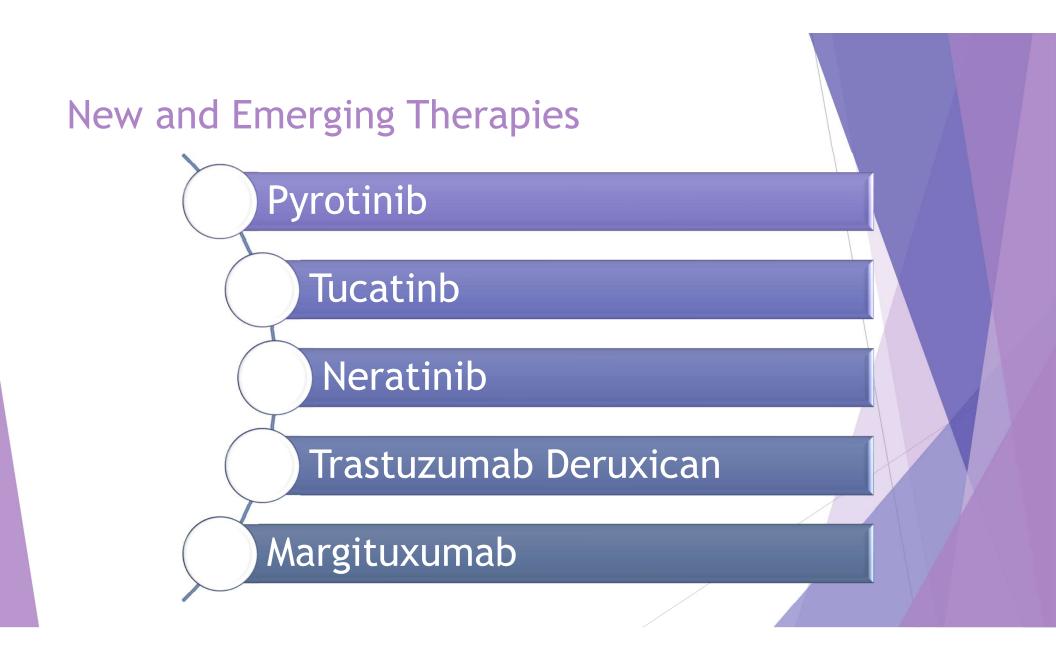
\*2-Year. DFS based on LN status LN neg: 99.4 vs 99.2%, HR 0.82 (0.32-2.03); LN 1-3: 97.8 vs 96.5%, HR 0.66 (0.41-1.02); LN ≥ 4: DFS 97.8 vs 96.5%, HR 0.65 (0.41-1.01).

Bulbul A, et al. Front. Oncol., 30 May 2018

# MetastaticManagementHer2+ BC

#### Current Approach to MBC HER-2+ Disease

Trastuzumab + Pertuzumab + First Line **Taxane** Second TDM-1 Line Cap+Lapatinib Chemo+Trastuzumab Lapatinib+Trastuzumab Third Endocrine RX+antiHer2 Rx (HR+) Line & Beyond Pertuzumab or TDM1 if not received earlier



#### **PHENIX Study Design**

Pyrotinib combined with capecitabine in women with HER2+ metastatic breast callcer previously treated with trastuzumab and tallanes: a randomized phase 3 study

- □ Double-blinded, multicenter, randomized phase 3 trial (NCT02973737)
- Primary objective: the efficacy of pyrotinib plus capecitabine after failure of trastuzumab

Randomization 2:1

#### Key eligibility criteria:

- Pathologically confirmed HER2positive\* metastatic breast cancer
- Disease progression during or after treatment with trastuzumab#, and were not amenable or available for trastuzumab or lapatinib treatment
- Prior taxane -containing regimen
- No. of lines of prior chemotherapy in the metastatic setting ≤ 2
- At least one measurable lesion
- ECOG performance status of 0 or 1

Pyrotinib (400 mg, orally, qd) + Capecitabine (1000 mg/m<sup>2</sup>, orally, bid on days 1–14 of each 21-day cycle)

#### Stratification:

- · Metastatic sites at screening (visceral versus non-visceral)
- Hormone receptor status (ER- and/or PR-positive versus ER- and PR-negative)

Placebo (400 mg, orally, qd) +
Capecitabine (1000 mg/m², orally, bid
on days 1–14 of each 21-day cycle)

At progression

Investigator's choice of pyrotinib (400 mg, orally, qd)

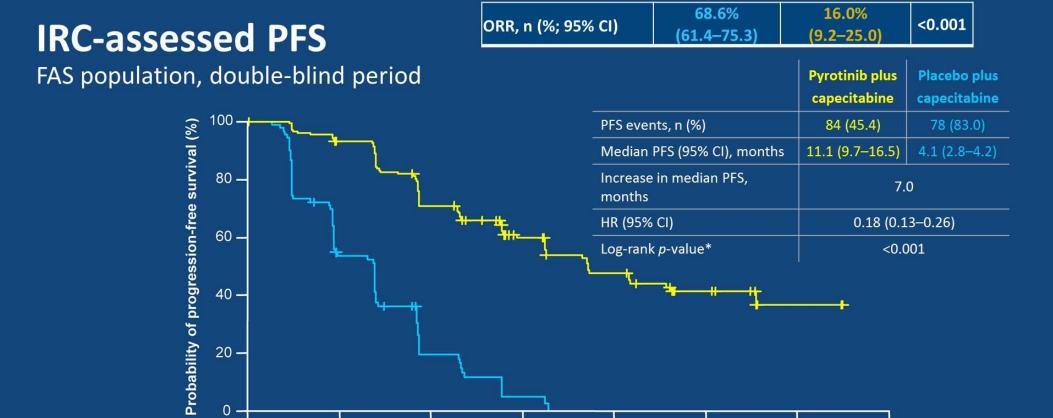
Treatment until disease progression, unacceptable toxicity, patient withdrawal, or investigator decision.

□Primary endpoint: IRC-assessed PFS

□Secondary endpoints: ORR, DOR, DCR, CBR, OS, and safety profile

\*HER2-positive: immunohistochemistry 3+ and/or fluorescence in situ hybridization positive; "Progression with trastuzumab: ≥2 cycles in the metastatic setting, or ≥3 months in adjuvant setting)
Abbreviations: IRC, independent review committee; DoR, duration of response; DCR, disease control rate; CBR, clinical benefit rate; OS, overall survival.





No. at risk: Pyrotinib plus capecitabine Placebo plus capecitabine

Time from randomisation (months)

\*Stratified by metastatic sites and hormone receptor status



#### PHENIX TRIAL

#### Strengths

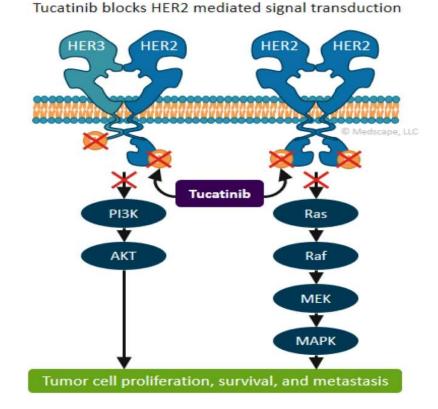
- Double-Blinded Trial
- PFS benefit 11.1m; HR 0.18 (Emilia TDM1 PFS 9.6m)
- ORR 68.6% (Emilia TDM1 ORR 43%)
- Sequential single agent activity (ORR 38%)
- Suggests activity in CNS

#### Potential Concerns/Questions

- Comparator is not standard second line regimen (capecitabine).
- Will be interesting to learn about OS in this patient population.
- G3 diarrhea in 30% of patients.

### Tucatinib Novel HER2-Specific TKI

- Tucatinib is orally bioavailable, highly potent
- Highly selective for HER2 > EGFR
- Decreased potential for EGFR-related toxicities (eg, diarrhea, skin rash)
- Improved tolerability may lead to better compliance, higher dose intensity, and duration of treatment
- Superior activity compared with lapatinib or neratinib in preclinical models of brain metastases<sup>[a]</sup>
- Two phase 1 combination trials were conducted in patients with HER2positive MBC
  - Tucatinib + T-DM1: mPFS 8.2 months; RR 47%<sup>[b]</sup>
  - Tucatinib + capecitabine + trastuzumab: mPFS 7.8 months, RR 61%<sup>[c]</sup>



a. Dinkel V, et al. AACR 2012. Abstract 852; b. Borges VF, et al. JAMA Oncol. 2018;4:1214-1220; c. Hamilton E, et al. SABCS 2017. Abstract P5-20-01.

#### HER2CLIMB: Phase III Study Design

Randomized, double-blind, placebo-controlled, active comparator phase III trial at 155 sites in 15 countries (February 2016 to May 2019); data cutoff: September 4, 2019; median f/u: 14.0 mos

Stratified by brain mets (yes vs no), ECOG PS (0 vs 1), and region (US or Canada vs rest of world)

Patients with HER2+ MBC; prior trastuzumab, pertuzumab, and T-DM1; ECOG PS 0-1; brain mets allowed\* (N = 612)

\*Including previously treated stable mets, untreated mets not needing immediate local therapy, and previously treated progressing mets not needing immediate local therapy.

Tucatinib 300 mg PO BID +
Trastuzumab 6 mg/kg Q3W (loading dose: 8 mg/kg C1D1) +
Capecitabine 1000 mg/m² PO BID, D1-14

(n = 410)

#### Placebo PO BID +

Trastuzumab 6 mg/kg Q3W (loading dose: 8 mg/kg C1D1) + Capecitabine 1000 mg/m<sup>2</sup> PO BID, D1-14 (n = 202)

#### Primary endpoint: PFS (RECIST v 1.1 by BICR) among first 480 randomized patients

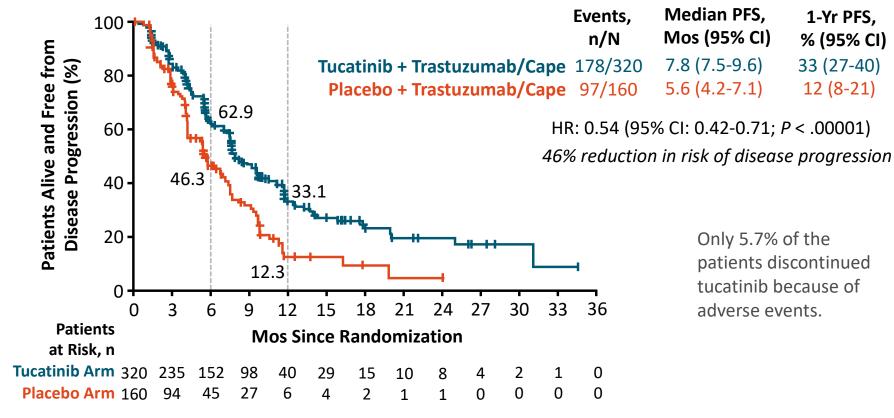
47%, which included 28% who had treated brain metastases and 19% who had progressive or untreated brain metastases Murthy. SABCS 2019. Abstr GS1-01. Murthy. NEJM. 2019;[E-pub].

Secondary endpoints (total population): OS, PFS in patients w/ brain mets, ORR in patients w/ measurable disease, safety in patients who received ≥ 1 dose of study tx

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21-day cycles

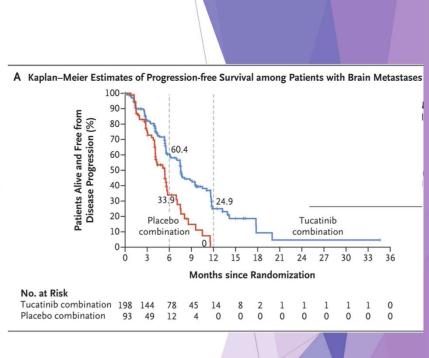
#### **HER2CLIMB: PFS (Primary Endpoint Population)**



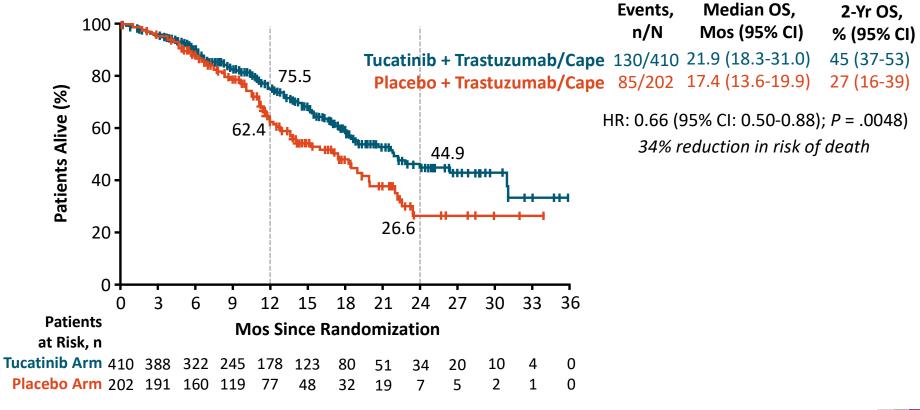
#### HER2CLIMB

#### **B** Subgroup Analysis of Progression-free Survival

Subgroup	No. of Events/ Total No.	Hazard Ratio for Disease Progression	on or Death (95% CI)
Total	275/480	H=-1	0.54 (0.42-0.71)
Age			
≥65 yr	51/96	<del></del>	0.59 (0.32-1.11)
<65 yr	224/384	<b>⊢</b> =-1	0.54 (0.41-0.72)
Race			
White	206/350	<b>⊢-</b> 1	0.57 (0.42-0.77)
Nonwhite	69/130	<b>├</b>	0.46 (0.26-0.82)
Hormone-receptor status			
Positive for ER, PR, or both	172/289	<b>⊢</b> I	0.58 (0.42-0.80)
Negative for ER and PR	103/191	<b>⊢=</b> 1	0.54 (0.34-0.86)
Baseline brain metastasis			
Yes	138/219	<b>⊢=</b> −1	0.46 (0.31-0.67)
No	136/260	<b>⊢</b> •−1	0.62 (0.44-0.89)
ECOG performance-status score			
0	134/235	H=-1	0.56 (0.39-0.80)
1	141/245	H=-1	0.55 (0.38-0.79)
Geographic region			
United States and Canada	179/307	<b>⊢=</b>	0.57 (0.41-0.78)
Rest of the world	96/173	H=	0.51 (0.33-0.79)
		0.1 1.0	10.0
			Combination etter



#### **HER2CLIMB: OS (Total Population)**



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#### Neratinib in HER2+ MBC: Study Design

Pooled analysis of 3 multicenter phase II or III trials

#### NALA

Metastatic HER2+ BC, ≥ 2 lines of HER2-directed therapy for metastatic disease, asymptomatic and stable brain metastases permitted (N = 621)



Neratinib 240 mg/day + Capecitabine 1500 mg/m<sup>2</sup> 14/21 days\* (n = 307)

Lapatinib 1250 mg/day + Capecitabine 2000 mg/m<sup>2</sup> 14/21 days (n = 314)

#### NEFERT-T

Metastatic HER2+ BC, previously untreated recurrent and/or metastatic disease, asymptomatic and stable brain metastases permitted (N = 479)



Neratinib 240 mg/day + Paclitaxel 80 mg/m<sup>2</sup> 14/21 D1,8,15, Q28D (n = 242)

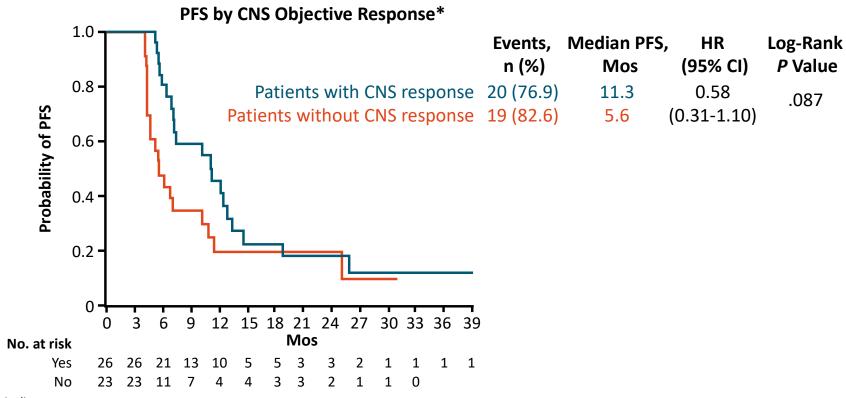
> Trastuzumab 4 mg/kg then 2 mg/kg QW + Paclitaxel 80 mg/m $^2$  14/21 D1,8,15, Q28D (n = 237)

**TBCRC 022** Metastatic HER2+ BC and measurable, progressive CNS metastases

(N = 37)

Neratinib 240 mg/day + Capecitabine 1500 mg/m<sup>2</sup> 14/21 days\* (n = 37)

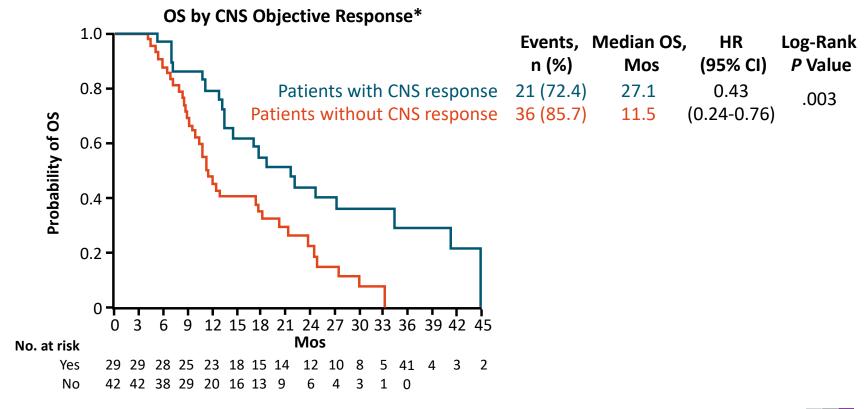
# Neratinib in HER2+ MBC: PFS by CNS Objective Response (Combined Trials)



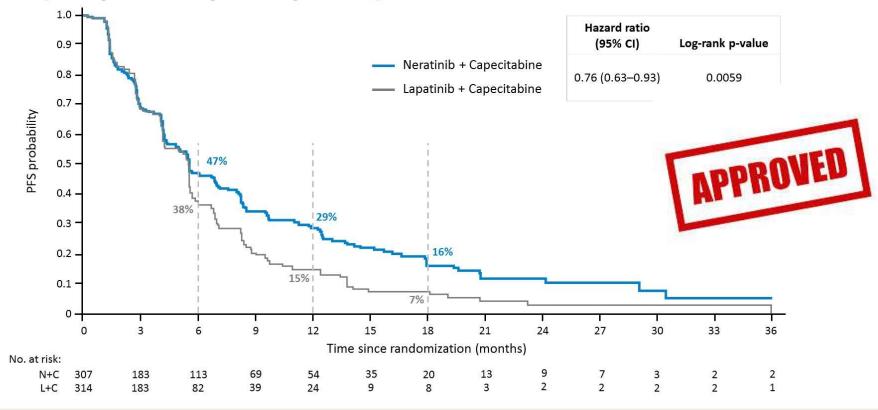
\*PFS for CNS and systemic disease.

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# Neratinib in HER2+ MBC: OS by CNS Objective Response (Combined Trials)



### PFS (co-primary endpoint)



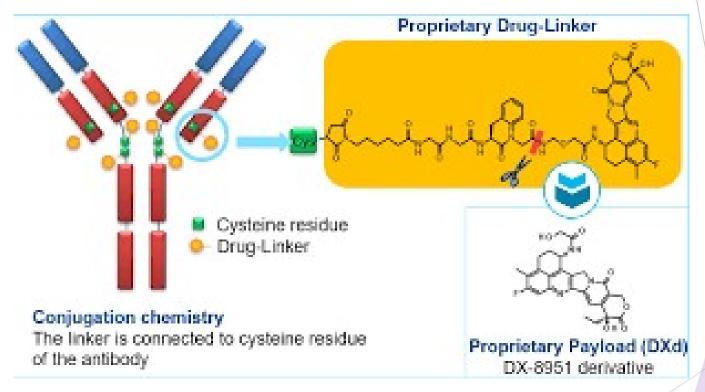
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PRESENTED BY: Adam Brufsky

#### Trastuzumab Deruxtecan



ADC comprising a humanized HER2-targeted mAb with a tumor-selective cleavable tetrapeptide linker and a topoisomerase I inhibitor "payload" It has a higher drug-to-antibody ratio than trastuzumab emtansine (8 to 1 vs. 3 to 1)

#### DESTINY-Breast01: Phase II Study Design

Open-label, multicenter, randomized, 2-part phase II study

Pharmacokinetics (n = 65)Dose Finding\* (n = 54)Continuation (n = 134)Adult patients with **T-DXd** 5.4 mg/kg HER2+ unresectable (n = 22)**T-DXd** 5.4 mg/kg and/or metastatic BC; T-DM1 Newly (n = 28)**T-DXd** 6.4 mg/kg **T-DXd** 5.4 mg/kg prior T-DM1; ECOG PS enrolled R/R (n = 22)(n = 130)0-1; stable, treated **T-DXd** 6.4 mg/kg patients (n = 249)brain metastases (n = 26)**T-DXd** 7.4 mg/kg allowed; history of T-DM1 (n = 23)significant ILD excluded **T-DXd** 5.4 mg/kg Intolerant (n = 4)(n = 4)

Primary endpoint: ORR by ICR (RECIST v1.1)

Secondary endpoints: investigator-assessed ORR, DCR, DoR, CBR, PFS, OS, PK, safety

Data cutoff: August 1, 2019

79 (42%) continuing treatment

105 (57.1%) d/c (mostly for PD, 28.8%)

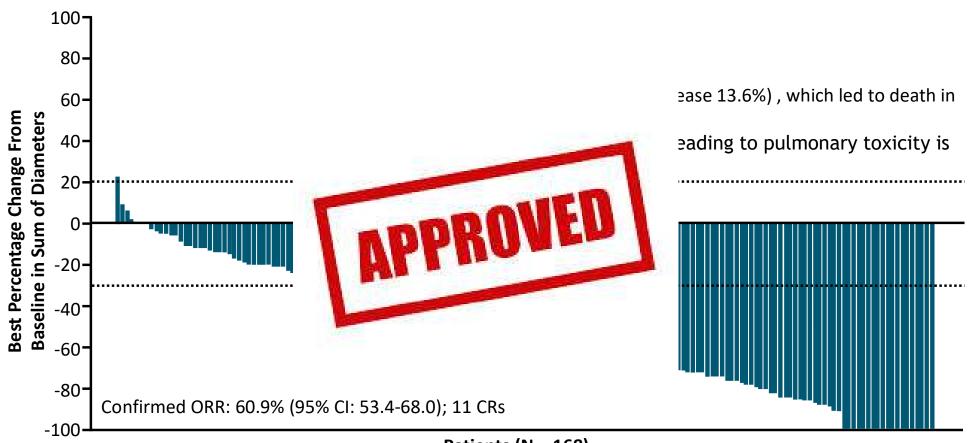
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Total enrolled at 5.4 mg/kg: n = 184

Part 2

Krop. SABCS 2019. Abstr GS1-03. Modi. NEJM. 2019:[Epub].

#### **DESTINY-Breast01: Best Change in Tumor Size**

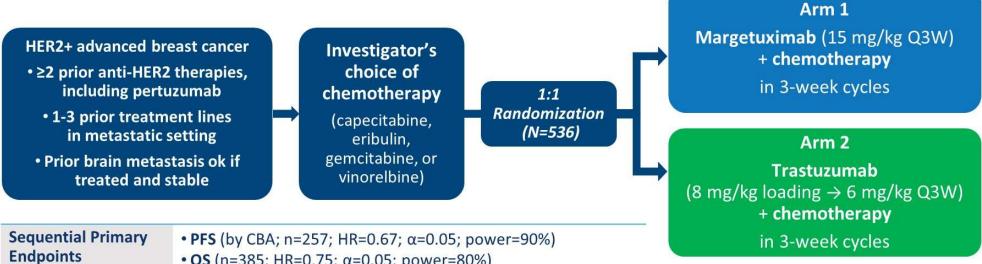


**Patients (N = 168)** 

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Krop. SABCS 2019. Abstr GS1-03. Modi. NEJM. 2019:[Epub].

#### Study CP-MGAH22-04 (SOPHIA) Design<sup>1,2</sup>



• **OS** (n=385; HR=0.75;  $\alpha$ =0.05; power=80%)

#### **Secondary Endpoints**

PFS (Investigator assessed)

Objective response rate (by CBA)

#### Tertiary/Exploratory **Endpoints**

- Clinical benefit rate (CBR), duration of response (DoR)
- Safety profile, antidrug antibody
- Effect of CD16A, CD32A, and CD32B on margetuximab efficacy

#### Stratification:

- Chemotherapy choice
- Prior therapies (≤2 vs >2)
- Metastatic sites (≤2 vs >2)

HR=hazard ratio; CBA=central blinded analysis.

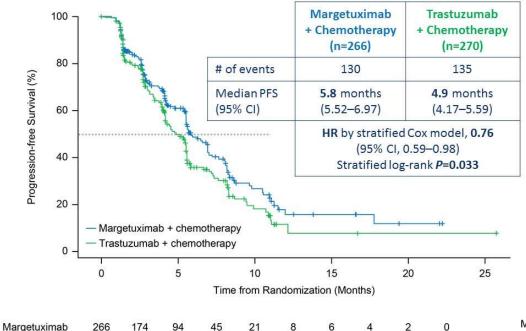
1. Rugo HS, et al. J Clin Oncol. 2016;34(suppl 15):TPS630. 2. Clinicaltrials.gov. NCT02492711. www.clinicaltrials.gov/ct2/show/NCT02492711. Accessed April 8, 2019.



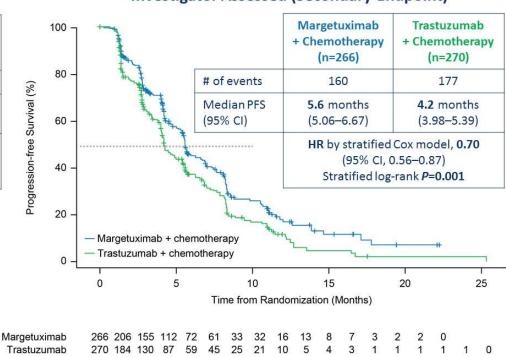


#### **PFS Analysis in ITT Population**

#### 24% Risk Reduction of Disease Progression Central Blinded Analysis (Primary Endpoint)



#### 30% Risk Reduction of Disease Progression Investigator Assessed (Secondary Endpoint)



• PFS analysis was triggered by last randomization on October 10, 2018, after 265 PFS events occurred

ITT population: N=536. CI=confidence interval.

158



270

Trastuzumab



74

33

#### SOPHIA Second Interim Survival Analysis: Response (ITT)

Outcome	Margetuximab + CT (n = 266)	Trastuzumab + CT (n = 270)	Nominal P Value
ORR*, n (%; 95% CI)	67 (25.2; 20.1-30.9)	37 (13.7; 9.8-18.4)	.0006
CBR <sup>†</sup> , n (%; 95% CI)	128 (48.1; 42.0-54.3)	96 (35.6; 29.9-41.6)	.0025
Best overall response, n (%)			
■ CR	5 (1.9)	4 (1.5)	
■ PR	62 (23.3)	33 (12.2)	
■ SD	143 (53.8)	158 (58.5)	
■ PD	40 (15.0)	57 (21.1)	
<ul><li>Not evaluable/available</li></ul>	16 (6.0)	18 (6.7)	
Median DoR, mos (95% CI)	6.9 (5.45-7.49)	7.0 (5.55-8.15)	.7400

\*CR + PR.  $^{\dagger}$ CR + PR + SD > 6 mos. Data cutoff: September 2019.

Rugo. SABCS 2019. Abstr GS1-02



#### Take home messages

- Anti Her2 therapy has led to a remarkable improvement of outcomes for patients with Her2 + BC
- Patient selection is key to determine right patients for a "more or less" approach
- Dual targeted therapy may provide greater benefit for some patients
- Emerging therapies in the metastatic setting show promise, especially for patients with brain metastasis