

# HCV Treatment Options in 2017/2018: What's Here and What's Coming Soon



Supported by educational grants from AbbVie; Bristol-Myers Squibb; Gilead Sciences; Janssen Therapeutics; Merck & Co., Inc; and ViiV Healthcare.

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#### **Disclosures**

Ira M. Jacobson, MD, has disclosed that he has received consulting fees from AbbVie, Bristol-Myers Squibb, Gilead Sciences, Intercept, Merck, and Trek; fees for non-CME/CE services received directly from a commercial interest or their agent (eg, speaker bureau) from Gilead Sciences, Intercept, and Merck; and funds for research support from Genfit, Gilead Sciences, and Merck.

Norah Terrault, MD, MPH, has disclosed that she has received consulting fees from Biotest, Gilead Sciences, Merck, and Mylan Pharmaceuticals and funds for research support from AbbVie, Biotest, Bristol-Myers Squibb, Gilead Sciences, and Merck.

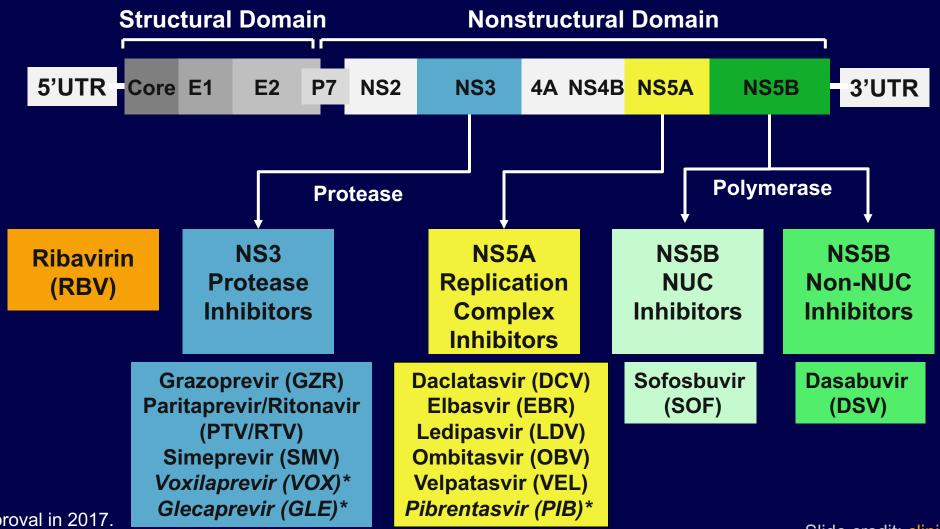
#### Where HCV Therapy Stands Now

- Interferon is gone in the US; ribavirin . . . not quite
- SVR in > 95% of pts
- "Difficult-to-cure" populations no longer difficult
  - Black raceCirrhosis

- Renal failure and kidney transplant
- HIV coinfection
   Older age
   Liver transplant

- Persons who inject drugs (PWID)
- Genotype 3 remains more challenging (but not by much)
- Emergent issues and controversies:
  - HBV reactivation
     HCC recurrence after DAA therapy
- Cost and access issues persist but improving

## **Approved DAAs From Multiple Classes: Basis of 2016 Combination HCV Regimens**



\*Possible approval in 2017.

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#### **Treatment Options for Genotype 1**



#### Recommended for GT1 Treatment-Naive or IFN-Experienced Pts Without Cirrhosis

HCV GT	Recommended Regimens (All 12 Wks Except as Noted)
1a	<ul> <li>LDV/SOF (8 wks if tx naive, nonblack, no HIV, and HCV RNA &lt; 6 million IU/mL)</li> <li>SOF/VEL</li> <li>DCV + SOF</li> <li>SMV + SOF</li> <li>EBR/GZR*</li> <li>OBV/PTV/RTV/DSV extended release + RBV or OBV/PTV/RTV + DSV BID + RBV</li> </ul>
1b	<ul> <li>LDV/SOF (8 wks if tx naive, nonblack, no HIV, and HCV RNA &lt; 6 million IU/mL)</li> <li>SOF/VEL</li> <li>DCV + SOF</li> <li>SMV + SOF</li> <li>EBR/GZR</li> <li>OBV/PTV/RTV/DSV extended release or OBV/PTV/RTV + DSV BID</li> </ul>

<sup>\*</sup>Only if no baseline NS5A elbasvir RASs detected.



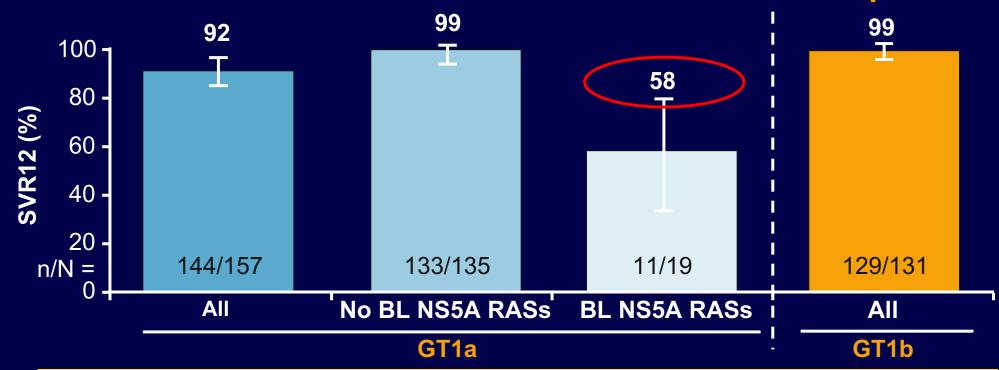
#### Recommended for GT1 Treatment-Naive or IFN-Experienced Pts With Compensated Cirrhosis

HCV GT	Recommended Regimens (All 12 Wks)				
ncv G1	Treatment Naive	IFN/RBV Experienced			
1a	<ul><li>EBR/GZR*</li><li>LDV/SOF</li><li>SOF/VEL</li></ul>	<ul><li>EBR/GZR*</li><li>LDV/SOF + RBV</li><li>SOF/VEL</li></ul>			
1b	<ul> <li>EBR/GZR</li> <li>LDV/SOF</li> <li>OBV/PTV/RTV/DSV ER</li> <li>OBV/PTV/RTV+ DSV BID</li> <li>SOF/VEL</li> </ul>	<ul> <li>EBR/GZR</li> <li>LDV/SOF + RBV</li> <li>OBV/PTV/RTV/DSV ER</li> <li>OBV/PTV/RTV+ DSV BID</li> <li>SOF/VEL</li> </ul>			

<sup>\*</sup>Only if no baseline NS5A elbasvir RASs detected.

### Adjust EBR/GZR Duration Based on Baseline NS5A RASs in GT1a

**C-EDGE Treatment Naive: 12 Wks of Elbasvir/Grazoprevir** 

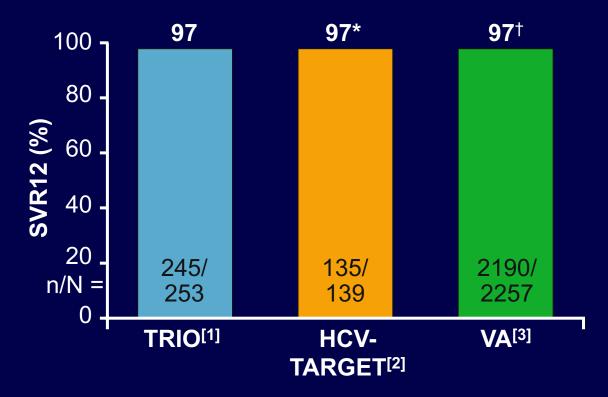


If NS5A RASs in GT1a, treat with EBR/GZR + RBV for 16 wks (alternative)
No baseline RAS testing needed in GT1b pts



### TRIO, HCV-TARGET, VA: Real-World Efficacy of EBR/GZR

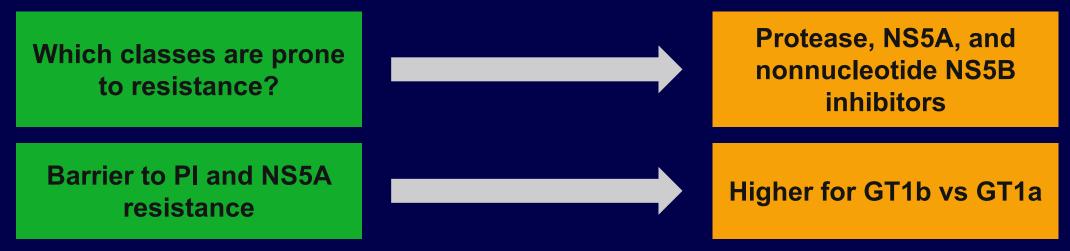
- Analyses of SVR12 rates in HCVinfected pts using specialty pharmacies and providers in realworld cohorts
  - US TRIO Network<sup>[1]</sup>
  - US and international clinical practices<sup>[2]</sup>
  - US Veterans Affairs Healthcare System<sup>[3]</sup>



\*For pts missing SVR12 outcome, data replaced with SVR4 outcome. †For pts missing SVR12 outcome, data replaced with HCV RNA test results obtained during posttreatment Wks 4-12.



#### **Resistance Considerations**



- Most pts with failure of current DAAs have emergent resistance-associated substitutions (RASs)
  - NS5A RASs persist much longer than PI RASs
- 15% of pts have baseline NS5A RASs with variable effects on GT1a response
- Second-generation drugs designed to cover RASs



#### **Treatment Options for Genotype 3**



# Recommended for Treatment-Naive Pts With Genotype 3 HCV

Cirrhosis?	RAS Test?	RAS Test Result	Recommended regimens
No	Don't test	-	DCV + SOF 12 wks SOF/VEL 12 wks
Voo	Test	No Y93	DCV + SOF ± RBV 24 wks SOF/VEL 12 wks
Yes		Y93	DCV + SOF + RBV 24 wks SOF/VEL + RBV 12 wks

# Recommended for PegIFN/RBV-Experienced Pts With Genotype 3 HCV

Cirrhosis?	RAS Test?	RAS Test Result	Recommended regimens
No	Test	No Y93	DCV + SOF 12 wks SOF/VEL 12 wks
INO	IESL	Y93	DCV + SOF + RBV 12 wks SOF/VEL + RBV 12 wks
Yes	Don't test	-	EBR/GZR + SOF 12 wks SOF/VEL + RBV 12 wks

## Need for RBV Based on Baseline Y93 RAS in GT3 With Cirrhosis *or* Previous PegIFN/RBV

- Based on very low SVR12 rates in these groups when treated without RBV
- For pts with both cirrhosis and previous pegIFN/RBV, RBV required regardless of Y93 status (unless using EBR/GZR + SOF)
- These recommendations are pending further data on optimal regimen<sup>[1]</sup>

CT2 Study and Danielation	SVR12, %				
GT3 Study and Population	No Y93H	Y93H			
ALLY-3: DCV + SOF for 12 Wks <sup>[2]</sup>					
■ Overall	92 (n = 162)	54 (n = 13)			
<ul><li>No cirrhosis</li></ul>	98 (n = 128)	67 (n = 9)			
■ Cirrhosis	71 (n = 34)	25 (n = 4)			
ASTRAL-3: SOF/VEL for 12 Wks <sup>[3]</sup>					
<ul><li>Overall</li></ul>	97 (n = 249)	84 (n = 25)			



#### Treatment Options for Genotypes 2, 4, 5, 6



#### Recommended Regimens for Treatment-Naive Pts With GT 2, 4, 5, 6 HCV

All regimens 12 wks

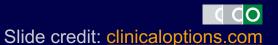
HCV GT	No Cirrhosis	Compensated Cirrhosis
2	<ul><li>SOF/VEL</li></ul>	■ SAME
4	<ul> <li>OBV/PTV/RTV + RBV</li> <li>SOF/VEL</li> <li>EBR/GZR</li> <li>LDV/SOF</li> </ul>	■ SAME
5 or 6	<ul><li>SOF/VEL</li><li>LDV/SOF</li></ul>	■ SAME

#### Recommended Regimens for PegIFN/RBV-Experienced Pts With GT2, 4, 5, 6 HCV

All regimens 12 wks unless noted otherwise

HCV GT	No Cirrhosis	Compensated Cirrhosis
2	<ul><li>SOF/VEL</li></ul>	■ SAME
4	<ul> <li>OBV/PTV/RTV + RBV</li> <li>SOF/VEL</li> <li>EBR/GZR*</li> <li>LDV/SOF</li> </ul>	<ul><li>SAME</li><li>SAME</li><li>SAME</li><li>LDV/SOF + RBV</li></ul>
5 or 6	<ul><li>SOF/VEL</li><li>LDV/SOF</li></ul>	■ SAME

<sup>\*</sup>Previous relapse only; pts with previous virologic nonresponse or breakthrough should be treated with 16 wks with addition of RBV.

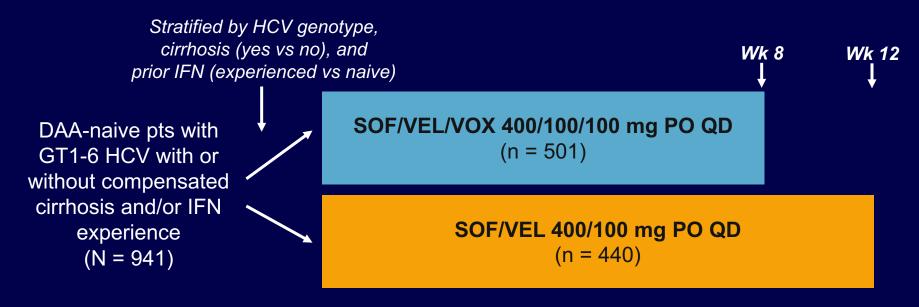


# Late-Phase Investigational HCV Regimens by Drug Classes

Regimen	NS5B Polymerase Nucleotide Inhibitor (buvir)	NS3/4A Protease Inhibitor ( previr)	NS5A Inhibitor ( asvir)
Sofosbuvir/velpatasvir/voxilaprevir	SOF	VOX	VEL
Glecaprevir/pibrentasvir		GLE	PIB
Grazoprevir/ruzasvir/uprifosbuvir	UPR	GZR	RZR
AL-335 + odalasvir + simeprevir	AL-335	SMV	ODV

### POLARIS-2: 8-Wk SOF/VEL/VOX vs 12-Wk SOF/VEL for DAA-Naive GT1-6 Pts

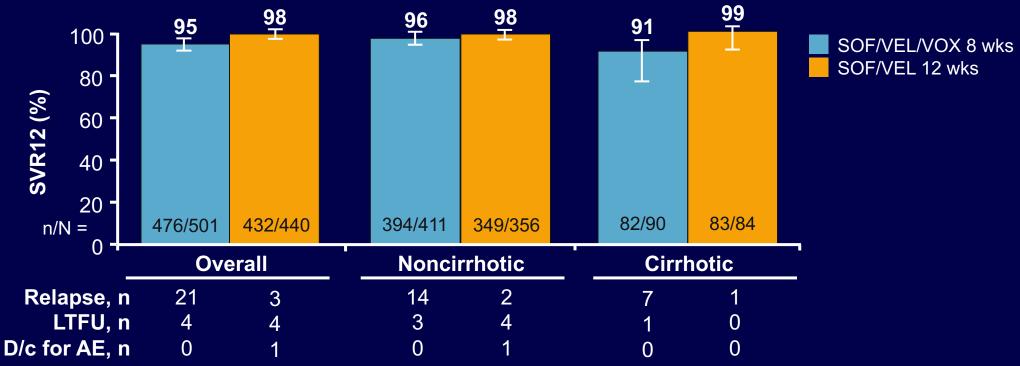
Randomized, open-label, active-controlled phase III trial



\*Treatment allocation randomized in pts with GT1-4 HCV; pts with GT5/6 HCV allocated to SOF/VEL/VOX arm; cirrhotic pts with GT3 HCV infection enrolled in POLARIS-3.

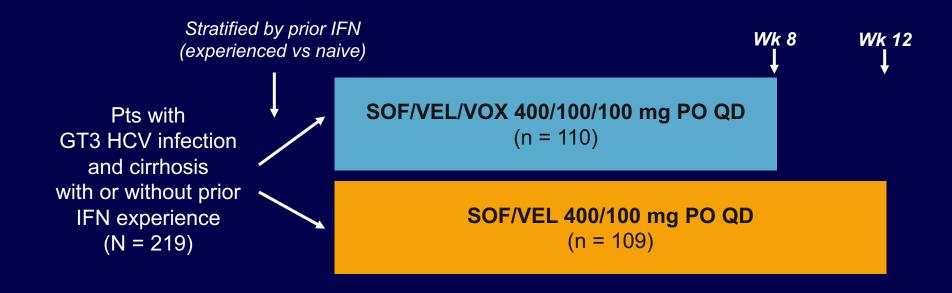
### POLARIS-2: SVR12 Rates With 8-Wk SOF/VEL/VOX vs 12-Wk SOF/VEL

- 8-wk SOF/VEL/VOX did not meet criteria for noninferiority vs 12-wk SOF/VEL
  - Treatment difference: -3.4% (95% CI: -6.2% to -0.6%)
  - 14/21 pts with relapse to SOF/VEL/VOX 8 wks had GT1a



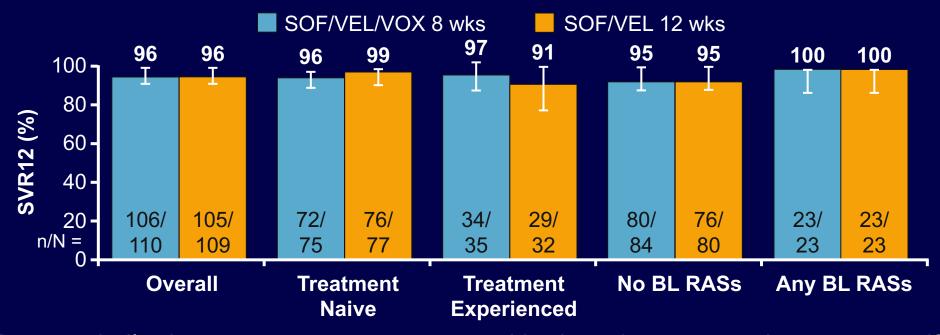
### POLARIS-3: 8-Wk SOF/VEL/VOX vs 12-Wk SOF/VEL for Cirrhotic, DAA Naive GT3

Randomized, open-label, active-controlled phase III trial



■ IFN experience in 29% to 32% of pts

### POLARIS-3: SVR12 Rates With 8-Wk SOF/VEL/VOX for Cirrhotic GT3 Pts



- SVR rates similar between treatment arms, and both regimens superior to prespecified historic SVR rate of 83% (P < .001 for each arm)
- Overall VF: SOF/VEL/VOX, n = 2 relapses; SOF/VEL, n = 1 each for relapse and ontreatment failure
- No treatment-emergent RASs in SOF/VEL/VOX arm; Y93H in both VFs in SOF/VEL arm

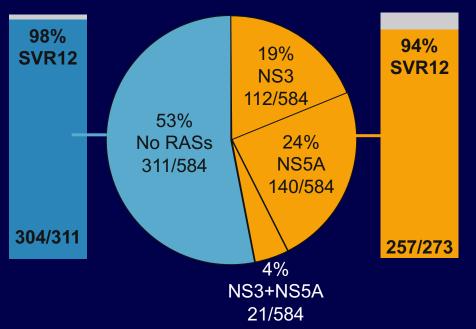
#### POLARIS-2, -3: Safety of SOF/VEL/VOX for 8 Wks

	POLARIS-2		POLARIS-3	
Outcome, %	SOF/VEL/VOX 8 Wks (n = 501)	SOF/VEL 12 Wks (n = 440)	SOF/VEL/VOX 8 Wks (n = 110)	SOF/VEL 12 Wks (n = 109)
Any AE	72	69	75	74
Serious AE	3	2	2	3
D/c for AE	0	< 1	0	1
Death	0	0	1	0
AE in > 10% of pts				
<ul><li>Headache</li></ul>	27	23	25	29
<ul><li>Fatigue</li></ul>	21	20	25	28
<ul><li>Diarrhea</li></ul>	18	7	15	5
<ul><li>Nausea</li></ul>	16	9	21	9



#### POLARIS-2, -3: Pooled Analysis of BL RAS Effect on SOF/VEL/VOX in DAA-Naive Pts

- 606 DAA-naive pts treated with 8-wk SOF/VEL/VOX in POLARIS-2 and -3
  - RASs assessed by deep sequencing (15% assay cutoff)



- VOX-specific and VEL-specific RASs had no impact on SVR
- No emergent RASs in 22/23 pts who relapsed after 8 wks of SOF/VEL/VOX

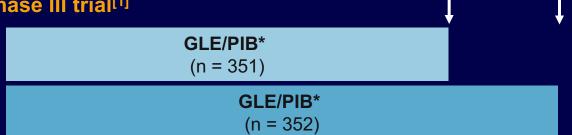
# ENDURANCE Studies: Glecaprevir/Pibrentasvir in Noncirrhotic Patients



### ENDURANCE-1, -2, -4: GLE/PIB for Treatment of GT1, 2, 4, 5, 6 HCV

#### **ENDURANCE-1:** randomized, open-label phase III trial<sup>[1]</sup>

Noncirrhotic pts with GT1 HCV with or without IFN experience or HIV coinfection (N = 703; 38% tx-experienced<sup>†</sup>)



Wk 8

Wk 12

#### ENDURANCE-2: randomized, double-blind, placebo-controlled phase III trial<sup>[2]</sup>

Noncirrhotic pts with GT2 HCV with or without IFN experience (N = 302; 29% to 30% tx-experienced<sup>†</sup>)



#### **ENDURANCE-4:** open-label, single-arm phase III trial<sup>[3]</sup>

Noncirrhotic pts with GT4-6 HCV with or without IFN experience (N = 121; 32% tx-experienced†)

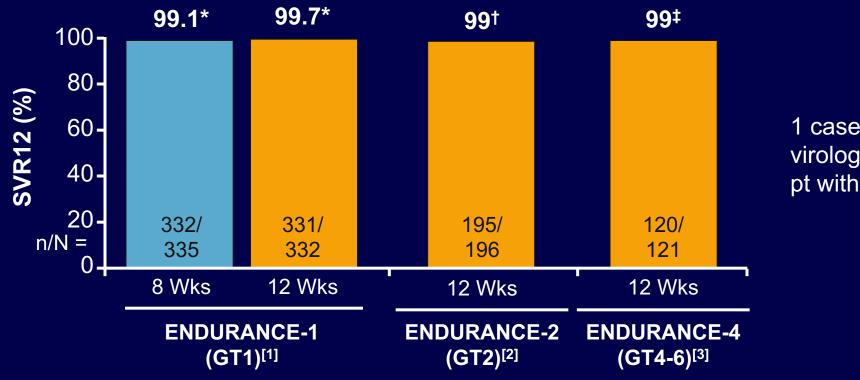


<sup>\*</sup>Dosing: GLE/PIB given as 3 coformulated 100/40-mg tablets QD for a total dose of 300/120 mg.



<sup>&</sup>lt;sup>†</sup>Treatment experience permitted: IFN or pegIFN ± RBV or SOF + RBV ± pegIFN.

## ENDURANCE-1, -2, -4 Studies: Efficacy of GLE/PIB for Treating GT1, 2, 4, 5, 6 HCV



1 case of on-treatment virologic failure at Day 29 in pt with GT1a HCV infection

<sup>\*</sup>ITT-PS analysis: included all pts receiving ≥ 1 dose of study drug; excluded pts with HIV coinfection or SOF experience. †ITT analysis: excluded pts with SOF experience. ‡ITT analysis.

## ENDURANCE-1, -2, -4 Studies: Safety of GLE/PIB for Treating GT1, 2, 4, 5, 6 HCV

	ENDURANCE-1[1]		ENDURANCE-2 <sup>[2]</sup>		ENDURANCE-4[3]
Outcome, %	GLE/PIB 8 Wks (n = 351)	GLE/PIB 12 Wks (n = 352)	GLE/PIB 12 Wks (n = 202)	PBO 12 Wks (n = 100)	GLE/PIB 12 Wks (n = 121)
Any AE	62	66	65	58	69
D/c for AE	0	< 1	0	0	2
Serious AE	1	1	1	1	< 1
Death	0	< 1	0	0	0
AE in ≥ 10% of pts					
■ Fatigue	9	12	11	10	17
<ul><li>Headache</li></ul>	19	18	12	12	21
AST grade ≥ 3*	0	< 1	1	1	0
ALT grade ≥ 3*	0	0	< 1	2	0
Total bilirubin grade 3 <sup>†</sup>	< 1	< 1	< 1	0	0

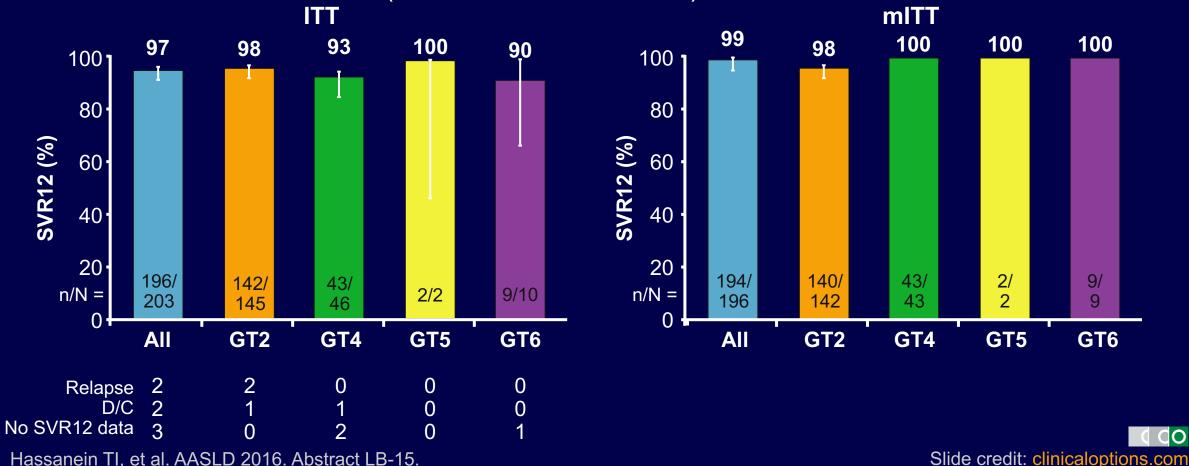
<sup>\*&</sup>gt; 5 times ULN. †3-10 times ULN.



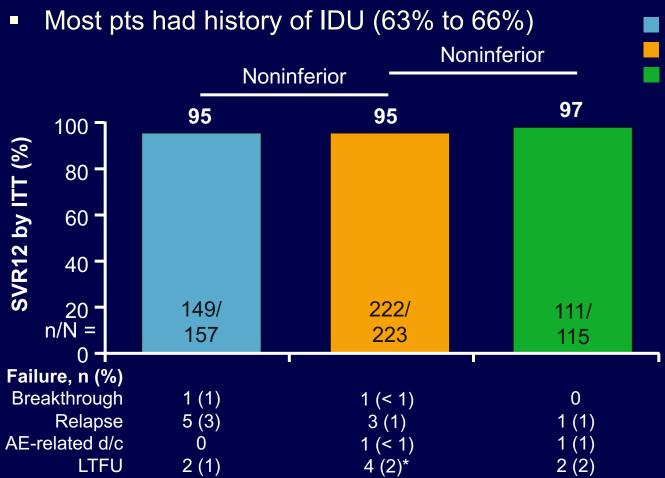
<sup>1.</sup> Zeuzem S, et al. AASLD 2016. Abstract 253. 2. Kowdley KV, et al. AASLD 2016. Abstract 73. 3. Asselah T, et al. AASLD 2016. Abstract 114.

### SURVEYOR 2, Part 4: 8 Wks GLE/PIB For Pts With GT 2, 4, 5, 6 HCV Without Cirrhosis

 99% SVR12 rate with 8-wk regimen in DAA-naive pts with GT2 HCV – noninferior to 95% historical control (SOF + RBV for 12 wks)



#### **ENDURANCE-3: Glecaprevir/Pibrentasvir in GT3 HCV Without Cirrhosis**



- 8-wk GLE/PIB
- 12-wk GLE/PIB
- 12-wk DCV + SOF
  - No serious AEs deemed related to study drug
  - No clinically relevant ALT increases, 1 isolated bilirubin increase (G/P 8 wks), 1 isolated neutrophil count decrease (G/P 12 wks)

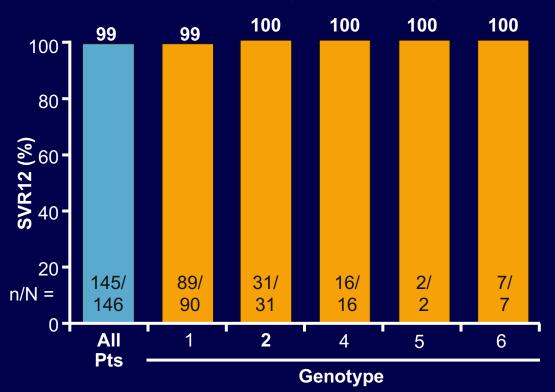
Foster GR, et al. EASL 2017. Abstract GS-007.



<sup>\*2</sup> other failures due to consent withdrawal and noncompliance.

# **EXPEDITION-1: Glecaprevir/Pibrentasvir in GT1,** 2, 4, 5, or 6 HCV and Compensated Cirrhosis

- Tx-naive and tx-exp'd pts enrolled<sup>[1,2]</sup>
  - 1 relapse in pt with GT1a HCV with new NS5A mutations (Q30R, H58D)



- No AE-related discontinuations or DAArelated serious AEs<sup>[1,2]</sup>
  - 1 death deemed unrelated to study drug
- Rare grade 3 laboratory abnormalities

AE, <sup>[1,2]</sup> n (%)	Pts (N = 146)
Any AE	101 (69)
Any serious AE	11 (8)
AEs occurring in ≥ 10% of pts ■Fatigue ■Headache ■Pruritus	28 (19) 20 (14) 14 (10)
HCC	2 (1)

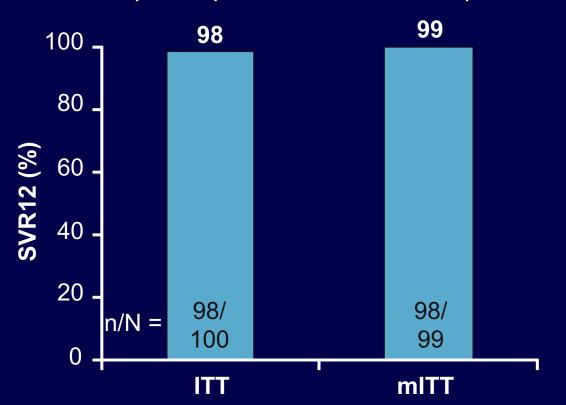
In EXPEDITION-2,<sup>[3]</sup> 98% SVR12 rate with GLE/PIB for 8 or 12 wks (without vs with cirrhosis) in HCV/HIV-coinfected pts

<sup>1.</sup> Forns X, et al. EASL 2017. Abstract GS-006. 2. ClinicalTrials.gov. NCT02642432.

<sup>3.</sup> Rockstroh J, et al. EASL 2017. Abstract LBP-522.

# MAGELLAN-2: Glecaprevir/Pibrentasvir for 12 Wks in GT1-6 HCV With Liver or Renal Transplant

- Liver/kidney transplant: 80%/20%
- 1 relapse in pt with GT3a HCV; 1 pt LTFU



 No deaths during study, 1 pt with transplant rejection (unrelated to DAA)

Outcome, %	GLE/PIB (N = 100)
Any AE	85
Serious AE  DAA related	8 2
D/c for AE  DAA related	1 0
AEs in ≥ 10% of pts  Headache Fatigue Nausea Pruritus	22 22 12 12
Grade ≥ 3 abnormality  ■AST  ■ALT  ■Total bilirubin  ■CrCl	0 1 1 2

# C-CREST 1 & 2: GZR/RZR/UPR ± RBV for Treating Pts With GT1-4, 6 HCV

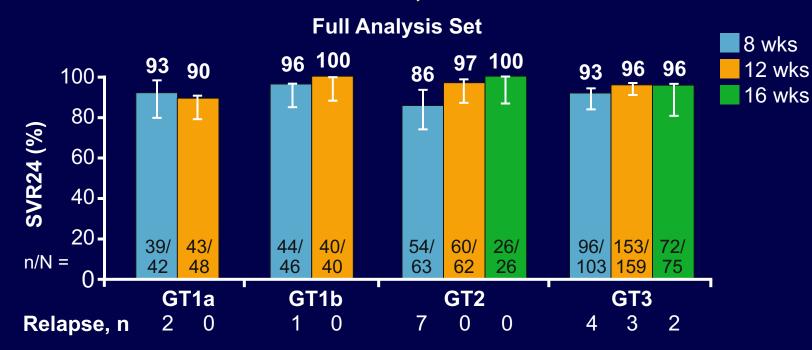
Part B: randomized, open-label phase II trials Wk 8 Wk 12 Wk 16 GZR/RZR/UPR (n = 180: GT1, n = 88; GT2, n = 32; GT3, n = 53; GT4, n = 7)GZR/RZR/UPR + RBV (n = 81: GT2, n = 31; GT3, n = 50)Patients with GT1-4, 6 HCV, GZR/RZR/UPR HCV RNA ≥ 10,000 IU/mL, (n = 217; GT1, n = 88; GT2, n = 46; GT3, n = 79; GT6, n = 4) with or without compensated GZR/RZR/UPR + RBV cirrhosis (n = 96: GT2, n = 16: GT3, n = 80)(N = 675)GZR/RZR/UPR (n = 76: GT2, n = 26: GT3, n = 50)GZR/RZR/UPR + RBV

Dosing: GZR/RZR/UPR dosed as two 50/30/225-mg tablets QD. Pts with GT3 HCV could be treatment naive or have failed on pegIFN/RBV; all others treatment naive. Cirrhosis definition in notes.

(GT3, n = 25)

Baseline: 35% to 43% cirrhotic; 44% of GT3 pts had prior pegIFN/RBV

### C-CREST 1 & 2: Efficacy of GZR/RZR/UPR ± RBV for Pts With GT1-4, 6 HCV



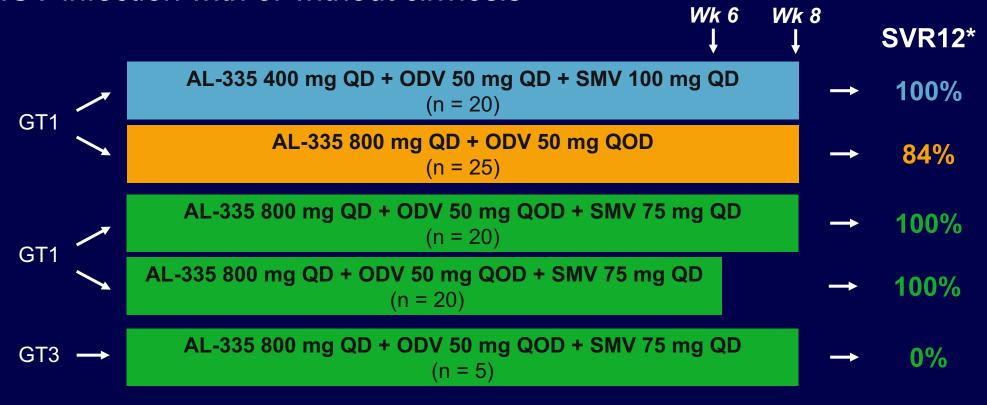
100% SVR12 rates in 7 pts with GT4 (treated for 8 wks) and 4 pts with GT6 (treated for 12 wks) HCV infection

Presence of cirrhosis, use of ribavirin, prior tx experience did not impact SVR12 rates

SVR12 by Baseline RAS Presence, % (n/N)	GT2 HCV		GT3 HCV	
	No L31M	L31M	No Y93H	Y93H
8 wks	94 (31/33)	81 (21/26)	98 (95/97)	50 (2/4)
12 wks	100 (28/28)	100 (31/31)	99 (147/148)	71 (5/7)

### AL-335 + ODV ± SMV for ≤ 12 Wks in Treatment-Naive Pts With GT1/3 HCV ± Cirrhosis

Randomized, open-label phase IIa trial; treatment-naive patients with GT1/3
HCV infection with or without cirrhosis



<sup>\*</sup>All pts with SVR12 also achieved SVR24.

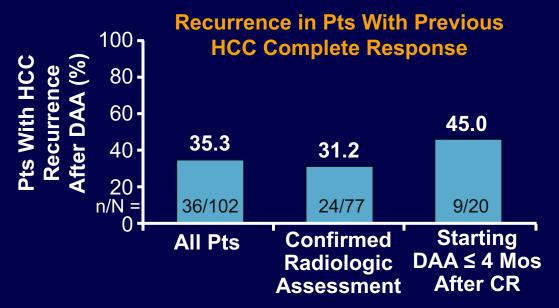


## Do DAAs Increase the Risk of de Novo or Recurrent HCC?



#### High Rate of HCC Recurrence With DAAs

Retrospective study of pts with history of HCC before starting DAA



- Among pts starting DAAs ≤ 4 mos after CR, 4 pts (20%) died
  - Deaths occurred in Mos 9, 10, 15, 16 after starting DAA

 10 pts had second HCC recurrence or progression

Endpoint	Pts With Recurrence (n = 24)*
Median time from DAA start to first recurrence, mos (IQR)	3.5 (2-7.6)
Median time from first to second recurrence/progression, mos (IQR)  Within 6 mos of first recurrence, n/n (%)	6.0 (3.2-8.2) 6/20 (30)
■Death, n (%)	5 (20.8)

<sup>\*</sup>Pts from cohort with confirmed radiologic assessment, no confounding factors.



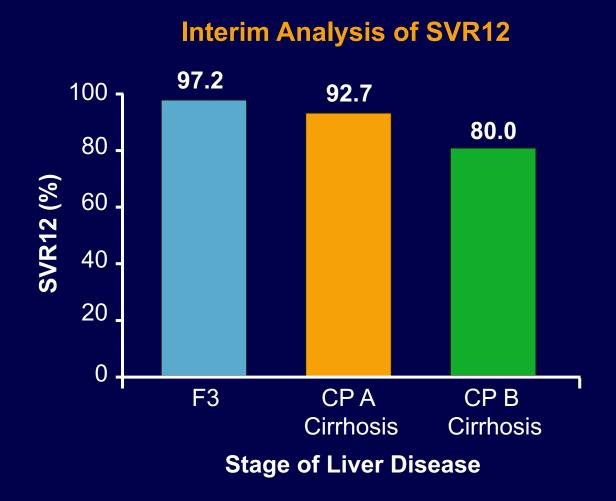
#### HCC Occurrence or Recurrence Equivalent in Pts With SVR to DAAs vs IFN

- Meta-analysis and meta-regression analysis of 41 studies (N = 13,875)
  - HCC occurrence in cirrhotic pts who achieved SVR with DAAs or IFN
  - HCC recurrence in pts who had had curative treatment for liver cancer

HCC and Risk Factor	Adjusted RR (95% CI)	<i>P</i> Value
HCC occurrence		
<ul><li>Average follow-up</li></ul>	0.77 (0.62-0.97)	.03
<ul><li>Average age</li></ul>	1.06 (0.99-1.14)	.08
■ Treatment (DAA vs IFN)	0.75 (0.22-2.52)	.62
HCC recurrence		
<ul><li>Average follow-up</li></ul>	0.79 (0.55-1.15)	.19
<ul><li>Average age</li></ul>	1.11 (0.96-1.27)	.14
■ Treatment (DAA vs IFN)	0.62 (0.11-3.45)	.56

### De Novo HCC in HCV-Infected Pts Treated With Oral DAAs

- Italian pts with HCV and advanced liver disease treated with DAAs and monitored January 2015 -June 2016
  - N = 3075
- Mean follow-up after starting DAA therapy: 300.8 days
  - 41 pts developed HCC
- HCC incidence analyzed by multivariate Cox regression (forward stepwise selection)



### De Novo HCC in HCV-Infected Pts Treated With Oral DAAs

Subgroup	HCC Incidence in Cirrhotic Pts, % per Pt-Yr	<i>P</i> Value
Child-Pugh score A/B	1.64/2.92	.58
DAA regimen  SOF + RBV  LDV/SOF ± RBV  SMV + SOF ± RBV  DCV + SOF ± RBV  OBV/PTV/RTV + DSV ± RBV	3.32 1.45 1.35 1.12 1.88	.90
APRI score < 2.5/≥ 2.5	1.52/3.27	.02
SVR12 no/yes	8.38/1.55	.001



### De Novo HCC in HCV-Infected Pts Treated With Oral DAAs

Subgroup	HCC Incidence in Cirrhotic Pts, % per Pt-Yr	<i>P</i> Value			
Child-Pugh score A/B	1.64/2.92	.58			
DAA regimen					
Cirrhotic pts with HCV treated with DAAs are not at increased risk of developing HCC compared with untreated pts					
-					
-					
risk of developing	g HCC compared with untreate				

### **HBV Reactivation During HCV DAA Therapy**



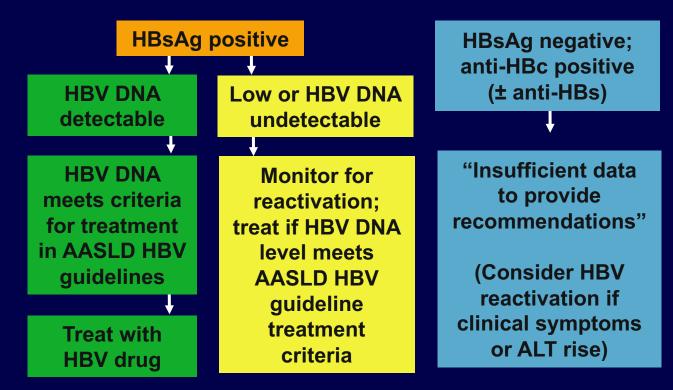
#### **HBV** Reactivation in Pts Receiving HCV DAAs

- Case reports of HBV reactivation in pts treated with SMV + SOF ± RBV,<sup>[1,2]</sup> DCV + ASV,<sup>[3,4]</sup> and LDV/SOF<sup>[5]</sup>
  - Possibly due to loss of host immune response to HBV<sup>[6]</sup>
- 29 confirmed cases of HBV reactivation in HCV DAA recipients in ~ 3 yrs (November 2013 to October 2016)<sup>[7]</sup>
  - Most cases occurred within 4-8 wks of HCV DAA initiation
- October 2016 FDA issued boxed warning



## HBV Testing/Monitoring During HCV DAA Therapy

- Test all pts initiating HCV therapy for HBsAg, anti-HBc, and anti-HBs
  - Vaccinate if no HBV markers; follow flow chart below if HBV markers present



#### **Conclusions**

- Multiple current regimens highly effective and safe across genotypes; confirmed in "real-world" studies
- GLE/PIB appears poised to be an 8-wk pangenotypic regimen for DAA-naive noncirrhotic pts
- Short duration SOF/VEL/VOX not superior to current regimens for DAA-naive pts;
   likely to find niche in pts with previous DAA failure
- GZR/RZR/UPR a promising pangenotypic regimen; phase III trial results awaited
- Controversy persists re: HCC recurrence after DAA-induced SVR
- Little evidence for spike in de novo HCC after SVR
- HBV reactivation very rare in anti-HBc—positive pts; precautions in HBsAg-positive pts especially with HBV viremia

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